VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Thindal, Erode - 638 012

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai)
(Accredited by NAAC with 'A+' grade)

REGULATIONS 2022

CURRICULUM AND SYLLABUS

B.Tech - INFORMATION TECHNOLOGY

Choice Based Credit System (CBCS)

SUMMARY OF CREDITS

S.No	Course Category	Credits per Semester								Total Credits	Credits in %	Credits as per AICTE Model Curriculum
		1	2	3	4	5	6	7	8			
1	HS	4	4					4		12	7.50	12
2	BS	11	8	4	4					27	16.88	25
3	ES	8	8	4	4					24	15.00	24
4	PC			12	16	12	11	4		55	34.38	48
5	PE					6	6	6		18	11.25	18
6	OE					3	3	3		9	5.63	18
7	EC						3		12	15	9.38	15
8	MC	✓										-
9	VC	✓										-
10	OC, SC, AC	✓										-
Total Credits / Sem		23	20	20	24	21	23	17	12	160		160

HS - Humanities and Social Science
BS - Basic Science
ES - Engineering Science
PC - Professional Core
PE - Professional Elective
OE - Open Elective
EC - Employability Enhancement Course (Project, Seminar, Internship, etc.)
MC - Mandatory Course
VC - Value added course (If three or more credits earned, then one elective course may be exempted)
OC - Online Course (If six or more credits earned, then two elective courses may be exempted)
SC - Self Study course
AC - Audit Course

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

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For Minor Degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

	VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)	CURRICULUM UG R – 2022 Incorporating Relative Grading System
Department	Information Technology	
Programme	B.Tech – Information Technology	

SEMESTER 1

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
1	22MCT01	Induction Programme	MC	2 Weeks			0	-	-	-
Theory										
2	22ENT11	Communicative English (For the students admitted in AY 2022–2023 only)	HS	3	0	0	3	40	60	100
2.a	22ENT11	Communicative English (For Students admitted from AY: 2023–2024 onwards)	HS	3	0	0	3	40	60	100
3	22MAT12	Matrices and Differential Calculus	BS	3	1	0	4	40	60	100
4	22PHT11	Engineering Physics	BS	3	0	0	3	40	60	100
5	22CYT11	Engineering Chemistry	BS	3	0	0	3	40	60	100
6	22CST11	Python Programming	ES	3	0	0	3	40	60	100
7	22MET11	Engineering Graphics	ES	2	0	4	4	40	60	100
8	22HST11	தமிழர் மரபு /Heritage of Tamils (For Students admitted from AY:2023-2024 onwards)	HS	1	0	0	1	40	60	100
Practical										
9	22PHL11	Physics and Chemistry Laboratory I	BS	0	0	2	1	60	40	100
10	22CSL11	Python Programming Laboratory (For the students admitted in AY 2022–2023 and 2023–2024 only)	ES	0	0	2	1	60	40	100
10.a	22CSL11	Python Programming Laboratory (For Students admitted from AY:2024-2025 onwards)	ES	0	0	2	1	60	40	100
Mandatory										
11	22MCT02	Universal Human Values	MC	2	0	0	0	100	0	100
						Total Credits	23			

SEMESTER 2

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22ENT21	Professional English (For the students admitted in AY 2022–2023 only)	HS	3	0	0	3	40	60	100
1.a	22ENT21	Professional English (For Students admitted from AY: 2023–2024 onwards)	HS	3	0	0	3	40	60	100
2	22MAT22	Probability and Statistics	BS	3	1	0	4	40	60	100
3	22PHT22	Physics for Information Sciences	BS	3	0	0	3	40	60	100
4	22EET11	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
5	22ITT21	C Programming	ES	3	0	0	3	40	60	100
6	22HST11	தமிழர் மரபு /Heritage of Tamils (For Students admitted in AY:2022-2023 only)	HS	1	0	0	1	40	60	100
6.a	22HST21	தமிழரும் தொழில் நுட்பமும் /Tamils and Technology (For Students admitted from AY:2023-2024 onwards)	HS	1	0	0	1	40	60	100
Practical										
7	22PHL21	Physics and Chemistry Laboratory – II	BS	0	0	2	1	60	40	100
8	22ITL21	C Programming Laboratory	ES	0	0	2	1	60	40	100
9	22EEL22	Engineering Practices Laboratory	ES	0	0	2	1	60	40	100
Mandatory										
10	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
						Total Credits	20			

SEMESTER 3										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22MAT34	Discrete Mathematics	BS	3	1	0	4	40	60	100
2	22ITT31	Object Oriented Programming using Java	PC	3	0	0	3	40	60	100
3	22ITT32	Data Structures using Python	PC	3	0	0	3	40	60	100
4	22ITC31	Digital Principles and Computer Organization	ES	3	0	2	4	50	50	100
5	22ITC32	Foundations of Data Science	PC	3	0	2	4	50	50	100
6	22HST21	தமிழரும் தொழில் நுட்பமும் /Tamils and Technology (For Students admitted in AY:2022-2023 only)	HS	1	0	0	1	40	60	100
Practical										
7	22ITL31	Object Oriented Programming Laboratory	PC	0	0	2	1	60	40	100
8	22ITL32	Data Structures Laboratory	PC	0	0	2	1	60	40	100
Total Credits							20			

SEMESTER 4										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22MAT42	Optimization Techniques and Queueing Theory	BS	3	1	0	4	40	60	100
2	22ITC41	Artificial Intelligence and Machine Learning	PC	3	0	2	4	50	50	100
3	22ITT41	Database Management Systems	PC	3	0	0	3	40	60	100
4	22ITC42	Embedded Systems and IoT (For the students admitted in AY 2022–2023 only)	ES	3	0	2	4	50	50	100
4a	22ITC42	Embedded Systems and IoT (For Students admitted from AY: 2023–2024 onwards)	ES	3	0	2	4	50	50	100
5	22ITT42	Operating Systems	PC	3	0	0	3	40	60	100
6	22ITT43	Design and Analysis of Algorithms	PC	3	1	0	4	40	60	100
Practical										
7	22ITL41	Database Management Systems Laboratory	PC	0	0	2	1	60	40	100
8	22ITL42	Operating Systems Laboratory	PC	0	0	2	1	60	40	100
Mandatory										
9	22MCL04	English for Professionals (For the students admitted in AY 2022–2023 and 2023–2024 only)	MC	0	0	2	0	100	0	100
9.a	22MCL04	English for Professionals (For Students admitted from AY:2024-2025 onwards)	MC	0	0	2	0	100	0	100
Total Credits							24			

SEMESTER 5										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22ITT51	Full Stack Web Development	PC	3	0	0	3	40	60	100
2	22ITT52	Computer Networks	PC	3	0	0	3	40	60	100
3	22ITT53	Formal Languages and Automata Theory	PC	3	1	0	4	40	60	100
4		Professional Elective - 1	PE	3	0	0	3	40	60	100
5		Professional Elective - 2	PE	3	0	0	3	40	60	100
6		Open Elective - 1	OE	3	0	0	3	40	60	100
Practical										
7	22ITL51	Full Stack Web Development Laboratory	PC	0	0	2	1	60	40	100
8	22ITL52	Computer Networks Laboratory	PC	0	0	2	1	60	40	100
Mandatory										
9	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
						Total Credits	21			

SEMESTER 6										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22ITC61	Object Oriented Software Engineering	PC	3	0	2	4	50	50	100
2	22ITT61	Mobile Application Development	PC	3	0	0	3	40	60	100
3	22ITT62	Distributed Computing	PC	3	0	0	3	40	60	100
4		Professional Elective - 3	PE	3	0	0	3	40	60	100
5		Professional Elective - 4	PE	3	0	0	3	40	60	100
6		Open Elective - 2	OE	3	0	0	3	40	60	100
Practical										
7	22ITL61	Mobile Application Development Laboratory	PC	0	0	2	1	60	40	100
8	22ITL62	Mini Project	EC	0	0	6	3	40	60	100
Mandatory										
9	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
						Total Credits	23			

SEMESTER 7										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Theory										
1	22ITT71	Economics and Management for Engineers	HS	3	0	0	3	40	60	100
2	22ITT72	Network Security	PC	3	0	0	3	40	60	100
3		Professional Elective - 5	PE	3	0	0	3	40	60	100
4		Professional Elective - 6	PE	3	0	0	3	40	60	100
5		Open Elective - 3	OE	3	0	0	3	40	60	100
6	22HST71	Human Values and Professional Ethics	HS	1	0	0	1	40	60	100
Practical										
7	22ITL71	Network Security Laboratory	PC	0	0	3	1	60	40	100
Mandatory										
8	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100
Total Credits							17			

SEMESTER 8										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
Practical										
1	22ITL81	Internship	EC	-	-	6	2	100	0	100
2	22ITL82	Project Work	EC	0	0	20	10	40	60	100
Total Credits							12			
Total Programme Credits							160			

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Full Stack Development for IT	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media	Vertical VI Artificial Intelligence and Machine Learning
Exploratory Data Analysis	Cloud Computing	Cloud Computing	Essentials of Ethical Hacking	Augmented Reality and VirtualReality	Knowledge Engineering
Recommender Systems	Service Oriented Architecture	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Soft Computing
Neural Networks and Deep Learning	Cloud Services Management	Cloud Services Management	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning
Text and Speech Analysis	UI and UX Design	Data Warehousing	Cyber Security	UI and UX Design	Text and Speech Analysis
Business Analytics	Software Testing and Automation	Storage Technologies	Engineering Secure Software Systems	Digital Marketing	Natural Language Processing
Image and Video Analytics	Web Application Security	Software Defined Networks	Cryptocurrency and Blockchain Technologies	Visual Effects	Game Theory
Computer Vision	DevOps	Stream Processing	Modern Cryptography	Game Development	Cognitive Science
Big Data Analytics	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Multimedia Data Compression and Storage	Ethics and AI

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VII. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI & VII.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2022.

PROFESSIONAL ELECTIVE COURSES: VERTICALS										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
VERTICAL 1: DATA SCIENCE										
1	22ITE11	Exploratory Data Analysis	PE	3	0	0	3	40	60	100
2	22ITE12	Recommender Systems	PE	3	0	0	3	40	60	100
3	22ITE13	Neural Networks and Deep Learning	PE	3	0	0	3	40	60	100
4	22ITE14	Text and Speech Analysis	PE	3	0	0	3	40	60	100
5	22ITE15	Business Analytics	PE	3	0	0	3	40	60	100
6	22ITE16	Image and Video Analytics	PE	3	0	0	3	40	60	100
7	22ITE17	Computer Vision	PE	3	0	0	3	40	60	100
8	22ITE18	Big Data Analytics	PE	3	0	0	3	40	60	100
VERTICAL 2: FULL STACK DEVELOPMENT FOR IT										
1	22ITE21	Cloud Computing	PE	3	0	0	3	40	60	100
2	22ITE22	Service Oriented Architecture	PE	3	0	0	3	40	60	100
3	22ITE23	Cloud Services Management	PE	3	0	0	3	40	60	100
4	22ITE24	UI and UX Design	PE	3	0	0	3	40	60	100
5	22ITE25	Software Testing and Automation	PE	3	0	0	3	40	60	100
6	22ITE26	Web Application Security	PE	3	0	0	3	40	60	100
7	22ITE27	DevOps	PE	3	0	0	3	40	60	100
8	22ITE28	Principles of Programming Languages	PE	3	0	0	3	40	60	100
VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
1	22ITE21	Cloud Computing	PE	3	0	0	3	40	60	100
2	22ITE32	Virtualization	PE	3	0	0	3	40	60	100
3	22ITE23	Cloud Services Management	PE	3	0	0	3	40	60	100
4	22ITE34	Data Warehousing	PE	3	0	0	3	40	60	100
5	22ITE35	Storage Technologies	PE	3	0	0	3	40	60	100
6	22ITE36	Software Defined Networks	PE	3	0	0	3	40	60	100
7	22ITE37	Stream Processing	PE	3	0	0	3	40	60	100
8	22ITE38	Security and Privacy in Cloud	PE	3	0	0	3	40	60	100
VERTICAL 4: CYBER SECURITY AND DATA PRIVACY										
1	22ITE41	Essentials of Ethical Hacking	PE	3	0	0	3	40	60	100
2	22ITE42	Digital and Mobile Forensics	PE	3	0	0	3	40	60	100
3	22ITE43	Social Network Security	PE	3	0	0	3	40	60	100
4	22ITE44	Cyber Security	PE	3	0	0	3	40	60	100
5	22ITE45	Engineering Secure Software Systems	PE	3	0	0	3	40	60	100
6	22ITE46	Cryptocurrency and Blockchain Technologies	PE	3	0	0	3	40	60	100

7	22ITE47	Modern Cryptography	PE	3	0	0	3	40	60	100
8	22ITE38	Security and Privacy in Cloud	PE	3	0	0	3	40	60	100
VERTICAL 5: CREATIVE MEDIA										
1	22ITE51	Augmented Reality and Virtual Reality	PE	3	0	0	3	40	60	100
2	22ITE52	Multimedia and Animation	PE	3	0	0	3	40	60	100
3	22ITE53	Video Creation and Editing	PE	3	0	0	3	40	60	100
4	22ITE24	UI and UX Design	PE	3	0	0	3	40	60	100
5	22ITE55	Digital Marketing	PE	3	0	0	3	40	60	100
6	22ITE56	Visual Effects	PE	3	0	0	3	40	60	100
7	22ITE57	Game Development	PE	3	0	0	3	40	60	100
8	22ITE58	Multimedia Data Compression and Storage	PE	3	0	0	3	40	60	100
VERTICAL 6: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING										
1	22ITE61	Knowledge Engineering	PE	3	0	0	3	40	60	100
2	22ITE62	Soft Computing	PE	3	0	0	3	40	60	100
3	22ITE13	Neural Networks and Deep Learning	PE	3	0	0	3	40	60	100
4	22ITE14	Text and Speech Analysis	PE	3	0	0	3	40	60	100
5	22ITE65	Natural Language Processing	PE	3	0	0	3	40	60	100
6	22ITE66	Game Theory	PE	3	0	0	3	40	60	100
7	22ITE67	Cognitive Science	PE	3	0	0	3	40	60	100
8	22ITE68	Ethics and AI	PE	3	0	0	3	40	60	100

OPEN ELECTIVES										
S. No	Course Code	Course Title	Category	Hours / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
OFFERED BY DEPARTMENT OF BIO MEDICAL ENGINEERING										
1	22BMO01	Biometric Systems and their Applications	OE	3	0	0	3	40	60	100
2	22BMO02	Healthcare Management Systems	OE	3	0	0	3	40	60	100
3	22BMO03	Basics of Bioinformatics	OE	3	0	0	3	40	60	100
4	22BMO04	Biology for Engineers	OE	3	0	0	3	40	60	100
5	22BMO05	Regulatory Requirements in Pharmaceutical Industries	OE	3	0	0	3	40	60	100
6	22BMO06	Rapid Prototyping	OE	3	0	0	3	40	60	100
7	22BMO07	Radiotherapy Basis and Applications	OE	3	0	0	3	40	60	100
8	22BMO08	Nanotechnology and Applications	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF CIVIL ENGINEERING										
1	22CEO01	Civil and Infrastructure Engineering	OE	3	0	0	3	40	60	100
2	22CEO02	Environmental pollution and waste Management	OE	3	0	0	3	40	60	100
3	22CEO03	Disaster Management and Mitigation	OE	3	0	0	3	40	60	100
4	22CEO04	Building Services	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING										
1	22CSO01	Foundation of AR/VR	OE	3	0	0	3	40	60	100
2	22CSO02	Web Designing	OE	3	0	0	3	40	60	100
3	22CSO03	Block Chain Fundamentals	OE	3	0	0	3	40	60	100
4	22CSO04	Knowledge Management	OE	3	0	0	3	40	60	100
5	22CSO05	Cloud Computing Essentials	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING										
1	22ECO01	Consumer Electronics	OE	3	0	0	3	40	60	100
2	22ECO02	Advanced Mobile Communication	OE	3	0	0	3	40	60	100
3	22ECO03	Optoelectronics	OE	3	0	0	3	40	60	100
4	22ECO04	IOT System Design and Applications	OE	3	0	0	3	40	60	100
5	22ECO05	5G Technologies	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING										
1	22EEO01	Domestic and Industrial Electrical Installations	OE	3	0	0	3	40	60	100
2	22EEO02	Renewable Energy Sources	OE	3	0	0	3	40	60	100
3	22EEO03	Electric Vehicles	OE	3	0	0	3	40	60	100
4	22EEO04	Energy Auditing and Conservation	OE	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING										
1	22MEO01	Industrial Instrumentation	OE	3	0	0	3	40	60	100
2	22MEO02	Product Design and Development	OE	3	0	0	3	40	60	100
3	22MEO03	Sustainable Manufacturing	OE	3	0	0	3	40	60	100
4	22MEO04	Entrepreneurship Development	OE	3	0	0	3	40	60	100
5	22MEO05	Fundamentals of Ergonomics	OE	3	0	0	3	40	60	100
6	22MEO06	Principles of Management and Industrial Psychology	OE	3	0	0	3	40	60	100
7	22MEO07	Safety Measures for Engineers	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF MEDICAL ELECTRONICS										
1	22MDO01	Introduction To Medical Electronics	OE	3	0	0	3	40	60	100
2	22MDO02	Hospital Waste Management	OE	3	0	0	3	40	60	100
3	22MDO03	Hospital Information System	OE	3	0	0	3	40	60	100
4	22MDO04	IoT Applications in Healthcare	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										
1	22ADO01	Fundamentals of Database	OE	3	0	0	3	40	60	100
2	22ADO02	Data Science for Engineers	OE	3	0	0	3	40	60	100
3	22ADO03	Cyber Security	OE	3	0	0	3	40	60	100
4	22ADO04	Data Visualization	OE	3	0	0	3	40	60	100
5	22ADO05	Business Analytics	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF INFORMATION TECHNOLOGY										
1	22ITO01	Basics of Java Programming	OE	3	0	0	3	40	60	100
2	22ITO02	Ethical Hacking	OE	3	0	0	3	40	60	100
3	22ITO03	E-Commerce and Applications	OE	3	0	0	3	40	60	100
4	22ITO04	Basics of Android Application Development	OE	3	0	0	3	40	60	100
5	22ITO05	Web Essentials	OE	3	0	0	3	40	60	100
6	22ITO06	Digital Video Editing	OE	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF SCIENCE AND HUMANITIES										
1	22GEO01	National Cadet Corps Studies – I	OE	3	0	0	3	40	60	100
2	22GEO02	National Cadet Corps Studies – II	OE	3	0	0	3	40	60	100

VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

Vertical I Fintech and Block Chain	**Vertical II Entrepreneurship**	**Vertical III Public Administration**	**Vertical IV Business Data Analytics**	**Vertical V Environmental and Sustainability**	**Vertical VI Artificial Intelligence**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development	Introduction to Data Science
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management	Principles of Artificial Intelligence
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials	Data Warehousing and Data Mining
Introduction to Blockchain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Digital Marketing and Social Network Analytics	Materials for Energy Sustainability	Machine Learning Techniques
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Supply Chain Analytics	Green Technology	Expert Systems
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis	Cognitive Science
-	-	-	-	Integrated Energy Planning for Sustainable Development	Gamification
-	-	-	-	Energy Efficiency for Sustainable Development	-

MINOR DEGREE COURSES: VERTICALS									
S. No	Course Code	Course Title	Hours / Week			Credits	Max. Marks		
			L	T	P		CA	SE	Tot.
VERTICAL I- FINTECH AND BLOCK CHAIN									
1	22ITM11	Financial Management	3	0	0	3	40	60	100
2	22ITM12	Fundamentals of Investment	3	0	0	3	40	60	100
3	22ITM13	Banking, Financial Services and Insurance	3	0	0	3	40	60	100
4	22ITM14	Introduction to Blockchain and its Applications	3	0	0	3	40	60	100
5	22ITM15	Fintech Personal Finance and Payments	3	0	0	3	40	60	100
6	22ITM16	Introduction to Fintech	3	0	0	3	40	60	100
VERTICAL II - ENTREPRENEURSHIP									
1	22MEM21	Foundations of Entrepreneurship	3	0	0	3	40	60	100
2	22MEM22	Team Building & Leadership Management for Business	3	0	0	3	40	60	100
3	22MEM23	Creativity & Innovation in Entrepreneurship	3	0	0	3	40	60	100
4	22MEM24	Principles of Marketing Management for Business	3	0	0	3	40	60	100
5	22MEM25	Human Resource Management for Entrepreneurs	3	0	0	3	40	60	100
6	22MEM26	Financing New Business Ventures	3	0	0	3	40	60	100
VERTICAL III – PUBLIC ADMINISTRATION									
1	22ECM31	Principles of Public Administration	3	0	0	3	40	60	100
2	22ECM32	Constitution of India	3	0	0	3	40	60	100
3	22ECM33	Public Personnel Administration	3	0	0	3	40	60	100
4	22ECM34	Administrative Theories	3	0	0	3	40	60	100
5	22ECM35	Indian Administrative System	3	0	0	3	40	60	100
6	22ECM36	Public Policy Administration	3	0	0	3	40	60	100
VERTICAL IV - BUSINESS DATA ANALYTICS									
1	22CSM41	Statistics for Management	3	0	0	3	40	60	100
2	22CSM42	Data mining for Business Intelligence	3	0	0	3	40	60	100
3	22CSM43	Human Resource Analytics	3	0	0	3	40	60	100
4	22CSM44	Digital Marketing and Social Network Analytics	3	0	0	3	40	60	100
5	22CSM45	Supply Chain Analytics	3	0	0	3	40	60	100
6	22CSM46	Financial Analytics	3	0	0	3	40	60	100
VERTICAL V - ENVIRONMENTAL AND SUSTAINABILITY									
1	22CEM51	Sustainable infrastructure Development	3	0	0	3	40	60	100
2	22CEM52	Sustainable Agriculture and Environmental Management	3	0	0	3	40	60	100
3	22CEM53	Sustainable BioMaterials	3	0	0	3	40	60	100
4	22CEM54	Materials for Energy Sustainability	3	0	0	3	40	60	100

5	22CEM55	Green Technology	3	0	0	3	40	60	100
6	22CEM56	Environmental Quality Monitoring and Analysis	3	0	0	3	40	60	100
7	22CEM57	Integrated Energy Planning for Sustainable Development	3	0	0	3	40	60	100
8	22CEM58	Energy Efficiency for Sustainable Development	3	0	0	3	40	60	100
VERTICAL VI - ARTIFICIAL INTELLIGENCE									
1	22ADM61	Introduction to Data Science	3	0	0	3	40	60	100
2	22ADM62	Principles of Artificial Intelligence	3	0	0	3	40	60	100
3	22ADM63	Data Warehousing and Data Mining	3	0	0	3	40	60	100
4	22ADM64	Machine Learning Techniques	3	0	0	3	40	60	100
5	22ADM65	Expert Systems	3	0	0	3	40	60	100
6	22ADM66	Cognitive Science	3	0	0	3	40	60	100
7	22ADM67	Gamification	3	0	0	3	40	60	100

VALUE ADDED COURSES

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
1	22VAC01	R Programming	VAC	0	0	2	1	100	0	100
2	22VAC02	Ruby on Rails	VAC	0	0	2	1	100	0	100
3	22VAC03	Stress Management and Emotional Intelligence	VAC	0	0	2	1	100	0	100
4	22VAC04	Kotlin Programming	VAC	0	0	2	1	100	0	100

MANDATORY COURSES

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
1	22MCT01	Induction Programme	MC	-	-	-	-	-	-	100
2	22MCT02	Universal Human Values	MC	2	0	0	0	100	0	100
3	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
4	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100
5	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
6	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
7	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100

L - Lecture Period
T - Tutorial Period
P - Practical Period

CA - Continuous Assessment
SE - Semester Examination
Tot. - Total

Category	Credits	Minimum contact periods per week	
Theory	3	3	1 Period = 50 Minutes duration
	4	4	
Practical	1	2	

22MCT01	INDUCTION PROGRAMME (Common to all B.E, B.Tech Programmes)	L	T	P	C
		-	-	-	0

Preamble:
This is a mandatory 2 week programme to be conducted as soon as the students enter theinstitution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department ofadmission, have a holistic outlook, and have a desire to work for national needs and beyond. Thegraduating student must have knowledge and skills in the area of his/her study. However, he/shemust also have broad understanding of society and relationships. Character needs to be nurturedas an essential quality by which he/she would understand and fulfill his/her responsibility as anengineer, a citizen and a human being. Besides the above, several meta-skills and underlyingvalues are needed."

"One will have to work closely with the newly joined students in making them feel comfortable,allow them to explore their academic interests and activities, reduce competition and make themwork for excellence, promote bonding within them, build relations between teachers and students,give a broader view of life, and build character. "Hence, the purpose of this programme is to make the students feel comfortable in their newenvironment, open them up, set a healthy daily routine, create bonding in the batch as well asbetween faculty and students, develop awareness, sensitivity and understanding of the self, peoplearound them, society at large, and nature.

The following are the activities under the induction program in which the student would be fullyengaged throughout the day for the entire duration of the program:

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to

explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

- Guide to Induction program from AICTE

22ENT11 **COMMUNICATIVE ENGLISH** **L T P C**
(Common to all B.E, B.Tech Programmes) **3 0 0 3**
(Students admitted during 2022- 23 only)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 9

Listening: Listening for General Information - Specific Details – Conversations - Telephone Conversation - Listening to Voicemail and Messages - Listening and Filling a form **Speaking**: Self Introduction - Introducing a Friend - Politeness Strategies - Telephone Conversation - Leave a Message with Another Person - Asking for Information to Fill Details in a form **Reading:** Reading Brochures - Telephone Messages - Social Media Messages relevant to Technical Contexts **Writing:** Writing Reviews - Book/Movie – Writing about Oneself **Grammar & Vocabulary:** Tenses - Types of Questions - Parts of Speech - Contextual Meaning of Words - Abbreviations and Acronyms.

UNIT 2 EXPRESSING CASUAL CONVERSATIONS 9

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry **Speaking:** Life Style Changes and Making Comparisons - Talking about Food - Making Conversation using Asking for Directions - Making an Enquiry - Role Plays - Dialogues **Reading**: Habit Formation and Changing Habits - International Cuisine - Reading a Print Interview and Answering Comprehension Questions **Writing**: E- Mail to Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations **Grammar & Vocabulary**: Evaluations and Comparisons with Adjectives – Prepositions - Modifiers.

UNIT 3 CLARIFICATIONS AND RECOMMENDATIONS 9

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking **Speaking:** Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD **Reading:** Reading Problems and Solutions – Articles - Essays drawn from various sources **Writing:** Making Recommendations - Giving Instructions - Note Making - Itinerary- Process Description **Grammar & Vocabulary**: Word Formation - Compound Nouns - Phrasal Verbs.

UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION 9

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech - Answering Multiple Choice Questions **Speaking**: Welcome Address - Vote of Thanks - Special Address on Specific Topic **Reading**: Life and Achievements of a Famous Personality - Reading Motivational Essays on Famous Engineers and Technologists **Writing:** Checklists - Business Communication - Quotations, Placing Orders, Complaints **Grammar & Vocabulary**: Modal Verbs and Probability - Collocations – Fixed Expressions - Semi-Fixed Expressions.

UNIT 5 WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS 9

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details **Speaking:** Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation - Training Facilities - Conference Facilities **Reading:** Reading Graphical Material for Comparison (advertisements) - Clarifying an Error in the Bill **Writing:** Writing Definitions – Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Designing a Website **Grammar & Vocabulary**: Use of Discourse Markers – One Word Substitution.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.

REFERENCES:

1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2nd Edition, New Delhi, 2018.
2. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

e -RESOURCES :

1. https://learnenglish.britishcouncil.org/intermediate-vocabulary
2. http://www.usingenglish.com
3. https://learnenglish.britishcouncil.org/intermediate-grammar
4. https://learnenglish.britishcouncil.org/speaking

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Converse and read fluently using basic grammar components.
CO2 Communicate through writing without any grammatical errors.
CO3 Write clear, coherent and organized passages adhering to instructions.
CO4 Speak effectively in real-time and business situations.
CO5 Enhance vocabulary through listening and reading.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO3	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO5	-	-	-	-	1	1	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ENT11	**COMMUNICATIVE ENGLISH** ***(Common to all B.E./B. Tech Programmes)*** ***(Students admitted during 2023- 24 onwards)***	**L T P C** **3 0 0 3**

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 9

Listening: Listening for General Information - Specific Details – Conversations - Telephone Conversation - Listening to Voicemail and Messages – Gap Filling **Speaking**: Self Introduction – Expressing Opinions - Introducing a Friend - Telephone Conversation - Leave a Message - **Reading:** Reading Brochures and Pamphlets **Writing:** Writing Reviews - Book/Movie – Writing about Oneself **Grammar & Vocabulary:** Parts of Speech - Tenses - Contextual Meaning of Words - Abbreviations and Acronyms.

UNIT 2 EXPRESSING CASUAL CONVERSATIONS 9

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry **Speaking:** Talking about Daily Routine - Talking about Food - Making Conversation using Asking for and Giving Directions - Making an Enquiry - Role Plays - Dialogues **Reading**: International Recipes - Reading a Print Interview and Answering Comprehension Questions **Writing**: E- Mail to a Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations **Grammar & Vocabulary**: Evaluations and Comparisons with Adjectives - Word Formation.

UNIT 3 CLARIFICATIONS AND RECOMMENDATIONS 9

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking **Speaking:** Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD **Reading:** Articles - Essays drawn from various sources - Note Making **Writing:** Writing Recommendations - Giving Instructions – Itinerary - Process Description **Grammar & Vocabulary**: Prepositions - Modifiers - Phrasal Verbs.

UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION 9

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech - Answering Multiple Choice Questions **Speaking**: Welcome Address - Vote of Thanks - Special Address on Specific Topic **Reading**: Life and Achievements of Famous People **Writing:** Checklists – Personal Letters **Grammar & Vocabulary**: Modal Verbs and Probability - Collocations – Fixed Expressions - Semi-Fixed Expressions.

UNIT 5 WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS 9

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details **Speaking:** Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation **Reading:** Reading Graphical Material for Comparison - Tables - Pie Charts **Writing:** Writing Definitions – Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Clarifying an Error in the Bill **Grammar & Vocabulary**: Types of Questions - Use of Discourse Markers – One Word Substitution.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

REFERENCES:

1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2nd Edition, New Delhi, 2018.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.

3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

e. RESOURCES :

1. https://learnenglish.britishcouncil.org
2. https://www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Converse and read fluently using basic grammar components.
CO2 Communicate through writing without any grammatical errors.
CO3 Write clear, coherent and organized passages adhering to instructions.
CO4 Speak effectively in real-time and business situations.
CO5 Enhance vocabulary through listening and reading.

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	1	-	-	1	1	-	-	2	3	-	1	-	-
Mapping Average	-	1	-	-	1	2.6	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT12	MATRICES AND DIFFERENTIAL CALCULUS	L	T	P	C
	(Common to B.E-CS, B.Tech-AI&DS and IT Programmes)	3	1	0	4

Preamble

The course aims at achieving conceptual understanding of topics such as Matrix Algebra and Calculus. The syllabus is designed to provide the skills for modeling engineering problems and understand the role of calculus in the discipline of engineering and computer science.

UNIT 1 EIGEN VALUES AND EIGEN VECTORS **9+3**

Eigen values and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Statement and application of Cayley Hamilton Theorem – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 DIFFERENTIAL CALCULUS **9+3**

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 3 ORDINARY DIFFERENTIAL EQUATIONS

Linear higher order differential equations with constant coefficients – Method of variation of Parameters – Cauchy's and Legendre's linear differential equations

UNIT 4 MULTIPLE INTEGRALS IN CARTESIAN COORDINATES **9+3**

Double integration–Change of order of integration, Area between two curves –Triple integration , Volume as triple integrals

UNIT 5 VECTOR CALCULUS **9+3**

Gradient of a Scalar point function – Divergence,Curl,Solenoidal and irrotational of a vector point function– Directional Derivative –Green's and Gauss divergence theorems (without proof)

LECTURE : 45, TUTORIAL : 15, TOTAL : 60 PERIODS

TEXT BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016
2. James Stewart, " Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Higher Engineering Mathematics", S.Chand & Company Limited, Chennai,2016.

e-RESOURCES:

1. https://www.digimat.in/nptel/courses/video/111107112/L14.html -Matrix Analysis with Applications'IIT Roorkee by Dr.S.K.Gupta
2. https://nptel.ac.in/courses/111105122 - 'Integral and Vector Calculus' , IIT Kharagpur by Prof. Hari Shankar Mahato

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine eigen values and eigenvectors of real symmetric matrices and reduce the quadratic form to canonical form by orthogonal transformation

CO2 Apply the concept of differential calculus to solve various application problems.

CO3 Solve linear differential equations with constant and variable coefficients .

CO4 Compute area and volume by double and triple integrals in Cartesian co-ordinates

CO5 Compute gradient, directional derivative by vector differentiation and determine line integrals, surface integrals and volume integrals by vector integration.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22PHT11	ENGINEERING PHYSICS	L	T	P	C
	(Common to all B.E, B.Tech Programmes)	3	0	0	3

Preamble

This course aims to impart the essential concepts of laser, fibre optics, ultrasonics, quantum physics and crystal structure and crystal defects. It also describes the physical phenomena related to the above mentioned concepts and their applications in engineering and provides motivation towards innovations.

UNIT I LASER **9**

Introduction –spontaneous emission and stimulated emission, population inversion, pumping. Einstein's coefficients - derivation. Types of lasers- Nd-YAG-CO_2, Semiconductor lasers (homojunction & heterojunction) – Industrial applications - lasers in welding, heat treatment, cutting- medical applications- holography-construction and reconstruction-Safety classes of laser.

UNIT II FIBRE OPTICS **9**

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – double crucible technique of fibre drawing - splicing, losses in optical fibre, dispersion - fibre optical communication system (Block diagram) - light sources - detectors - fibre optic sensors – temperature & displacement - endoscope.

UNIT III ULTRASONICS **9**

Introduction – Production – magnetostriction effect – piezoelectric effect - piezoelectric generator- detection of ultrasonic waves properties – cavitations - velocity measurement – acoustic grating - Industrial applications – drilling, welding, soldering and cleaning – SONAR - non destructive testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications - sonograms.

UNIT IV QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – deduction of Wien's displacement law and Rayleigh – Jeans' law from Planck's theory – Compton effect - theory and experimental verification – matter waves – Schrödinger's wave equation – time independent and time dependent equations – physical significance of wave function – particle in a one dimensional box.

UNIT-V CRYSTAL PHYSICS **9**

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – d spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – polymorphism and allotropy - crystal defects – point, line and surface defects.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai publishers, 2009.
2. Mani Naidu S., "Engineering Physics", 2nd Edition, Pearson Publishing, 2011.

REFERENCES:

1. Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 9th Edition, Thomson Brooks Cole, 2013
2. Palanisamy P.K., "Engineering Physics", 2nd Edition, Scitech Publications, 2011
3. Chitra Shadrach and Sivakumar Vadivelu, "Engineering Physics", 1st Edition, Pearson Education, 2007.

e-RESOURSES

1. http://oupinheonline.com/book/bhattacharya-tandon-engineering-physics/9780199452811.
2. https://www.khanacademy.org/science/physics/quantum-physics.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compare Nd-YAG, CO_2 and Semiconductor lasers for welding, heat treatment, cutting, medical applications and holography using Stimulated Emission.

CO2 Demonstrate the knowledge of wave optics using light waves for communication system.

CO3 Describe the production and applications of ultrasonics.

CO4 Examine the dual nature of light waves using quantum theory for Black body radiation and Schrodinger's wave equations in particle in a one and three dimensional box.

CO5 Explain the description of a crystal structure in terms of atom positions, unit cells, and crystal symmetry; and to relate the crystal symmetry to the symmetry observed in a diffraction experiment.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO2	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO3	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO4	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO5	3	2	1	1	1	1	1	-	-	1	1	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22CYT11	ENGINEERING CHEMISTRY (Common to all B.E, B.Tech Programmes)	L	T	P	C
		3	0	0	3

Preamble

The study of water technology enables engineers to acquire skills to choose the appropriate method of water treatment for industrial and domestic purposes. Electrochemistry and corrosion explain the fundamentals, identification and corrosion prevention for solving electrochemical and corrosion problems. The study of energy storage devices exposes some of the most commonly used energy storage devices. Nanochemistry empowers engineers to acquire knowledge about nanomaterials and their applications in various fields. Polymeric materials aim to equip the engineering students to realize the importance of chemistry in composites and conducting polymers.

UNIT 1 WATER TECHNOLOGY *9*

Hardness – types and its units – Boiler troubles – scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming – Internal conditioning – carbonate and calgon conditioning - External conditioning – demineralization process – Desalination – electrodialysis, reverse osmosis - Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods – Ozonisation).

UNIT 2 ELECTROCHEMISTRY AND CORROSION *9*

Electrochemistry – Emf Series and its applications. Metal Finishing – Manufacture of Printed Circuit Board.

Corrosion – mechanism – Galvanic, atmospheric (O_2) and Pitting corrosion. Protective coating – electroplating of nickel and electroless copper plating on printed circuit board.

UNIT 3 ENERGY STORAGE DEVICES *9*

Batteries – types – Construction and working of Primary battery – Zinc-Air/carbon, Secondary batteries – Lead-acid battery and Lithium-ion battery, Fuel cells – H_2-O_2 fuel cell and Microbial fuel cell.

UNIT 4 NANOCHEMISTRY *9*

Nanomaterials –Types – Synthesis – sol-gel and laser ablation – Characterization – Scanning Electron Microscope and Transmission Electron Microscope – Principle and instrumentation (block diagram) – Properties – optical, electrical, mechanical and magnetic and Applications of nanomaterials – medicine, agriculture, electronics and catalysis.

UNIT 5 POLYMERS *9*

Polymers – thermoplastics and thermosetting plastics – polymerization – types (definition only) – Compounding of plastics – fabrication – compression and injection – Composites – polymer matrix composites (Fibre reinforced composites) and metal matrix composites – Conduction polymers – General mechanism of conduction in polymers.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Engineering chemistry, 17th Edition. P. C. Jain & Monica Jain, Dhanpat Rai Publishing Company, 2021.
2. Applied chemistry, 2nd Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, McGraw Hill Education (India) Private Limited, 2019.

REFERENCES:

1. Wiley Engineering Chemistry, 2nd Edition, Wiley,Wiley India Pvt. Ltd, New Delhi, 2014.
2. Engineering chemistry, 2nd Edition. O. G. Palanna, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
3. A Textbook of NanoScience, 2nd Edition, Dr. Rakesh Kumar, Dr. Kamala Pati Tiwary, S. K. Kataria & Sons, New Delhi, 2013.

e-RESOURCES:

1. http://nptel.ac.in/courses/113105028/ , "Science and Technology of Polymers"- Prof. Basudam Adhikari, Materials Science Centre, IIT Kharagpur
2. https://archive.nptel.ac.in/courses/118/102/118102003/ , "Nano structured materials-Synthesis, Properties, Self-Assembly and Applications" - Prof. Ashok K Ganguli, Department of Chemistry, IIT Delhi

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Evaluate the process to purify hard water using internal and external treatment.
CO2 Apply the principle of electrochemistry in PCB etching and surface coating to prevent corrosion.
CO3 Compare and contrast the performance of primary, secondary and flow battery.
CO4 Analyze the characteristics of nanomaterials synthesized by top down and bottom-up process with the aid of SEM and TEM.
CO5 Categorize the types of polymeric materials and fabrication of plastic by injection and compression molding for engineering applications.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO2	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO3	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO4	3	2	2	1	1	1	2	-	1	1	1	1	-	-
CO5	3	2	2	1	1	1	2	-	1	1	1	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22CST11	PYTHON PROGRAMMING (Common to all B.E, B.Tech Programmes)	L	T	P	C
		3	0	0	3

Preamble

Python is easy to use, powerful, and versatile, making it a great choice for beginners and experts alike. Python's readability makes it a great first programming language — it allows you to think like a programmer and not waste time understanding the mysterious syntax that other programming languages can require. The syntax in Python helps the programmers to do coding in fewer steps**.** Python is widely used in bigger organizations because of its multiple programming paradigms.

UNIT 1 COMPUTING FUNDAMENTALS 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).

UNIT 2 INTRODUCTION TO PYTHON 9

Python interpreter, data types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT 3 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 4 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 5 FILES, MODULES AND PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Introduction to Pygame tool; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1. E Balagurusamy," Problem Solving and Python Programming", McGraw Hill Education, 2018
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1stEdition, Notion Press, 2021.

e-RESOURCES:

1. https://swayam.gov.in/course/4178-spoken-tutorial-python-english, "Introduction to Python", Prof. Prabhu Ramachandran, IIT Bombay.
2. https://onlinecourses.nptel.ac.in/noc18_cs21, "Programming, Data Structures and Algorithms Using Python", Prof.Madhavan Mukund, IIT-Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Use the basics of algorithmic problem solving techniques (pseudo code, flow chart, language basics) for a given problem.
CO2 Apply suitable python conditional and looping statements to solve a given problem.
CO3 Define Python functions and use function calls to solve problems.
CO4 Use Python data structures (lists, tuples, and dictionaries) to represent complex data.
CO5 Create python packages, modules and files for a given scenario.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO2	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO3	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO4	3	2	2	2	1	-	-	-	-	-	1	1	-	-
CO5	3	2	2	2	1	-	-	-	-	-	1	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MET11	ENGINEERING GRAPHICS (Common to all B.E, B.Tech Programmes)	L	T	P	C
		2	0	4	4

Preamble

The knowledge of Engineering graphics is essential for the Engineering graduates in proposing new product designs through drawings and interpreting data from existing drawings. Engineering Design inculcates into an Engineer the creativity and knowledge on various aspects to be considered while designing and realizing the functional products and processes. This course deals with Engineering curves, orthographic and pictorial projections, sectional views and development of surfaces.

UNIT 1 INTRODUCTION AND PLANE CURVES 12

Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications –Size, layout and folding of drawing sheets – Diagonal scales and vernier scales- Lines, lettering and dimensioning - Basic geometrical constructions (circular and polygonal surfaces). (PRACTICE ONLY AND NOT FOR EXAMINATIONS).

Curves used in Engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT 2 PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Orthographic projection- principles-Principal Planes - First angle projection- Projection of points in four quadrants – End point projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method.

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT 3 PROJECTION OF SOLIDS 12

Projection of simple solids- Cube, prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane and parallel to the other by rotating object method.

UNIT 4 SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position when cut by a cutting plane which is inclined to one of the reference planes and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids in simple vertical position – Cube, prisms, pyramids, cylinder and cone.

UNIT 5 ISOMETRIC AND FREE HAND SKETCHING 12

Principles of isometric projection – Isometric scale –Isometric projections of simple solids - Prisms, pyramids, cylinder and cone- Combination of two solid objects in simple vertical position.

Visualization concepts- Free hand sketching – Conversion of Isometric view to orthographic views. Perspective projection of simple solids (Qualitative only).

Introduction to CAD software (Not for Examinations)

LECTURE : 45, PRACTICAL : 15, TOTAL : 60 PERIODS

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Ltd, 13th Edition, 2015.
2. Jeyapoovan T. , "Engineering Graphics with AUTOCAD", Vikas Publishing House Pvt., Ltd., 7th Edition, 2015.

REFERENCES:

1. Bhatt N.D., Panchal, V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, 2014.
2. Parthasarathy N.S. and Vela Murali, "Engineering Drawing", Oxford University Press, 1st Edition, Second Impression 2015.
3. Luzzader W..J. and Duff J.M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

e-RESOURCES:

1. http://nptel.ac.in/courses/105104148, "Engineering Graphics" - Dr. Nihar Ranjan Patra , IIT Kanpur
2. http://cfd.annauniv.edu/webcontent.htm, "Engineering Graphics" - Dr. Velamurali

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Draw the various conic sections and Engineering curves
CO2 Sketch projections of lines and planes with vertical and inclined positions
CO3 Draw the projections of solids kept in various positions.
CO4 Sketch sectioned views of solids and development of surfaces.
CO5 Draw the isometric and orthographic views from given pictorial views.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	2	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	3	-	2	-	-
CO5	3	2	1	-	-	-	-	-	-	3	-	2	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22HST11	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT 1 LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical 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 2 HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

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 3 FOLK AND MARTIAL ARTS 3

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

UNIT 4 THINAI CONCEPT OF TAMILS 3

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 5 CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIANCULTURE 3

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 : 15

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே .கே. பிள்ளை (வெளியீடு :தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 Civilization 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) (Publishedby: 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.

22PHL11	PHYSICS AND CHEMISTRY LABORATORY I	L	T	P	C
	(Common to all B.E, B.Tech Programmes)	0	0	2	1

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as wavelength of laser and mercury spectrum, Numerical aperture and acceptance angle of an optical fiber, velocity of ultrasonic waves and thermal conductivity of bad conductor and additionally necessitate the practical skills in determination of rate of corrosion in mild steel, water quality parameters and amount of iron in the given sample.

PHYSICS LABORATORY I

LIST OF EXPERIMENTS

1. Determination of Optical property of Laser and Particle size of Lycopodium powder.
2. Determination of Numerical aperture and acceptance angle of an optical fiber.
3. Determination of velocity of ultrasonic waves- Ultrasonic Interferometer.
4. Determination of wavelength of mercury spectrum- Spectrometer grating.
5. Determination of Thermal conductivity of Bad conductor.

CHEMISTRY LABORATORY I

LIST OF EXPERIMENTS

1. Determination of alkalinity in water sample
2. Determination of Calcium and Magnesium hardness in water by EDTA method.
3. Determination of rate of corrosion in Mild steel by weight loss method.
4. Determination of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
5. Determination of iron content of the given solution using a potentiometer

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Experiment and determine the optical property of light sources and acceptance angle of optical fiber using Laser and Spectrometer.

CO2 Experiment and determine the velocity of ultrasonic waves and thermal conductivity of a given bad conductor using ultrasonic interferometer and Lee's disc.

CO3 Experiment and estimate type and amount of alkalinity, Calcium and Magnesium hardness in water sample using titrimetry.

CO4 Experiment and determine the rate of corrosion in mild steel by weight loss method.

CO5 Experiment and determine the amount of iron content present in the given sample using potentiometer and spectrophotometer.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

22CSL11 **PYTHON PROGRAMMING LABORATORY** **L T P C**

(Common to all B.E, B.Tech Programmes) **0 0 2 1**

(For the students admitted in AY 2022–2023 and 2023–2024 only)

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow 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.)
2. Python programming using simple statements and expressions
   (exchange the values of two variables, circulate the values of n variables, distance between two points)
3. Scientific problems using Conditionals and Iterative loops.
   (Number series, Number Patterns, pyramid pattern)
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 of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries.
   (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions.
   (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings.
   (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries
   Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling
10. Developing a game activity using Pygame like bouncing ball, car race

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Design flowcharts using Raptor.

CO2 Develop programs using expressions and Control statements in Python.

CO3 Develop programs using functions, packages for a given problem..

CO4 Process compound data using Python data structures

CO5 Utilize Python packages in developing software applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO2	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO3	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO4	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO5	2	2	2	3	-	-	-	-	1	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22CSL11 **PYTHON PROGRAMMING LABORATORY** **L T P C**

(Common to all B.E, B.Tech Programmes) **0 0 2 1**

(For Students admitted from AY:2024-2025 onwards)

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow 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.)
2. Python programming using simple statements and expressions
   (exchange the values of two variables, circulate the values of n variables, distance between two points)
3. Scientific problems using Conditionals and Iterative loops.
   (Number series, Number Patterns, pyramid pattern)
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 of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries.
   (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions.
   (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings.
   (reverse, palindrome, character count, replacing characters)
8. Implementation of searching algorithms using linear and binary search technique.
9. Implementation of sorting algorithms using selection sort and insertion sort method.
10. Implementing programs using written modules and Python Standard Libraries
    Libraries (pandas, numpy. Matplotlib, scipy)
11. Implementing real-time/technical applications using File handling.
12. Developing a game activity using Pygame like bouncing ball, car race.

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1	Design flowcharts using Raptor.
CO2	Develop programs using expressions and Control statements in Python.
CO3	Develop programs using functions, packages for a given problem..
CO4	Process compound data using Python data structures
CO5	Utilize Python packages in developing software applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO2	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO3	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO4	2	2	2	3	-	-	-	-	1	-	-	1	-	-
CO5	2	2	2	3	-	-	-	-	1	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCT02 UNIVERSAL HUMAN VALUES L T P C
2 0 0 0

Preamble:

• To develop the understanding as physical health and factors for strengthening life force.
• To expose the students on to areas of mediation and impart the knowledge on social virtues and morals.

UNIT 1 Physical Health 6

SKY – Introduction – Education as a means for youth empowerment – Greatness of Education – Yoga for Youth Empowerment – Simplified Physical Exercises: Explanation – Hand, Leg, Breathing and Eye exercises – Kapalabathi, Makarasanam, Massaging, Acupressure and Relaxation practices – Yogasanas- Explanation – Benefits.

UNIT 2 Strengthening Life Forces 6

Reasons for Diseases: Natural Reasons (Hereditary, Planetary Position, Natural Calamities and Climatic changes) – Artificial Reasons (Food, Thought, Deed). Philosophy of Kayakalpa: Physical Body –Life Force – Biomagnetism – Mind. Maintaining Youthfulness – Postponing Aging – Transformation of Food into seven Body constituents.

UNIT 3 Wellness of Mind 6

Classification of Mind Waves – Beta, Alpha, Theeta, Delta – Agna Meditation – Benefits. Shanthi Mediation – Benefits. Thuriya Meditation – Benefits. Blessing and its Benefits: Auto Suggestion – Blessing the family and others – Blessings the World – Divine Protection

UNIT 4 Virtues 6

Individual Virtues: Self Control – Self Confidence – Speaking Truth – Contentment – Humility – Mind Control. Tolerance – Adjustment – Sacrifice – Forgiveness. Cleanliness (Body, Dress, Surrounding)-External, Mental, Inner Cleanliness. **Societal Virtues** :Ahimsa – Services, Patriotism – Equality, Respecting the parents and elders – Caring for them – Respecting Teachers. Punctuality – Time Management.

UNIT 5 Morals 6

Importance of introspection: I and Mine (Ego, Possessiveness), Six Temperaments: Greed – Anger – Miserliness – Immoral Sexual Passion – Inferior Superior complex – Vengeance. Maneuvering the Six Temperaments: Contentment – Tolerance – Charity – Chastity – Parity – Forgiveness. Five important Benefits of Meditation: Perspicacity – Magnanimity – Adaptability – Receptivity – Creativity. (Enhancing memory) (Effective Examination Preparation)

TOTAL : 30 PERIODS

TEXT BOOKS:

1. "Yoga for Youth Empowerment" compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi, 1st Edition 2016.
2. "Yoga for Human Excellence", compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi 1st Edition 2009.

e-RESOURCE:

1. www.online.vethathiri.edu.in "online in (Virtual) Programme on Yoga and Human Excellence".

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Demonstrate the knowledge on physical health
CO2 Discuss the various factors for strengthening life force
CO3 Classify mind waves and explain the benefits of meditation
CO4 Explain individual and social virtues
CO5 Identify and explain the importance of morals.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	2	2	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	2	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-"No correlation

22ENT21 **PROFESSIONAL ENGLISH** **L T P C**

(Common to all B.E, B.Tech Programmes) **3 0 0 3**

(Students admitted during 2022- 23 only)

Preamble:

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

UNIT 1 ANALYTICAL READING 9

Listening: Listening to Podcasts - Anecdotes - Stories - Event Narration - Documentaries and Interviews with Celebrities - Evaluative Listening - Advertisements - Listening and Filling a Graphic Organizer **Speaking**: Conversation Skills – Opening - Turn Taking - Closing - Explaining how something works - Marketing a Product - Persuasive Speech Techniques **Reading:** Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning **Writing**: Professional E-mails – E-mail Etiquette - Compare and Contrast Essays **Grammar & Vocabulary**: Prepositional Phrases - Impersonal Passive Voice - Product Description.

UNIT 2 SUMMARISING 9

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology - Listening Technical Information from Podcasts **Speaking**: Summarizing - Oral Reporting - Narrating Personal Experiences – Events - Interviewing a Celebrity **Reading:** Reading Scientific and Technical Articles - Texts **Writing:** Lab Reports - Summary Writing **Grammar & Vocabulary**: Purpose Expressions - Same Word used as Different Parts of Speech.

UNIT 3 DESCRIBING VISUAL MATERIALS 9

Listening: Listening to the Panel Discussion **Speaking**: Speaking at Formal Situations - Mini Presentation and Making Recommendations **Reading:** Reading Journal Articles - Speed Reading - Interpretation of Graphics – Tables - Pie Chart - Flow Chart - Bar Chart **Writing**: Data Commentaries - Describing Visual Materials - Mechanics of Writing - Writing Complaints to Editorial Columns **Grammar & Vocabulary:** Subject-Verb Agreement - Pronouns - Relative Pronouns.

UNIT 4 WRITING E-MAILS AND JOB APPLICATION LETTERS 9

Listening: Listening to Model Interviews **Speaking**: Speaking at Different Types of Interviews - Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) **Writing:** Filling up the Job Application Letter – Cover Letter – Résumé Preparation - Internship Application **Grammar & Vocabulary:** Error Correction – 'If' Conditionals - Infinitives - Gerunds.

UNIT 5 REPORT WRITING 9

Listening: Viewing a Model Group Discussion **Speaking**: Participating in a Group Presentation - Presentation **Reading:** Cause and Effect Essays – Letters and E-mails of Complaint **Writing:** Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report - Feasibility Report - Designing and Reporting Surveys - Writing Discursive Essays **Grammar & Vocabulary:** Reported Speech - Numerical Adjectives - Idioms and Phrases.

TOTAL: 45 PERIODS

TEXT BOOK:

1. 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited. 2019.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook , Oxford University Press, 2020.

REFERENCES:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
2. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

e -RESOURCES :

1. www.eslgold.com
2. www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

CO1	Read for gathering and understanding information using narrative techniques.
CO2	Develop and demonstrate listening skills for academic and professional purposes.
CO3	Apply apt vocabulary and construct grammatically correct sentences in professional situations.
CO4	Face interviews with communicative competence and confidence with a good knowledge of career skills.
CO5	Enhance writing skills for essays and for preparing reports.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO3	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO5	-	-	-	-	1	1	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ENT21	**PROFESSIONAL ENGLISH** ***(Common to all B.E./B. Tech Programmes)*** ***(Students admitted during 2023- 24 onwards)***	**L T P C** **3 0 0 3**

Preamble:

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

UNIT 1 ANALYTICAL READING **9**

Listening: Listening to Anecdotes - Stories - Event Narration – Documentaries and Interviews with Celebrities - Advertisements - Listening and Gap Filling Exercises **Speaking**: Conversation Skills – Initiating - Turn Taking - Closing – Explaining how something works - Persuasive Speech Techniques **Reading:** Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning **Writing**: Professional E-mails – E-mail Etiquette – Compare and Contrast Essays **Grammar & Vocabulary**: Prepositional Phrases –Same Word used as Different Parts of Speech.

UNIT 2 SUMMARISING **9**

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology – Listening Technical Information from Podcasts **Speaking**: Summarizing - Oral Reporting – Narrating Personal Experiences – Events – Interviewing a Celebrity **Reading:** Reading Scientific and Technical Articles - Texts **Writing:** Lab Reports - Summary Writing. **Grammar & Vocabulary**: Impersonal Passive Voice - Purpose Expressions.

UNIT 3 DESCRIBING VISUAL MATERIALS **9**

Listening: Listening to the Panel Discussion **Speaking**: Speaking at Formal Situations –Mini Presentation and Making Recommendations **Reading:** Reading Journal Articles - Speed Reading - Interpretation of Graphics – Flow Chart - Bar Chart **Writing**: Data Commentaries - Describing Visual Materials – Mechanics of Writing - Writing Complaints to Editorial Columns **Grammar & Vocabulary:** Subject-Verb Agreement – Pronouns - Relative Pronouns - Numerical Adjectives.

UNIT 4 WRITING E-MAILS AND JOB APPLICATION LETTERS **9**

Listening: Listening to Model Interviews **Speaking**: Speaking at Interviews – Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) **Writing:** Filling up the Job Application – Cover Letter – Résumé Preparation – Internship Application **Grammar & Vocabulary:** 'If' Conditionals – Infinitives – Gerunds - Compound Nouns.

UNIT 5 REPORT WRITING **9**

Listening: Viewing a Model Group Discussion **Speaking**: Participating in a Group Talk –
Reading: Cause and Effect Essays – Business Letters **Writing:** Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report – Feasibility Report - Designing and Reporting Surveys – Writing Discursive Essays **Grammar & Vocabulary:** Reported Speech – Idioms and Phrases.

TOTAL: 45 PERIODS

TEXT BOOK:

1. 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited .2019.

REFERENCES:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook , Oxford University Press, 2020.
3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

e. RESOURCES :

1. www.eslgold.com
2. www.usingenglish.com

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Read for gathering and understanding information using narrative techniques.

CO2 Develop and demonstrate listening skills for academic and professional purposes.

CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.

CO4 Face interviews with communicative competence and confidence with a good knowledge of career skills.

CO5 Enhance writing skills for essays and for preparing reports.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 2	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 3	-	1	-	-	1	3	-	-	2	3	-	1	-	-
CO 4	-	-	-	-	1	3	-	-	2	3	-	1	-	-
CO 5	-	-	-	-	1	1	-	-	2	3	-	1	-	-
Mapping Average	-	1	-	-	1	2.6	-	-	2	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT22	PROBABILITY AND STATISTICS	L	T	P	C
	(Common B.E – CS and B.Tech – IT, AI & DS Programmes)	3	1	0	4

Pre-requisites : Matrices and Differential Calculus

Preamble

Probability theory is an important foundation for computer science field such as machine learning, artificial intelligence, computer graphics and randomized algorithms. Statistics is the language of the uncertainties in the modern information age. It's descriptive and inferential roles not only formulate the basis of the growth of almost all the disciplines of the contemporary world, but also provide an array of non-traditional employment avenues ranging from that of sport analysis to business analysis..

UNIT 1 PROBABILITY THEORY **9+3**

Basic definitions and rules for probability, conditional probability-independence of events-Baye's theorem- Random variables - Discrete and continuous random variables. Distributions: Discrete distributions – Binomial, Poisson – Continuous distributions –Uniform, Exponential and Normal distributions.

UNIT 2 TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression

UNIT 3 ESTIMATION THEORY 9+3

Estimation :Point and interval estimation-Confidence Interval for the population Mean for Large and Small Samples,Confidence Interval for the Population Proportion for Large Samples

UNIT 4 TESTING OF HYPOTHESIS 9+3

Large sample test based on Normal distribution for single mean and difference of means – Small sample tests based on t distributions for testing of means and F distributions for testing of variances – χ^2 test – Contingency table (Test for Independency) – Goodness of fit.

UNIT 5 ANALYSIS OF VARIANCE 9+3

Assumptions, One way and two way classifications - Completely randomized design – Randomized block design –Latin square design.

Lecture : 45; Tutorial : 15; Total : 60

TEXT BOOKS:

1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Edition 2014.
2. Walpole R.E., Myers R.H., Myers S.L., and Ye K., "Probability and Statistics for Engineers and scientists", 9th Edition, Pearson Education India,2012.

REFERENCES:

1. Johnson R.A., 'Miller and Freund's Probability and Statistics for Engineers," 8th Edition, Pearson Education India, 2011.
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Veerarajan T., "Probability, Statistics and Random Processes with Queueing theory and Queueing Networks", 4th Edition, Tata McGraw Hill Edition, New Delhi, 2015.

e-Resources:

1. http://nptel.ac.in/courses/111104075/13, "Analysis of Variance and Design of Experiments, Module-III,Dr.Shalabh, Department of Mathematics and Statistics, Indian Institute of Technology,Kanpur.

2. http://nptel.ac.in/courses/111105041/40/, "Probability and Statistics", Prof. Dr. Somesh Kumar, Department of Mathematics, Indian Institute of Technology, Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Solve the problems involving discrete and continuous distributions using the properties of Probability.

CO2 Measure the degree of relationship between the two dimensional random variables using correlation and regression.

CO3 Analyze the estimation problems using suitable estimators.

CO4 Test the hypothesis for given small and large samples and determine the Goodness of fit of the sample using Chi-square test.

CO5 Analyze the given samples based on their variance.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	2	2	-	-	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22PHT22	PHYSICS FOR INFORMATION SCIENCES	L	T	P	C
	(Common to B.E-CS, B.Tech-AI&DS and IT Programmes)	3	0	0	3

Prerequisites : Engineering Physics

Preamble

Knowledge about the electronic structure of metals and semiconductors has manifested as a technology to design materials of desired properties. The knowledge of magnetic materials, superconductors and optical behavior of materials form the basis of solid state devices. Nanomaterials are envisioned in self-replicating robots at the molecular scale, in engines of creation.

UNIT 1 CONDUCTING MATERIALS 9

Conductors – Classical free electron theory of metals – Electrical and thermal conductivities -Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi function – Density of energy states –Carrier concentration in metals.

UNIT 2 SEMICONDUCTING MATERIALS 9

Classification of Semiconductors - Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Derivation of carrier concentration in n-type and p-type semiconductor– Variation of Fermi level with temperature and impurity concentration - Hall effect – Determination of Hall coefficient – Zener diode-Varactor diode.

UNIT 3 MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – Comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – Soft and hard magnetic materials – Antiferromagnetic materials-Uses of Magnetic materials in computers-Hard disk drive-CRT motors-Cooling fans-Optical disc drives.

Superconductivity : Properties – Type I and type II superconductors –BCS theory of superconductivity (qualitative) – High Tc superconductors – Josephson effect -Applications of superconductors –SQUID, cryotron, magnetic levitation.

UNIT 4 OPTICAL MATERIALS 9

Classification of optical materials – Absorption in metals, insulators & Semiconductors (concept only)-carrier generation and recombination processes-LED's – Organic LED's – Polymer light emitting materials – Plasma light emitting devices— Laser diodes – Optical data storage techniques, LCD.

UNIT 5 NANOMATERIALS 9

Nanomaterials: Introduction-properties –Classification of synthesis routes- Methods of Synthesis- Ball milling – Sol gels –Chemical Vapour Deposition (CVD) – Applications of Nanomaterials. Nanoforms of Carbon - Buckminster fullerene- graphene –Carbon nanotubes : Fabrication – Arc method – Pulsed Laser Deposition (PLD)- Quantum wires, Quantum dots-preparation, properties and applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Palanisamy P.K, "Materials Science", 2nd Edition, Scitech publications (India) Pvt. Ltd., Chennai, 2015.
2. S.O.Pillai "Solid State Physics",9th Edition,New Age International(P) Ltd,Publishers New Delhi,2020.

REFERENCES:

1. Balasubramaniam R, "Callister's Materials Science and Engineering", 2nd Edition, Wiley-India 2014.
2. Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 1st Edition, Wiley, New Delhi, December 2020.
3. Donald A.Neamen, "Semiconductor Physics and Devices: Basic Principles",4th Edition, Tata McGraw-Hill, 2012

e-RESOURCES

1. http://nptel.ac.in/courses/122102008 , "Materials Science" – Dr. S. K. Gupta, IIT Delhi
2. https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the behaviour of conducting materials based on classical and Quantum theory for Electrical and Thermal conductors.

CO2 Demonstrate the knowledge on semiconductors with respect to carrier concentration and halleffect using density of energy states.

CO3 Compare the properties of magnetic materials for dia, para and ferro magnets and discuss theapplications of Magnetic materials and superconductors using CRT Motors,Cooling fans SQUID, Cryotron and MAGLEV.

CO4 Discuss the functioning of optical materials in metals,insulators and semiconductors for optical data storage devices.

CO5 Describe the synthesis and characterization of nano materials using CVD, PLD, Arc method for carbon nano tubes.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO2	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO3	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO4	3	2	1	1	1	1	1	-	-	1	1	1	-	-
CO5	3	2	1	1	1	1	1	-	-	1	1	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22EET11	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to B.E-CE,CS,ME, B.Tech-AI&DS and IT Programmes)	L	T	P	C
		3	0	0	4

Preamble

The course covers the fundamentals of basic electrical circuit parameters of both ac and dc circuits and the characteristics of motors and generators. The basics of semiconductor devices and logic gates provides the necessary initiative for the students to acquire the knowledge in basic electronics.

UNIT 1 DC CIRCUITS AND AC CIRCUITS **9**

DC Circuits: Basic Definitions - Resistance: Resistors in Series and Parallel - Ohm's Law - Method of solving a circuit by Kirchoff's laws. AC Circuits: Basic Definitions - Alternating Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor - Analysis of AC Circuit: R, L, C, Series RL, RC & RLCCircuits.

UNIT 2 POWER SYSTEMS **9**

Structure of Power System - Generation: Introduction to Conventional and Non Conventional Energy Sources - Transmission: Overhead and Underground Systems - Distribution: Single phase and three phase system - Basic principles of Earthing.

UNIT 3 ELECTRICAL MACHINES **9**

Laws of Electromagnetic Induction – Fleming's Right and Left hand rules – Lenz's law. DC Generator: Construction and working principle - DC Motor: Construction and working principle - Single Phase Induction Motor: Split Phase and Capacitor Start Induction Motor.

UNIT 4 ELECTRONICS DEVICES **9**

PN junction Diode and its Characteristics - Zener Diode and its Characteristics - Half and Full wave Rectifiers - Bipolar Junction Transistor - CE configuration and its characteristics.

UNIT 5 DIGITAL ELECTRONICS **9**

Boolean Algebra - Theorems and Laws - De-Morgan's theorem - Logic Gates - Universal Gates - Implementation of Boolean functions. Binary Arithmetic: Addition - Subtraction - Multiplication - Division - Half adder and Full adder circuits.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 1st Edition, 2014.
2. Mittle V N and Aravind Mittal, "Basic Electrical engineering", McGraw Hill Education, 2nd Edition, 2006.

REFERENCES:

1. V.K.Mehta and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand& Company Ltd,2015.
2. SedhaR.S.,"Applied Electronics",S.Chand& Company Ltd,2006.
3. Thomas L.Floyd.,"DigitalFundamentals",PearsonEducation,PrenticeHall,Tenth Edition,2010.

e-RESOURCES:

1. NPTEL, http://nptel.ac.in/courses/117106101/ , "Basic Electrical Circuits", Prof. NagendraKrishnapura, IIT,Madras.
2. NPTEL, http://nptel.ac.in/downloads/108105053/ , "Basic Electrical Technology", Prof. Dr. L. Umanand, IIS,Bangalore.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analyze the various DC and AC circuits and find the circuit parameters.
CO2 Describe the principles of power system engineering.
CO3 Illustrate the construction and working principle of electrical machines.
CO4 Explain the basics of semiconductor devices and its applications.
CO5 Describe the basics of Number systems and Logic gates.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO2	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO3	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO4	2	3	2	-	-	-	1	-	-	-	-	1	-	-
CO5	2	3	2	-	-	-	1	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT21 **C PROGRAMMING** **L T P C**

3 0 0 3

Preamble:

This course aims at giving adequate exposure to students on the principles of procedural programming language. The course is intended to introduce the students to computational thinking and make the students develop C Programs using basic programming constructs. The course will enable the students to apply the fundamentals of C programming to solve Engineering problems.

UNIT 1 BASICS OF C PROGRAMMING **9**

Introduction to Programming – Introduction to C - Structure of C program – Compilation and Execution - C Tokens –Keywords, Variables, Constants - Data Types – Input/output statements - Operators: Precedence and Associativity - Expressions – Type Conversion and Typecasting - Decision control and Looping statements - Preprocessor directives. Case study: EB Bill Generation

UNIT 2 ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization – One dimensional array –Linear Search, Binary Search. Two dimensional arrays – Matrix Operations (Addition, Multiplication and Transpose) – Strings - String operations: length, compare, concatenate, copy, reverse – Array of Strings. Case Study: Sorting of student namelist in a classroom

UNIT 3 FUNCTIONS AND POINTERS **9**

Introduction to functions - Built-in functions (string functions, math functions) – User-defined functions - Function prototype, function definition, function call – Parameter passing: Pass by value, Pass by reference - Recursion. Pointers – Declaration – Pointer expression and Pointer arithmetic – Array of pointers –Function Pointers – Case Study: Scientific calculator using built-in functions and user defined functions

UNIT 4 STRUCTURES, UNION AND ENUMERATED DATATYPES **9**

Structure **-** Nested structures – Pointer and Structures – Array of structures – Structure and Functions – Union - Example Programs using structures and Unions – Enumerated Data types. Case Study: Create employee datasheet using Structure, Union.

UNIT 5 FILE PROCESSING **9**

Introduction to Files – Using Files in C – Reading and writing Files –Types of file processing: Sequential access, Random access - Functions for selecting a record - Command line arguments - Storage classes – Dynamic memory allocation. Case study: Processing stock details of Library.

TEXT BOOKS: **TOTAL: 45 PERIODS**

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, 3rd Edition, Oxford University Press, 2013.

REFERENCES:

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, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs45/preview

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Apply suitable data type and control statements in C language to solve the given problem.

CO2 Experiment the given list of data through sorting or searching techniques in C.

CO3 Develop C programs using functions and pointers to access arrays.

CO4 Apply user defined data types like structures and unions to solve problems.

CO5 Develop C programs to store and process the given data using files.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO2	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO3	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO4	3	2	3	2	-	2	1	-	-	-	-	1	-	-
CO5	3	2	3	2	-	2	1	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22HST21	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT 1 WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT 2 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 3 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 4 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 5 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 : 15

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே .கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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 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) (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) – ReferenceBook.

22MCT03	ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to all B.E, B.Tech Programmes)	L 2	T 0	P 0	C 0

Preamble

The study of biodiversity reflects the level of national interest in natural resources and heritage, which is considered as an important part of a country's wealth. As India is one of the world's 12 giant diversity hubs, we need to focus on understanding, preserving and utilizing the biodiversity of our biological resources. Environmental protection is an important issue for today's society, as scientific research provides evidence of increased global warming, ozone depletion and increased pollution. Engineers need to learn the importance of green synthesis in the design, development and evaluation of structures, devices and systems to provide practical solutions to the problems caused by the pollution and depletion of natural resources.

UNIT 1 NATURAL RESOURCES, ECOSYSTEM AND BIODIVERSITY 6

Forest Resources – use and over exploitation – Water Resources – use and over utilization – Dams – benefits and problems – Ecosystem – structure and function – Biodiversity – types – threats to biodiversity – Biodiversity conservation–In-situ and Ex-situ – Role of an individual in conservation of natural resources.

UNIT 2 ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures – Air Pollution, Water Pollution, Soil Pollution – Solid waste – methods of disposal – sanitary landfill, incineration and composting – Environmental Impact Assessment and ISO 14000.

UNIT 3 E-WASTE AND ITS MANAGEMENT 6

E-Waste – sources of e-waste – hazardous substances in e-waste – effects of e-waste on environment and human health – need for e-waste management – disposal treatment methods of e-waste – Global scenario of e-waste – e-waste in India- case studies.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT 6

Social issues – Sustainable development – Water conservation – rain water harvesting. Disaster Management – floods, earthquake, cyclone and landslides. Role of IT in environment and human health.

UNIT 5 GREEN CHEMISTRY 6

Green Chemistry – twelve principles of green chemistry – Importance of green synthesis – Green synthesis – dimethyl carbonate – Bio-catalysts – extraction of gold – Applications of green synthesis.

TOTAL : 30 PERIODS

TEXT BOOKS:

1. Environmental Science, 5th Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, V. N. Kowshalya, Pearson India Education services Private Limited, 2020.
2. Environmental Science and Engineering, 2nd edition, Dr.T. Arun Luiz , V K publications, 2018.

REFERENCES:

1. Environmental Science and Engineering, 3rd reprint, Benny Joseph, McGraw Hill Education (India) Private Limited, New Delhi, 2015.
2. Engineering Chemistry, 1st Impression, K. Sesha Maheswaramma, Mridula Chugh, Pearson India Education Services Private Limited, 2016.
3. Introduction to Environmental Engineering and Science, 2nd edition, Gilbert M. Masters, Prentice Hall of India Private Limited, 2015.

e-RESOURCES:

1. https://www.digimat.in/nptel/courses/video/105105169/L01.html , "Electronic waste management-issues and challenges"- Prof. Brajesh Kumar Dubey, Department of Civil Engineering, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/105/103/105103205/, "Municipal solid waste management"- Prof. Ajay Kalamdhad, Department of Civil Engineering, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Recognize the biodiversity threats, overexploitation of forest and overutilization of water to conserve biodiversity.
CO2 Analyze sources, impacts, air and water pollution control measures and solid waste management to maintain a green environment.
CO3 Identify the Environmental impacts of e-waste and its management.
CO4 Explain human health, environment and disaster management through information technology.
CO5 Apply the principles of green chemistry to green synthesis for a sustainable environment.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO2	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO3	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO4	3	2	1	1	1	2	3	2	1	1	1	2	-	-
CO5	3	2	1	1	1	2	3	2	1	1	1	2	-	-
Mapping Average	**3**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**-**	**-**

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22PHL21	PHYSICS AND CHEMISTRY LABORATORY II	L	T	P	C
	(Common to all B.E, B.Tech Programmes)	0	0	2	1

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as young's modulus, band gap, Co-efficient of viscosity, thickness of thin wire and Rigidity modulus of wire. This course also aims to impart the significance and estimation of DO and Cl^- content in water sample by titrimetric method. Amount of Na^+, $Ba^{2+}$and acid with electroanalytical techniques such as flame photometry, conductometry and pH meter in the aqueous solutions has been quantitatively analyzed.

PHYSICS LABORATORY II
LIST OF EXPERIMENTS

1. Determination of Young's modulus by Uniform bending method.
2. Determination of bandgap of semiconductors.
3. Determination of co-efficient of viscosity by Poiseuille's method.
4. Determination of thickness of thin wire by Air wedge method.
5. Determination of rigidity modulus-torsion pendulum.

CHEMISTRY LABORATORY II
LIST OF EXPERIMENTS

1. Determination of Dissolved Oxygen content of waste water sample by Winkler's method.
2. Determination of chloride content of wastewater sample by Argentometric method.
3. Estimation of dissolved metal ions present in wastewater using flame photometer.
4. Conductometric precipitation titration of $BaCl_2$ vs Na_2SO_4 using conductivity meter.
5. Determination of acid strength in waste water using pH meter.

TOTAL : 45 PERIODS

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, Air wedge and Torsion Pendulum

CO2 Experiment and determine the band gap energy of a given semiconducting material using Zener diode.

CO3 Experiment and determine the physical characteristics of a given liquid using Poiseuille's method.

CO4 Experiment and estimate the amount of dissolved oxygen by Winkler's method and Chloride content by Mohr's method.

CO5 Analyse the concentration of metal ions and acid present in the wastewater with the aid of Flame photometer, Conductivity meter and pH meter.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO2	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO3	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO4	2	1	-	3	-	1	1	-	1	1	1	1	-	-
CO5	2	1	-	3	-	1	1	-	1	1	1	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) "-" No correlation

22ITL21 **C PROGRAMMING LABORATORY** **L T P C**
0 0 2 1

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to solve Engineering problems using C programming language.

LIST OF EXPERIMENTS

1. If the three sides of a triangle are entered through the keyboard, write a program to check whether the triangle is valid or not. The triangle is valid if the sum of two sides is greater than the largest of the three sides.
2. A university has the following rules for a student to qualify for a degree with A as the main subject and B as the subsidiary subject:
   (a) He should get 55 percent or more in A and 45 percent or more in B.
   (b) If he gets than 55 percent in A he should get 55 percent or more in B. However, he should get at least 45 percent in A.
   (c) If he gets less than 45 percent in B and 65 percent or more in A he is allowed to reappear in an examination in B to qualify.
   (d) In all other cases he is declared to have failed.
   Write a program to receive marks in A and B and Output whether the student has passed, failed or is allowed to reappear in B.
3. Twenty-five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many are negative, how many are even and how many odd.
4. Write a program that extracts part of the given string from the specified position. For example, if the sting is "Working with strings is fun", then if from position 4, 4 characters are to be extracted then the program should return string as "king". Moreover, if the position from where the string is to be extracted is given and the number of characters to be extracted is 0 then the program should extract entire string from the specified position.
5. A positive integer is entered through the keyboard, write a program to obtain the prime factors of the number. Modify the function suitably to obtain the prime factors recursively.
6. Write a function to compute the distance between two points and use it to develop another function that will compute the area of the triangle whose vertices are A(x1, y1), B(x2, y2), and C(x3, y3). Use these functions to develop a function which returns a value 1 if the point (x, y) lines inside the triangle ABC, otherwise a value 0.
7. An animal could be a canine (dog, wolf, fox, etc.), a feline (cat, lynx, jaguar, etc.), a cetacean (whale, narwhal, etc.) or a marsupial (koala, wombat, etc.). The information whether a particular animal is canine, feline, cetacean, or marsupial is stored in bit number 0, 1, 2 and 3 respectively of a integer variable called type. Bit number 4 of the variable type stores the information about whether the animal is Carnivore or Herbivore. For the following animal, complete the program to determine whether the animal is a herbivore or a carnivore. Also determine whether the animal is a canine, feline, cetacean or a marsupial.
8. There is a structure called employee that holds information like employee code, name, date of joining. Write a program to create an array of the structure and enter some data into it. Then ask the user to enter current date. Display the names of those employees whose tenure is 3 or more than 3 years according to the given current date.

9. Given a list of names of students in a class, write a program to store the names in a file on disk. Make a provision to display the nth name in the list (n is data to be read) and to display all names starting with S.
10. Assume that a Master file contains two fields, Roll no. and name of the student. At the end of the year, a set of students join the class and another set leaves. A Transaction file contains the roll numbers and an appropriate code to add or delete a student. Write a program to create another file that contains the updated list of names and roll numbers. Assume that the Master file and the Transaction file are arranged in ascending order by roll numbers. The updated file should also be in ascending order by roll numbers.

TOTAL: 45 PERIODS

Course Outcomes:

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

CO1 Develop and test the C program to solve a given problem statement using suitable data types, decision making and control statements.
CO2 Write the C program to process the given list of data using the concepts of arrays and strings
CO3 Develop and test the C program for the given problem statement using functions and recursion.
CO4 Apply the concepts of structure and union to solve a given problem statement in C.
CO5 Construct the C program to store and process the given data using files.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO2	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO3	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO4	2	3	3	3	2	1	1	-	1	-	-	2	-	-
CO5	2	3	3	3	2	1	1	-	1	-	-	2	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22EEL22	ENGINEERING PRACTICES LAB	L T P C
	(Common to CS, AI&DS and IT Branches)	0 0 2 1

Preamble:

The students are given the introduction upon the basics of computer which comprises of the study of Motherboard and interfacing components and operating system. They were given the practice for assembling a PC, assembling RAM in a motherboard, assembling hard disk drive in a cabinet, assembling CD/DVD ROM in a cabinet, establishing data connection and fixing wires. The basic knowledge of electrical and electronics is mandatory and it is practiced with the wiring experiments and by verification of the basic logic gates.

LIST OF EXPERIMENTS

COMPUTER

1) Study and identification of standard desktop personal computer.
2) Study of Motherboard and interfacing components.
3) Install, upgrade and configure Windows operating systems.
4) Install, upgrade and configure Linux operating systems.
5) Computer Assembly and Configuration : Steps for assembling a PC, assembling RAM in a motherboard, assembling hard disk drive in a cabinet, assembling CD/DVD ROM in a cabinet,establishing data connection and fixing wires.
6) System Installation: Steps for installing different softwares (including antivirus software, printer andscanner software).

ELECTRICAL AND ELECTRONICSELECTRICAL

7) Residential house wiring using switches, fuse, indicator and lamps.
8) Fluorescent lamp wiring.
9) Stair case wiring.
10) Reading of voltage, current, power, energy and other parameters with 1 phase digital energy meter
11) Measurement of earth resistance

ELECTRONICS

12) Identification and Study of Electronic components and equipments – Resistors, capacitors, inductors,colour coding and measurement.
13) Measurement of AC signal parameters (peak-peak, RMS value, period, frequency) using CRO.
14) Verification of the truth tables of logic gates: AND, OR, XOR and NOT.
15) Construction of Half Wave and Full Wave Rectifiers and study their output waveforms.
16) Soldering practice – Using general purpose PCB.

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Explain the principal and interfacing components of a personal computer

CO2 Install and update windows and Linux operating systems in a personal computer or a laptop.

CO3 Explain computer assembly and configuration and also system installation with software including antivirus software, printer and scanner software.

CO4 Construct various types of domestic wiring and measure the various electrical parameters.

CO5 Develop and test circuits with active elements and verify truth table of logic gates.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	3	-	-	1	-	1	1	-	1	-	-
CO2	1	2	1	3	-	-	1	-	1	1	-	1	-	-
CO3	1	2	1	3	-	-	1	-	1	1	-	1	-	-
CO4	1	2	2	3	-	-	1	-	1	1	-	1	-	-
CO5	1	2	2	3	-	-	1	-	1	1	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT34	DISCRETE MATHEMATICS	L	T	P	C
	(Common to B.E CSE & B.TECH – AIDS, IT)	3	1	0	4

Pre-requisites : 22MAT12-Matrices and Differential Calculus, 22MAT22-Probability and Statistics

Preamble :

Discrete Mathematics is a branch of mathematics involving discrete elements that uses algebra and arithmetic. It is increasingly being applied in the practical fields of computer science. Propositional calculus is a formal system whose expressions represent formal objects which can be used in the design of combinational digital circuits. The predicate logic is a part of artificial intelligence which is applicable in the field of robotics, medicine and it is used in intelligent database in order to solve some complex problems. Combinatorics is a fundamental mathematical discipline which provides a foundation in counting techniques that can be applied to algorithm analysis. Graph is a formal way to represent a network. Many problems in computer system can be analyzed using models based on graphs. Concepts of Groups provide the background essential to the study of finite state machines, switching theory and logic design.

UNIT 1 PROPOSITIONAL CALCULUS 9+3

Propositions –Logical connectives–Compound propositions-Conditional and biconditional propositions – Truth tables–Tautologies and contradictions–Contra positive–Logical equivalences and implications – Normal forms–Principal conjunctive and disjunctive normal forms–Rules of inference.

UNIT 2 PREDICATE CALCULUS 9+3

Predicates–Statement functions –Variables-Free and bound variables–Quantifiers –Universe of discourse– Logical equivalences and implications for quantified statements–Theory of inference –The rules of universal specification and generalization.

UNIT 3 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 4 GRAPHS 9+3

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

UNIT 5 GROUP THEORY 9+3

Groups – Subgroups – Permutation groups –Normal subgroup and cosets – Lagrange's theorem – Homomorphism –First fundamental theorem of homomorphism- -Cayley's Theorem.

LECTURE : 45 TUTORIAL : 15 TOTAL : 60 PERIODS

TEXT BOOKS:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata Mc Graw Hill Private Limited, New Delhi, Special Indian Edition, 2014
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd, New Delhi, 47th Reprint, 2015.

REFERENCES:

1. Ralph.P.Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education(Singapore) Private Limited, New Delhi, 8th Impression 2016
2. Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Academic Press, UK, Reprinted 2014.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Learning Private Limited, Delhi, 2016.

4. Bernard Kolman, Robert Busby, Sharon C. Ross "Discrete Mathematical Structures" 6th Edition,Pearson Education(Singapore) Private Limited, New Delhi, 2014.

e-RESOURCES:

1. http://nptel.ac.in/courses/106106094/1, "Propositional Logic" , http://nptel.ac.in/courses/106106094/3, "Predicate Calculus" and https://nptel.ac.in/courses/106106094/40 "Lattices" Dr.Kamala Krithivasan, Department of Computer Science and Engineering, Indian Institute of Technology, Madras.

2. http://nptel.ac.in/courses/111107058/20, "Graph Theory", and http://nptel.ac.in/courses/111107058/38, "Inroduction to Recurrence Relations" , Dr.Sugata Gangopadhyay, Department of Mathematics, Indian Institute of Technology, Roorkee.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Construct and check the validity of mathematical arguments using propositional calculus

CO2 Compute the logical structures of ordinary language statements using predicate calculus.

CO3 Compute combinatorial problems by applying Pigeonhole Principle, Permutations and Combinations and solve Linear Recurrence Relations using Generating functions

CO4 Determine whether the graphs are Hamiltonian and/or Eulerian and check Isomorphism between graphs

CO5 Classify the given set as Semigroup, Monoid or Group by using the properties of groups.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT31 OBJECT ORIENTED PROGRAMMING USING JAVA

L	T	P	C
3	0	0	3

Pre-requisites: -

Preamble

This course focuses on the fundamentals of object-oriented programming and Java programming language. Students will also be able to understand the fundamentals of packages, inheritance, and interfaces. The ability to create Java applications with threads, generic classes, exceptions, and I/O streams will be taught to the students. Additionally, using JAVAFX, students will be able to create graphic user interface applications.

UNIT 1 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- JavaDoc comments- I/O Basics – Reading and Writing Console I/O.

UNIT 2 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 3 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 4 FILE I/O, GENERICS, STRING HANDLING 9

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 5 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 : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105191/
2. https://www.w3resource.com/java-tutorial/java-object-oriented-programming.php

Course Outcomes: Upon completion of this course, students will be able to

CO1 Apply the concepts of classes and objects to solve simple problems.
CO2 Demonstrate the principles of inheritance, packages and interfaces in Java programming for a real world problem.
CO3 Apply exception handling mechanisms and multithreaded model to solve real world problems using Java.
CO4 Develop a Java application using I/O packages, string classes, generics concepts for the given problem.
CO5 Integrate the concepts of event handling, JavaFX components and controls for developing GUI based applications.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	2	3	1	1	1	-	-	-	-	2	3	2
CO2	2	3	2	3	1	1	1	-	-	-	-	3	3	2
CO3	2	3	2	3	1	1	1	-	-	-	-	2	3	2
CO4	2	3	2	3	1	1	1	-	-	-	-	3	3	2
CO5	1	3	2	3	1	1	1	-	-	-	-	2	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT32 DATA STRUCTURES USING PYTHON

L	T	P	C
3	0	0	3

Pre-requisites : Python Programming, Python Programming Laboratory

Preamble

Data structure is an arrangement of data in computer's memory in such a way that it could make the data quickly available to the processor for required calculations. Lists, arrays, stacks, queues, heaps, trees, and graphs are the more commonly used data structures. Choosing an appropriate data structure to solve the given problem greatly influences the characteristics of the obtained solution.

UNIT 1 ABSTRACT DATA TYPES **7**

Abstract Data Types (ADTs) - ADTs and classes - Introduction to OOP concepts - classes in Python - Inheritance.

UNIT 2 LINEAR STRUCTURES **11**

List ADT - Array-based Implementations - Linked List Implementations - Singly Linked Lists - Circularly Linked Lists - Doubly Linked Lists - Applications of Lists - Stack ADT - Queue ADT - Applications of Stacks and Queues.

UNIT 3 TREES **9**

Tree ADT - Tree Traversals - Binary Tree ADT - Expression trees - Binary Search Tree ADT – AVL Trees. Binary Heap - Heap Sort.

UNIT 4 GRAPHS **9**

Graph Definition - Representation of Graphs - Types of Graph - Breadth-first traversal - Depth-first traversal - Topological Sort - Dijkstra's algorithm - Minimum Spanning Tree - Prim's algorithm - Kruskal's algorithm.

UNIT 5 SEARCHING, SORTING AND HASHING **9**

Searching - Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort. Hashing - Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

Total : 45 Periods

TEXT BOOKS:

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures and Algorithms in Python” (An Indian Adaptation), Wiley, 2021.
2. Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015.

REFERENCES:

1. Narasimha Karumanchi, “Data Structures and Algorithmic Thinking with Python” Careermonk, 2015
2. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms", Third Edition, PHI Learning, 2010.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs26/preview, “Programming, Data Structures and Algorithms Using Python”, Prof. Madhavan Mukund, IIT-Bombay.
2. https://nptel.ac.in/courses/106106133, “Programming, Data structures and Algorithms”, Prof. Hema A Murthy, Dr. N S. Narayanaswamy, Prof. Shankar Balachandran, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain ADT and create a class using Python to solve the given problem.

CO2 Create list, stack and queue ADT for a given set of elements using array and linked list implementation and apply specific ADT for a given application.

CO3 Construct a tree for a given list of data by ensuring tree properties and analyze inorder, preorder, postorder traversal for a constructed tree.

CO4 Implement a suitable shortest path algorithm and identify the minimum spanning tree for the given graph such that the sum of the edges weights is minimum.

CO5 Apply a suitable searching, sorting and hashing algorithms for a given list of data considering the size and ordering of data.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	1	1	-	-	1	-	1	3	3
CO2	3	2	2	1	-	1	1	-	-	1	-	1	3	3
CO3	3	2	2	1	-	1	1	-	-	1	-	1	3	3
CO4	3	2	2	1	-	1	1	-	-	1	-	1	3	3
CO5	3	2	2	1	-	1	1	-	-	1	-	1	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITC31 DIGITAL PRINCIPLES AND COMPUTER ORGANISATION

L	T	P	C
3	0	2	4

Pre-requisites :- Basics of Electrical and Electronics Engineering

Preamble

This course aims at giving adequate exposure to students on the design of combinational circuits and design sequential circuits. Students can identify the basic structure and operation of a digital computer and the design of data path unit, control unit for processor and to familiarize with the hazards. Students can also infer the concept of various memories and I/O interfacing.

UNIT 1 COMBINATIONAL LOGIC **9**

Combinational Circuits – Karnaugh Map (2,3,4 variables) - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers – Demultiplexers.

UNIT 2 SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT 3 COMPUTER FUNDAMENTALS **9**

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

UNIT 4 PROCESSOR **9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.

UNIT 5 MEMORY AND I/O **9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

List of Experiments

1. Verification of Boolean theorems using logic gates
2. Design and implementation of Half Adder, Full Adder and binary to gray code converter.
3. Design and implementation of multiplexers/ Demultiplexers.
4. Design and implementation of Synchronous counters.
5. Simulator based study of Computer Architecture

Total : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020

REFERENCES:

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
2. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

e-RESOURCES:

1. Digital Circuits [Prof. Anil Mahanta - IIT Guwahati] http://nptel.ac.in/courses/117103064/# Digital Circuits and Systems [Prof. S. Srinivasan - IIT Madras]
2. http://nptel.ac.in/courses/117106086/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Experiment with Adders, Subtractor, Code Converters, Encoder, Decoder, Multiplexer and Demultiplexer by deriving logical expressions using K-Map.

CO2 Construct sequential logic circuits to implement shift registers and counters using Flipflops and analyze the design procedures

CO3 State the fundamentals of computer systems and analyze the execution of an instruction set using different addressing modes for a given computer architecture and organization.

CO4 Construct the datapath and describe the effect of data hazard, control hazard for a given pipeline processor.

CO5 Explain the memory hierarchy and illustrate the operation of cache memory for a given computer organization. Compare the standard I/O interfaces and data transfer techniques to access I/O devices for the given computer system.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	1	-	-	1	-	-	1	3	2
CO2	2	3	2	2	-	1	-	-	1	-	-	1	3	2
CO3	2	3	2	2	-	1	-	-	-	-	-	1	3	2
CO4	2	3	2	2	1	1	-	-	1	-	-	1	3	2
CO5	2	3	2	2	-	1	-	-	-	-	-	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITC32	FOUNDATIONS OF DATA SCIENCE	L	T	P	C
		3	0	2	4

Pre-requisites : Python Programming

Preamble

The main objective of data science is to discover patterns in data. It makes sense of the data through a variety of statistical techniques. After data extraction, wrangling, and pre-processing, a data scientist must carefully examine the data.

UNIT 1 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 of Data.

UNIT 2 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 3 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 of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.

UNIT 4 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 5 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.

List of Experiments

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Visualizing Geographic Data with Basemap

Total : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES:

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

e-RESOURCES:

1. https://nptel.ac.in/courses/106106179
2. https://www.coursera.org/learn/foundations-of-data-science

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Discuss data science process with the help of data mining and exploratory data analytics.

CO2 Explain the types of data and describe those using Normal Distributions and Standard (z) Scores.

CO3 Demonstrate the usage of statistical inference and regression models in data science.

CO4 Utilize Python Library Numpy and Pandas for Data Wrangling.

CO5 Apply visualization Libraries in Python to interpret and explore data for an application.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	2	3	1	-	-	-	-	-	1	2	3
CO2	3	2	2	1	3	1	-	-	-	-	-	1	2	3
CO3	3	2	1	2	3	1	1	1	-	-	-	1	2	3
CO4	3	2	2	1	3	1	1	1	2	-	-	1	2	3
CO5	3	2	1	2	3	1	1	1	2	-	-	1	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL31 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C
0 0 2 1

Preamble:
The goal of the course is to give students the ability to construct software using Java programming for practical applications. The ideas of classes, packages, interfaces, inheritance, exception handling, and file processing will be understood and applied by the students. Students are also capable of creating applications using event handling and general programming.

LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)

2. Develop stack and queue data structures using classes and objects.

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 gross and net salary.

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.

5. Solve the above problem using an interface.

6. Implement exception handling and creation of user defined exceptions.

7. 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, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.

8. Write a program to perform file operations.

9. Develop applications to demonstrate the features of generics classes.

10. Develop applications using JavaFX controls, layouts and menus.

SOFTWARE

- Operating Systems: Linux / Windows
- Front End Tools: Eclipse IDE / Netbeans IDE

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Develop simple Java programs to implement searching, sorting and linear ADT.

CO2 Design and develop Java programs using stack, queue, inheritance and abstract class.

CO3 Develop simple applications to demonstrate the use of exceptions and multithreading.

CO4 Implement files and generics concepts for the given problem.

CO5 Create GUIs and event driven programming applications for real world problems.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	-	1	1	-	1	2	2	2	3	2
CO2	2	1	3	1	-	1	1	-	2	3	3	2	3	2
CO3	2	2	1	2	1	1	1	-	1	2	1	3	3	2
CO4	2	2	1	3	-	1	1	-	3	1	1	1	3	2
CO5	1	3	3	1	3	2	2	-	1	1	1	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL32 **DATA STRUCTURES LABORATORY** **L T P C**

0 0 2 1

Preamble:

This laboratory course is intended to provide students with opportunities to get hands on training to implement various data structures like lists, arrays, stacks, queues, heaps, trees, and graphs using Python programming language.

LIST OF EXPERIMENTS

1. Program to implement Singly Linked List of ordered integers (ascending/descending) with insert, search and display operations.
2. Program to simulate Stack using array and linked list.
3. Program to simulate Queue using array and linked list.
4. Program to traverse a binary tree in preorder, in-order and post-order.
5. Program to insert, delete and search for a node in a Binary Search Tree.
6. Program for graph traversals by applying: (a) Breadth First Search. (b) Depth First Search.
7. Consider the motor racing game in which there are n participants. Get the points scored by each participant. Write a program to sort the positions of players in ascending order based on points scored using heap sort and print the highest score.
8. Program to search for a character in a given message using linear search technique.
9. A person has registered for voter id, he received a voter number and he need to check whether it exist in the voter list or not. Use binary search to check whether the voter number exist in the list or not.
10. For the given route map with cost of transportation between different cities, find the shortest route from a source to all the other cities using Dijkstra's Algorithm.
11. For the given network identify Spanning tree to connect the points in the network with minimum cost.

SOFTWARE

- Python 3 interpreter / open source IDE

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

1. Develop a python program to simulate stack and queue data structures using array and linked list
2. Demonstrate the traversals of binary tree, binary search tree and a graph for a given set of elements.
3. Develop a python program to arrange the players' position in ascending order using heap sort.
4. Write a Python program to search for a given element in a tree using linear and binary search.
5. Implement a suitable shortest path algorithm for identifying minimum path cost for the given real world problem.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	2	1	-	-	1	-	-	1	2	2
CO2	2	3	2	3	2	1	-	-	1	-	-	1	2	2
CO3	2	3	2	3	2	1	-	-	1	-	-	1	2	2
CO4	2	3	2	3	2	1	-	1	1	-	-	1	2	2
CO5	2	3	2	3	2	1	-	1	1	-	-	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MAT42	OPTIMIZATION TECHNIQUES AND QUEUEING THEORY (Common to B.E CSE & B.TECH – AIDS, IT)	L	T	P	C
		3	1	0	4

Pre-requisites : 22MAT12-Matrices and Differential Calculus , 22MAT22- Probability and Statistics

Preamble:.

Optimization Techniques is a discipline to aid decision making and improving efficiency of the system by applying advanced analytical methods. Simplex Algorithm is a powerful method for solving linear programming problems. The Transportation and Assignment problems deal with assigning sources and jobs to destinations and machines and minimize the Transportation cost. PERT and CPM are techniques of project management useful in the basic managerial functions of planning, scheduling and control. Queuing theory provides a rich and useful set of mathematical models for the analysis and design of service process

UNIT 1 LINEAR PROGRAMMING PROBLEM **9+3**

Introduction to Optimization Techniques,General mathematical formulation for Linear Programming Problem-Canonical and Standard form of LPP,Solution of LPP by graphical Method, simplex method and Big-M method.

UNIT 2 TRANSPORTATION AND ASSIGNMENT PROBLEM **9+3**

Transportation Models– Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI method. Case of Degeneracy. Assignment Models – Balanced and Unbalanced Problems. Solution by Hungarian method

UNIT 3 NETWORK MODELS **9+3**

Introduction - determining the critical path, project scheduling by Critical Method (CPM),Programme Evaluation and Review Technique (PERT) .

UNIT 4 QUEUEING THEORY **9+3**

Markovian queues – Single server with infinite capacity–Multiple server with infinite capacity – Single server with finite capacity – Multiple server with finite capacity –Little's formula.

UNIT 5 ADVANCED QUEUEING MODELS **9+3**

M/G/1 queue – PollaczekKhinchin formula - M/D/1 and M/EK/1 as special cases – Series queues without blocking – Open Jackson networks

LECTURE : 45 TUTORIAL : 15 TOTAL : 60 PERIODS

TEXT BOOKS:

1. Hamdy A.Taha, "Operations Research", 8th Edition, Pearson Prentice Hall , Chennai,2007
2. D.Gross,JohnF.Shortle, James M.Thompson and C.M.Harris,"Fundamentals of Queueing Theory", Wiley India Pvt Ltd,4thReprint,2013.

REFERENCES:

1. A. Ravindran, Don T. Phillips, James J. Solberg, "Operations Research: Principles and Practice", 2nd Edition, Wiley India Edition, New Delhi, 2007.
2. Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, Wiley Dream Tech. India (P) Ltd,New Delhi,2013.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ma48/preview ”OPERATION RESEARCH “ by Dr. Kusum Deep, Department of Mathematics, Indian Institute of Technology Roorkee, India
2. http://nptel.ac.in/courses/112106131/30“Queueing Models”,Prof. G. Srinivasan, Department of Management Studies Indian Institute of Technology,Chennai.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Formulate the LPP and solve the LPP using graphical method, simplex method and Big M method.

CO2 Solve Balanced and Unbalanced transportation and assignment Problems and get the optimal solutions.

CO3 Construct and use the terminology of project management (PM) as established by CPM and PERT.

CO4 Identify and solve the queueing systems with finite and infinite population using Markovian queueing models.

CO5 Identify and solve the Non Markovian queueing system, series queues and Open Jackson Networks using Markovian queueing models.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 4	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO 5	3	3	2	2	-	-	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITC41 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L	T	P	C
3	0	2	4

Pre-requisites :-

Preamble

Intelligent machines have replaced human capabilities in many areas. Artificial intelligence is the intelligence exhibited by machines or software. It is the branch of computer science that emphasizes on creating intelligent machines that work and reacts like humans. This course is designed to span a wide variety of topics in computer science research, including machine learning, Game playing, Expert Systems etc.

UNIT 1 PROBLEM SOLVING **9**

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

UNIT 2 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- case study: Emails that are either SPAM or HAM

UNIT 3 SUPERVISED LEARNING **9**

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests- case study on decision-making in selected multinational enterprises.

UNIT 4 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 5 NEURAL NETWORKS **9**

Perceptron - 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.

PRACTICAL EXERCISES:

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

Total : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", FourthEdition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016

e-RESOURCES:

1. An Introduction to Artificial Intelligence, IIT Delhi, By Prof. Mausam, https://onlinecourses.nptel.ac.in/noc22_cs56
2. Introduction to Machine Learning, By Prof. Balaraman Ravindran, IIT Madras, https://onlinecourses.nptel.ac.in/noc22_cs29

Course Outcomes: Upon completion of this course, students will be able to:

CO1: Explain the fundamental concepts of problem-solving in artificial intelligence using search and optimization technique.

CO2: Explain the probabilistic reasoning techniques to solve weather forecasting problems and classifying emails as spam or ham using naive Bayes models.

CO3: Discuss the different supervised learning algorithms and their applications in Anomaly pattern detection and classification

CO4: Elaborate the underlying principles of unsupervised learning algorithms for modeling complex data distributions.

CO5: Explain the principles behind neural network models that simulate human behavior and address its vanishing gradients.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	3	-	1	1	1	1	3	3	3	1	2
CO2	1	1	1	3	1	1	1	1	1	2	1	3	2	2
CO3	2	1	2	1	1	1	1	1	2	1	1	3	1	1
CO4	3	1	3	1	-	1	1	1	2	1	2	1	2	2
CO5	3	1	1	2	2	1	1	1	3	1	2	3	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT41	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisites :

Preamble

The course aims to provide an understanding about the fundamentals of database, database system architecture and various database design technique. It also helps to familiarize SQL standards and various SQL operations. An overview of normalization, query optimization and transaction management is also provided.

UNIT 1 DATABASE SYSTEMS **7**

Overview of File processing system- Purpose of Database System-Views of data–Data Models–Database Languages—Database System Architecture–Database users and Administrator.

UNIT 2 DATABASE DESIGN **9**

Database design & E-R Model: Entity–Relationship model (E-R model)–E-R Diagrams-Constraints-Extended E-R features. Introduction to Relational Model: Database schema–Keys- Schema Diagrams – Relational Query languages – Relational Operations.

UNIT 3 SQL **10**

SQL Standards-Data types–structure of SQL queries–additional basic operations-set operations-null values- aggregate functions-nested sub queries-modification of the database. Intermediate SQL: Joins-Views- Transactions-Integrity constraints–Authorization. Advanced SQL-Triggers.

UNIT 4 NORMALIZATION AND QUERY OPTIMIZATION **10**

Relational database design: Functional Dependencies -Normalization and its normal forms-Denormalization- Data Storage: RAID – Tertiary Storage – File organization – Organization of records in files. Query Processing - Query optimization

UNIT 5 TRANSACTION MANAGEMENT **9**

Transaction concepts- Transaction recovery-Properties of Transaction-Serializability-Concurrency Control – Locking Mechanisms-Two Phase Commit Protocol-Dead lock. Case study: Database connectivity using SQL.

Total : 45 Periods

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson / Addision wesley, 2007.
3. Atul Kahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.

e-RESOURCES:

1. http://www.nptelvideos.in/2012/11/database-management-system.html, Database Management Systems, Dr.S.Srinath, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compare File processing system with Database systems in terms of performance, scalability and data storage for efficient access of data.

CO2 Design a database schema using E-R model, Relational model and apply relational algebra operations like selection, projection, join and Cartesian product to solve the given problem.

CO3 Develop SQL queries using aggregate functions, nested sub queries, joins and views for the given problem.

CO4 Apply suitable normalization and query optimization techniques to normalize the give relation and to optimize the query for efficient access of data.

CO5 Discuss serialization and concurrency control mechanisms to avoid deadlock problem in transaction processing.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	-	1	1	1	-	-	-	1	2	-
CO2	2	3	2	3	-	1	1	1	-	-	1	1	2	2
CO3	2	3	2	3	-	1	1	1	-	-	1	1	2	-
CO4	2	3	2	3	-	1	1	1	-	-	-	1	2	-
CO5	2	3	2	3	-	1	1	1	-	-	-	1	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITC42	EMBEDDED SYSTEMS AND IoT	L	T	P	C
		3	0	2	4

Pre-requisites :

Preamble

The aim of this course is to learn the internal architecture and programming of an embedded processor and interfacing I/O devices to the processor and evolution of the Internet of Things (IoT). This course makes the students to build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform. This course will enable the students to apply the concept of Internet of Things in real world scenario.

UNIT 1 8-BIT EMBEDDED PROCESSOR 9

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

UNIT 2 EMBEDDED C PROGRAMMING 9

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

UNIT 3 IOT AND ARDUINO PROGRAMMING 9

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

UNIT 4 IOT COMMUNICATION AND OPEN PLATFORMS 9

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

UNIT 5 APPLICATIONS DEVELOPMENT 9

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

List of Experiments

1. Design an IOT based system.
2. Write Basic and arithmetic Programs Using Embedded C.
3. Perform ALU operations.
4. Introduction to Arduino platform and programming.
5. Introduction to Raspberry PI platform and python programming.
6. Communicate between Arduino and Raspberry PI using any wireless medium.
7. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth).
8. Log Data using Raspberry PI and upload to the cloud platform.
9. Setup a cloud platform to log the data.
10. Design an IOT based system.

Total : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition,2014.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press,2017.

REFERENCES:

1. Michael J. Pont, "Embedded C", Pearson Education,2007.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier,2006.

e-RESOURCES:

1. https://nptel.ac.in/courses/128108016/," ACM India Summer School on IoT and Embedded Systems,IIT Madras.
2. https://nptel.ac.in/courses/106103182/," NOC:Embedded Systems-Design Verification and Test, Dr. Santosh Biswas, Prof.Jatindra Kumar Deka, Prof.Arnab sarkar - IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the architecture of embedded processors.
CO2 Write embedded C programs.
CO3 Design simple embedded applications.
CO4 Compare the communication models in IOT.
CO5 Design IoT applications using Arduino/Raspberry Pi /open platform.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	-	-	-	-	1	2	3	3	2	1
CO2	2	1	3	2	2	-	-	-	1	2	2	3	3	1
CO3	3	1	3	3	1	-	-	-	1	2	1	1	2	2
CO4	3	2	3	2	1	-	-	-	1	2	2	3	2	2
CO5	2	3	3	2	2	-	-	-	1	3	3	2	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITC42	EMBEDDED SYSTEMS AND IoT	L T P C
	(For Students admitted from AY:2023-2024 onwards)	3 0 2 4

Pre-requisites: Digital Principles and Computer Organization

Preamble

The aim of this course is to learn the internal architecture and programming of an embedded processor and interfacing I/O devices to the processor and evolution of the Internet of Things (IoT). This course makes the students to build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform. This course will enable the students to apply the concept of Internet of Things in real world scenario.

UNIT 1 8-BIT EMBEDDED PROCESSOR 9

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

UNIT 2 EMBEDDED C PROGRAMMING AND ITS PROTOCOLS 9

Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need for RTOS – Multiple Tasks and Processes – Context Switching – Priority based Scheduling Policies- I2C Interfacing and Programming– UART Interfacing and Programming – SPI Interfacing and Programming.

UNIT 3 IOT AND ATMEL32P CONTROLLER PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices versus Computers – IoT Configurations – Basic Components – Introduction to ATMEL32P Controller and ESP-32 Controller and its Types- Sketches – Pins – Input/output from Pins using Sketches.

UNIT 4 IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols - MQTT (Message Queuing Telemetry Transport)– Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins with Sensor Data with JSON Packet – Connecting to the Cloud.

UNIT 5 APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Industry Load Automation –Smart Agriculture – Smart Cities – Smart Healthcare- Energy Monitoring –Air Quality Index Monitoring.

List of Experiments

1. Write Basic and Arithmetic Programs Using Embedded C. (CO2)
2. Embedded System Protocols Interfacing with Controller -I2C-SPI-UART Programming. (CO2)
3. Introduction to Arduino IDE for ATMEL32P – ESP-32 & Python IDE for Raspberry Pi. (CO3)
4. IoT Protocols like MQTT Interfacing Cloud Integration with JSON Method. (CO4)
5. GPIO Pin Interfacing with Raspberry Pi Sensor Data LOG and Actuator Control Using Python. (CO4)
6. Open Sources Cloud Integrations with Wi-Fi Credentials Monitoring and Control Applications. (CO5)

Total : (L:45+P:15) 60 PERIODS

Text books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition,2014.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press,2017.

References

1. Michael J. Pont, "Embedded C", Pearson Edition 2022.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things Applications to the Smart Grid and Building Automation", Wiley Publications, 2012.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier,2006

e- Resources

1. https://onlinecourses.nptel.ac.in/noc25_cs44/preview
2. https://nptel.ac.in/courses/128108016/," ACM India Summer School on IoT and Embedded Systems,IIT Madras

Course Outcomes: Upon completion of this course, students will be able to:

CO1: Explain the internal architecture and functional components of an 8-bit microcontroller
CO2: Write embedded system programs to interface memory and I/O devices using C.
CO3: Apply IoT concepts to program ATMEL32P and ESP-32 controllers for integrating sensors, actuators, and shields in IoT systems
CO4: Implement IoT communication models and protocols to interface devices, access GPIO pins, process sensor data using JSON, and connect to the cloud.
CO5: Design embedded systems for developing IoT applications in industry automation, smart agriculture, smart cities, healthcare, energy monitoring, and air quality index monitoring.

Mapping of Cos with POs and PSOs

Cos/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	2	-	1	-	-	-	-	-	1	2	2
CO2	2	3	2	2	3	1	-	-	1	1	-	1	3	3
CO3	3	1	1	2	3	1	-	-	1	-	-	1	3	3
CO4	3	1	3	3	3	1	1	-	1	-	1	1	3	3
CO5	2	3	3	3	3	2	2	1	1	1	1	1	3	3

1-Slight(Low), 2-Moderate(Medium), 3-Substantial (High).

22ITT42	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The aim of this course is to introduce the concepts of operating system abstractions, mechanisms and implementations. The course makes the students to develop the optimal solution for CPU scheduling, synchronization problems and deadlocks. This course will enable the students to apply the appropriate memory, file and disk management technique for effective resource utilization.

UNIT 1 INTRODUCTION **7**

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods. Case Study: Linux Process and Thread Management.

UNIT 2 PROCESS MANAGEMENT **11**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT 3 MEMORY MANAGEMENT **10**

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT 4 STORAGE MANAGEMENT, FILE & I/O SYSTEMS **10**

Mass Storage system – Disk Structure - Disk Scheduling and 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; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT 5 VIRTUAL MACHINES AND MOBILE OS **7**

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

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7 th Edition, Prentice Hall, 2018

Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

e-RESOURCES:

1. http://nptel.ac.in/courses/106108101/ “Introduction to operating system”, Prof P.C.P. Bhatt , IISc-Bangalore.
2. https://nptel.ac.in/courses/106106144/2/ “Introduction to operating system”, Prof Chester Rebeiro,IIT-Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the structure and functions of Operating Systems for multiuser environment considering Linux process and thread management as a case study.
CO2	Evaluate the FIFO, SJF, Priority scheduling, Round Robin process scheduling algorithms for a given set of process considering the arrival time, burst time and resources.
CO3	Analyze the memory allocation techniques and page replacement algorithms for a given reference strings with minimum page fault.
CO4	Evaluate the FIFO, SSTF, SCAN, CSCAN, LOOK, CLOOK disk scheduling algorithms with minimum seek time for a given disk request and analyze file allocation methods for efficient file organization
CO5	Explain the functionality of Virtualization and compare iOS and Android Operating Systems.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	2	-	-	-	-	-	1	3	2
CO2	2	3	2	2	-	2	-	1	-	-	-	1	3	2
CO3	2	3	2	2	-	2	1	-	-	-	-	1	3	2
CO4	2	3	2	2	-	2	-	-	-	-	-	1	3	2
CO5	2	3	2	2	-	2	-	-	-	-	-	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT43 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	1	0	4

Pre-requisites : Probability and Statistics, Data Structures using Python.

Preamble

This course enables the student to understand various algorithm design techniques, and know how to apply those techniques to various problems. The analysis of various algorithms can be performed and select the best algorithm for solving a problem.

UNIT 1 ALGORITHM ANALYSIS **9 + 3**

Introduction – Notion of Algorithm – Fundamentals of Algorithmic problem Solving – Important Problem types – Fundamentals of the Analysis of Algorithm Efficiency - Analysis Framework – Asymptotic notations and Basic Efficiency Classes - Mathematical Analysis of Recursive and Non-recursive algorithms - Empirical analysis of Algorithms-Algorithm Visualization.

UNIT 2 BRUTE FORCE AND DIVIDE & CONQUER **9 + 3**

Brute Force: Selection and Bubble Sort, Sequential search and String Matching – closest pair and convex hull problem. Divide and Conquer: Merge sort – Quick sort – Binary tree traversals and related properties – Strassen's Matrix Multiplication – closest pair and convex hull problem.

UNIT 3 DECREASE & CONQUER AND TRANSFORM & CONQUER **9 + 3**

Decrease and Conquer: Insertion Sort - Topological Sorting – Fake coin problem – Computing a Median and the Selection Problem. Transform and Conquer: Presorting – Balanced search trees – AVL trees - 2-3 Trees - Heaps and Heap sort

UNIT 4 DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE **9 + 3**

Introduction to Dynamic Programming - Warshall's and Floyd's Algorithms - Optimal Binary Search Trees – 0/1 Knapsack Problem and Memory functions. Introduction to Greedy Technique – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm- Huffman Trees.

UNIT 5 BACKTRACKING & BRANCH AND BOUND **9 + 3**

Backtracking- n-Queens problem - Hamiltonian Circuit Problem - Subset Sum problem - Branch and Bound – 0/1 Knapsack problem - Traveling Salesman Problem-Introduction to P, NP and NP-complete Problems.

Total : 45 + 15 = 60 Periods

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

REFERENCES:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second edition, Galgotia Publications, New Delhi, 2010.
2. Donald E. Knuth, "The Art of Computer Programming", Pearson Education, 2009.
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

e-RESOURCES:

1. https://nptel.ac.in/courses/106101060/ "Design and Analysis of Algorithms", Prof. Abhiram Ranade, IITBombay
2. http://nptel.ac.in/courses/106106131/, "Design and Analysis of Algorithms", Prof.Madhavan Mukund, IITMadras

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Differentiate recursive and non-recursive algorithms using asymptotic notations.

CO2 Evaluate the performance of Selection sort, Bubble sort, Merge sort and Quick sort considering input data set properties, running time and code size.

CO3 Implement and analyze the problems using Decrease & Conquer and Transform & Conquer techniques.

CO4 Analyze the efficiency of solving graphical problems using dynamic programming and greedy technique

CO5 Illustrate the design strategies for n-Queens problem, Hamiltonian circuit problem, subset sum problem, Knapsack problem, Traveling salesman problem using Backtracking and Branch & Bound techniques.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	1	1	1	-	-	-	1	3	2
CO2	2	3	2	2	-	1	1	1	-	-	-	1	3	2
CO3	2	3	2	2	-	1	1	1	-	-	-	1	3	2
CO4	2	3	2	2	-	1	1	1	-	-	-	1	3	2
CO5	2	3	2	2	-	1	1	1	-	-	-	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL41	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

Co-requisites : Database Management Systems

Preamble

This laboratory course is intended to provide students with opportunities to get hands on training to create database with SQL queries, Joins, Aggregate functions, Triggers and Exception Handling using Oracle / MySQL.

LIST OF EXPERIMENTS

1. Create a database and work with SQL queries to retrieve information from the database.
2. Create an Employee database to set various constraints.
3. Work with Joins, aggregate functions
4. Creation of database objects: Synonyms, Sequences, Views, Indexes and save point.
5. Study of PL/SQL block.
6. Develop simple programs using PL/SQL.
7. Creation of Procedures.
8. Creation of Functions.
9. Work with Triggers and Exception handling
10. Mini project (Application Development using Oracle / MySQL)
    - Payroll processing.
    - Banking System.
    - Library Information System

SOFTWARE

- Oracle/ SQL/ Mysql

Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Apply DDL and DML commands to store and manipulate information in the database.

CO2 Apply the concept of views, indexes, sequences, joins and aggregate functions to perform analysis on data in the database.

CO3 Develop simple programs using PL/SQL for the given problem.

CO4 Apply procedure, trigger, exception handling and function to provide solutions for the given problem.

CO5 Develop real time applications (Banking system, Payroll processing and Library Information system) using SQL.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	2	1	-	-	1	1	-	-	2	-
CO2	2	3	2	3	2	1	-	-	1	1	-	-	2	-
CO3	2	3	2	3	2	1	-	-	1	1	-	-	2	-
CO4	2	3	2	3	2	1	-	-	1	1	-	-	2	-
CO5	2	3	2	3	2	1	-	-	1	1	-	-	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL42 **OPERATING SYSTEMS LABORATORY** **L T P C**
0 0 2 1

Preamble:
The main aim of this course is to implement the concepts of operating system mechanisms and policies. The course makes the students to implement the program that provide the optimal solution for CPU scheduling, synchronization problems and deadlocks. This course will also enable the students to apply the designed module to appropriate memory, file and disk management technique for effective resource utilization.

LIST OF EXPERIMENTS

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

a. First Fit b. Worst Fit c. Best Fit

12. Write C programs to implement the various Page Replacement Algorithms
13. Write C programs to Implement the various File Organization Techniques
14. Implement the following File Allocation Strategies using C programs

a. Sequential b. Indexed c. Linked

15. Write C programs for the implementation of various disk scheduling algorithms
16. Install any guest operating system like Linux using VMware.

SOFTWARE

- Linux :Ubuntu / OpenSUSE / Fedora / Red Hat / Debian / Mint OS
- GCC compiler

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1	Demonstrate the procedure to install Windows OS and Test Shell commands in UNIX
CO2	Develop C Program to implement CPU scheduling algorithms, deadlock avoidance algorithms and page replacement algorithms for a given set of processes considering arrival time, burst time and resources.
CO3	Develop C program to implement thread, process synchronization and Inter Process Communication for a given set of processes by using semaphore and shared memory mechanisms
CO4	Construct a C program to implement file allocation and organization techniques for a given set of files by using sequential, indexed and linked file allocation methods
CO5	Develop C Program for memory management by using paging technique.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	3	-	-	-	-	1	-	-	-	2	-
CO2	1	1	1	3	-	-	-	-	1	-	-	-	2	-
CO3	1	1	1	3	-	-	-	-	1	-	-	-	2	-
CO4	1	1	1	3	-	-	-	-	1	-	-	-	2	-
CO5	1	1	1	3	-	-	-	-	1	-	-	-	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCL04	ENGLISH FOR PROFESSIONALS (For the students admitted in AY 2022–2023 and 2023–2024 only)	L	T	P	C
		0	0	2	0

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

UNIT 1 LISTENING **5**

Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing

UNIT 2 READING **7**

Poem - Robert Frost - Road Not Taken- Decision Making- Biographies of Famous Personalities.- Reading and Note Making on News Articles

UNIT 3 WRITING **5**

Letter Writing - Letters Seeking Permission- Letters Seeking Apology - Letters Requesting Certificates – Analytical Writing

UNIT 4 SPEAKING **9**

Watching Presentations - Presentation Techniques - Group Presentation - Group Discussion

UNIT 5 VERBAL ABILITY **4**

Parajumbles - Sentence Completion - Identifying Common Errors

TOTAL: 30 PERIODS

REFERENCES:

1 M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.

2 Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

eRESOURCES :

1. https://agendaweb.org/listening/audio-books-mp3.html
2. https://www.ndtv.com/world-news
3. http://learnenglishteens.britishcouncil.org/skills/reading
4. https://www.bbc.com/

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Analyze the given listening material and answer the questions correctly employing listening techniques.

CO2 Analyze the given reading material and answer the questions correctly employing reading techniques.

CO3 Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.

CO4 Take part effectively in group discussion, conforming no profession norms and to give extemporaneous presentation.

CO5 Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-
Mapping Average	-	-	-	-	3	-	-	-	3	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCL04	ENGLISH FOR PROFESSIONALS (Students admitted during 2023-2024 onwards)	L	T	P	C
		0	0	2	0

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

UNIT 1 LISTENING **5**

Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing

UNIT 2 READING **7**

Reading for gist - Biographies of Famous Personalities - Reading and Note Making on News Articles

UNIT 3 WRITING **5**

Letter Writing - Seeking Permission- Seeking Apology - Letters Requesting Certificates – Analytical Writing and Issue based writing

UNIT 4 SPEAKING **9**

Presentation Techniques - Presentation with visual aids – Extempore and Impromptu talk

UNIT 5 VERBAL ABILITY **4**

Parajumbles - Sentence Completion - Identifying Common Errors

TOTAL: 30 PERIODS

REFERENCES:

1 M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.

2 Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

eRESOURCES :

1. https://agendaweb.org/listening/audio-books-mp3.html
2. https://www.ndtv.com/world-news
3. http://learnenglishteens.britishcouncil.org/skills/reading
4. https://www.bbc.com/

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Analyze the given listening material and answer the questions correctly employing listening techniques.

CO2 Analyze the given reading material and answer the questions correctly employing reading techniques.

CO3 Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.

CO4 Take part effectively in group discussion, conforming no profession norms and to give extemporaneous presentation.

CO5 Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-
Mapping Average	-	-	-	-	3	-	-	-	3	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT51	FULL STACK WEB DEVELOPMENT	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

This course explores the dynamic intersection of front-end design and back-end functionality, equipping with the skills to create immersive digital experiences through web development.

UNIT 1 INTRODUCTION TO HTML AND JAVASCRIPT 9

The Modern Web- Introduction to HTML- From Server to Browser- Styling- Components- Responsive Design- Applying CSS to HTML. JavaScript- Understanding JavaScript Data Types-Variables and Operators- JavaScript Objects- Looping - Functions- Manipulating Strings- Working with Arrays.

UNIT 2 BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React.

UNIT 3 REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering.

UNIT 4 NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.

UNIT 5 MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications- Cloud Deployment.

Total : 45 Periods

TEXT BOOKS:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, ‘Node.js, MongoDB and Angular Web Development’, Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, ‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019.

REFERENCES:

1. Chris Northwood, ‘The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer’, Apress; 1st edition, 2018
2. Kirupa Chinnathambi, ‘Learning React: A Hands-On Guide to Building Web Applications Using React and Redux’, Addison-Wesley Professional, 2nd edition, 2018

e-RESOURCES:

1. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
2. https://www.coursera.org/specializations/full-stack-react

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Create a basic web page for the given scenario using the concepts of HTML and Java script.

CO2 Discuss the framework and architectural components for web application development using Express, Angular and Node.

CO3 Build React applications with React components and state and discuss server-side rendering techniques in MERN applications.

CO4 Explain the principles of Node.js with packages, events and listeners and use them to implement HTTP services for an web application.

CO5 Explain the components of MongoDB and develop web application using MongoDB and Node.js

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	1	1	-	-	-	-	-	1	3	2
CO2	3	3	3	3	1	1	-	-	-	-	-	1	3	2
CO3	3	3	3	2	2	1	1	-	-	-	-	1	3	2
CO4	3	3	3	2	2	1	1	-	-	-	-	1	3	2
CO5	3	3	3	3	2	1	1	-	-	-	-	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT52	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

The course aims to provide an understanding of computer networks architecture, various technologies available to build a network and protocols in use at different levels of network layers stack. An overview of global Internet, Internet applications and types of protocols used for mail transfer is also provided.

UNIT 1 DATA COMMUNICATIONS 9

Data Communication– Networks–The OSI Model– Layers in the OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media

UNIT 2 DATA LINK LAYER 9

Framing – Error Detection and Correction– IEEE Standards (802.3,802.5,802.11)– MAC protocols and types.

UNIT 3 NETWORK LAYER 9

Internetworking: Switching and Bridging – Basic Internetworking-IPv4 - IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).

UNIT 4 TRANSPORT LAYER 9

Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services.

UNIT 5 APPLICATION LAYER 9

Domain Name System - File Transfer – Web Services and SNMP - HTTP - Electronic Mail (SMTP, POP3, IMAP, MIME).

Total : 45 Periods

TEXT BOOKS:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers, 2021.
2. Behrouz A. Forouzan, “Data Communications and Networking”, Fifth Edition, Tata McGraw -Hill, 2013.

REFERENCES:

1. William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.
2. James.F. Kurouse& W. Rouse, “Computer Networking: A Top down Approach Featuring”, Sixthedition, Pearson Education, 2013.
3. William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.

e-RESOURCES:

1. http://www.nptel.ac.in/downloads/106105080, “Computer Networks”, Prof.Sujoy Ghosh, IIT Kharagpur.
2. https://www.elsevier.com/journals/subjects/computer-science

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Interpret the importance of layering, addressing and annotate the protocol stack of OSI and TCP/IP model.

CO2 Explain MAC protocols (Ethernet, Token Ring and Wi-Fi) supported by Data Link layer to ensure hop-to-hop reliable communication.

CO3 Implement IP addressing and routing protocols to find shortest route to achieve reliable network-layer data transmission.

CO4 Classify the transport layer protocols and explain the congestion control or congestion avoidance techniques to ensure quality of service.

CO5 Analyze the functions and services provided by the application layer protocols (HTTP, SMTP and DNS).

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	-	3	-	1	1	-	-	-	-	1	3	2
CO2	2	3	-	3	-	1	1	-	-	-	-	1	3	2
CO3	2	3	-	3	-	1	1	-	-	-	-	1	3	2
CO4	2	3	-	3	-	1	1	-	-	-	-	1	3	2
CO5	2	3	-	3	-	1	1	-	-	-	-	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT53	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	C
		3	1	0	4

Pre-requisites :-

Preamble

This course enables the student to know the models of computation, along with their variants in the context of formal languages and their recognizers. This can be applied in designing compilers and pattern recognition system.

UNIT 1 FINITE AUTOMATA 9+3

Introduction to formal proof – Additional forms of proof – Inductive proofs – Basic Definitions – Finite Automaton – DFA & NDFA – Finite Automaton with epsilon moves – Equivalence of NFA and DFA – Equivalence of NDFA's with and without epsilon moves – Minimization of DFA.

UNIT 2 REGULAR EXPRESSIONS AND LANGUAGES 9+3

Regular Languages – Regular Expression – FA and Regular Expressions –Closure properties of regular languages – Equivalence of finite Automaton and regular expression - Proving languages not to be regular –Pumping Lemma for Regular sets – Problems on Pumping Lemma.

UNIT 3 CONTEXT-FREE GRAMMARS AND LANGUAGES 9+3

Grammar Introduction– Types of Grammar – Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols – Unit productions – Null productions – Greiback Normal form – Chomsky normal form – Problems on CNF and GNF – Closure properties of CFL.

UNIT 4 PUSHDOWN AUTOMATA 9+3

Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL – pumping lemma for CFL – problems based on pumping Lemma.

UNIT 5 TURING MACHINE AND UNDECIDABILITY 9+3

Definitions of Turing machines – Models – Computable languages and functions – Techniques for Turing machine construction -Multihead and Multitape TM – The Halting problem -Partial Solvability – Problems about TM –A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Ladner's Theorem –Undecidable problems about Turing Machine.

TOTAL: L:45+T:15=60 PERIODS

TEXT BOOKS:

1. J.E. Hopcroft, R. Motwani Tuand J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2014.
2. John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, nTata McGraw Hill Publishing Company, New Delhi, 2011.

REFERENCES:

1. MichealSipser, "Introduction of the Theory and Computation", Third Edition, Thomson Brokecole, 2013.

2. Linz Peter, "An Introduction to Formal Languages and Automata", Sixth Edition, Jones & Bartlett Learning, 2016.
3. Mishra and Chandrashekaran, "Theory of Computer Science–Automata Languages and Computation", Third Edition, PHI, 2008.

e-RESOURCES:

1. http://nptel.ac.in/courses/, "Theory of computation", Prof. Raghunath Tewar, IIT- Kannpur.
2. http://nptel.iitm.ac.in, "Theory of computation", Prof. Kamala Krithivasan, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design a Finite Automata for a given regular language and translate a given automata into deterministic and non-deterministic finite automata using minimization techniques.

CO2 Analyse the equivalence of Finite Automata and Regular Expression and identify whether the given language is regular or not using pumping lemma.

CO3 Create the Chomsky normal form and Greiback normal form for given CFG using simplification techniques.

CO4 Design a PDA for a given CFG/CFL and identify whether the given language is CFG or not using pumping lemma.

CO5 Apply programming techniques involved in Turing Machine to solve decidable and undecidable problems to achieve efficiency.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	-	1	-	-	-	-	-	1	3	-
CO2	1	3	3	3	-	-	-	-	-	-	-	1	3	-
CO3	1	3	3	3	-	-	-	-	-	-	-	1	3	-
CO4	1	3	3	3	-	2	-	-	-	-	-	1	3	-
CO5	1	3	3	3	-	2	-	-	-	-	-	1	3	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL51	FULL STACK WEB DEVELOPMENT LABORATORY	L	T	P	C
		0	0	2	1

Preamble

This laboratory course is intended to provide students with opportunities to get hands on training to develop full stack applications with web components as per the requirements.

LIST OF EXPERIMENTS

The Instructor can choose the technology stack to develop the following full stack experiments based on the Full Stack Web Development Theory Course.

1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.

   (or)

   Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
2. Create a food delivery website where users can order food from a particular restaurant listed in the website.

   (or)

   Develop a classifieds web application to buy and sell used products
3. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
4. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.
5. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.

Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design full stack applications with clear understanding of user interface, business logic and data storage.

CO2 Design and develop user interface screens for the given web application.

CO3 Implement the functional requirements using MongoDB, React and Node.js for the given web application.

CO4 Design and develop project management system website using MongoDB, React and Node.js based on the requirements

CO5 Design and develop online survey application integrating the database and service components.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	1	1	1	1	2	1	1	1	3	3
CO2	2	3	3	3	1	1	1	1	2	1	1	1	3	3
CO3	2	3	3	3	1	1	1	1	2	1	1	1	3	3
CO4	2	3	3	3	1	2	1	1	1	1	2	1	3	3
CO5	2	3	3	3	1	1	1	1	1	1	1	1	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL52	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	2	1

Preamble

The course aims to provide a development of socket programming, simulation of Stop & Wait, Go back- N, Selective Repeat protocols and Distance Vector Routing algorithm along with the simulation of point-to-point and local area network using Cisco packet tracer.

LIST OF EXPERIMENTS

1. Simulate the network topologies (Bus, Ring, Star and Mesh) using Cisco Packet Tracer.
2. Simulate and identify the difference in working operation of Hub and Switch using Cisco Packet Tracer.
3. Implement bit stuffing and byte stuffing.
4. Program to simulate Stop & Wait protocol.
5. Implementation of Sliding Window Protocol.
6. Program to simulate Distance Vector Routing algorithm.
7. Socket program to implement echo client and echo server using TCP.
8. Socket program to contact a given DNS server to resolve a given host name using UDP.
9. Set up a Local Area Network (LAN) using Cisco Packet Tracer which involves configuring IP addressing, understanding the Address Resolution Protocol (ARP), manipulating routing tables, and verifying communication between hosts.
10. Establish a LAN in Cisco Packet Tracer and perform traffic analysis for FTP using Traffic Generator.

Total : 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Simulate the network topologies and differentiate the working principle of hub and switch using Cisco Packet Tracer for data communication.

CO2 Experiment Automatic Repeat Request protocols (Stop and Wait, Go back-N and SelectiveRepeat) using the appropriate elements and packages in Socket programming.

CO3 Develop a java program to find shortest path using Distance Vector for a given scenario.

CO4 Write a java socket program for simulating TCP communication and UDP communication.

CO5 Create a Local Area Network and perform traffic analysis using Cisco Packet Tracer.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3	1	1	-	-	1	-	-	-	3	2
CO2	3	2	2	3	1	1	-	-	1	-	-	-	3	2
CO3	3	2	2	3	1	1	-	-	1	-	-	-	3	2
CO4	3	2	2	3	1	1	-	-	1	-	-	-	3	2
CO5	3	2	2	3	1	1	-	-	1	-	-	-	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCT05 APTITUDE AND LOGICAL REASONING

L	T	P	C
2	0	0	0

Preamble:

Aptitude tests are used to determine an individual's ability/potential to succeed in a certain task, with no prior knowledge or training and are frequently used as part of a pre-employment assessment. Aptitude tests are a proven tool used to identify those who are best equipped to carry out any given role.
A **logical reasoning test** is a form of testing that is widely used by corporate employers to help assess candidates during their recruitment process.

Course Outcomes : Upon completion of the course, students will be able to

1. Solve the given equation using appropriate simplification methods and compute time, work, capacity and identify the pattern by analyzing the given problem/scenario
2. Apply aptitude method of ratio and proportion to solve the given scenario.
3. Calculate time, speed, distance by applying suitable aptitude method for the given problem statement.
4. Calculate percentage and profit & loss for the given problem statement and Compute simple interest, compound interest for the given problem/scenario.
5. Use their logical thinking abilities to solve given problem involving direction sense, seating arrangement and coding & decoding.

UNIT 1 Unitary methods **6**

Number System, Time and Work, Pipes And Cisterns

UNIT 2 Numerical Computation **6**

Ratio and Proportion, Problems on Ages

UNIT 3 Numerical Estimation I **6**

Time and Distance, Problems on Trains, Boats and Streams

UNIT 4 Numerical Estimation II **6**

Percentage, Profit and Loss, Simple Interest and Compound Interest

UNIT 5 Logical Reasoning **6**

Direction Sense, Seating Arrangements, Coding and Decoding

TOTAL : 30 PERIODS

REFERENCES:

1. Dr.R.S.Aggarwal, “Quantitative Aptitude for Competitive Examination”, S.Chand Publications, 2022
2. Dr.R.S.Aggarwal, “A Modern Approach to Verbal & Non-Verbal Reasoning”, S.Chand Publications, 2022

22ITC61	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	2	4

Pre-requisites :-

Preamble

This course enables the student to know the Software Engineering Lifecycle and make them to improve the quality and productivity of system analysis, design, testing and management.

UNIT 1 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 2 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 – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram- CASE TOOLS.

UNIT 3 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 4 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 CheckingCase Study.

UNIT 5 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.

PRACTICAL EXERCISES:

For the list of suggested domains given below choose a domain and do the following 9 experiments.

SUGGESTED DOMAINS FOR A MINI-PROJECT:

- Passport automation system.
- Book bank
- Exam registration
- Stock maintenance system.
- Online course reservation system
- Airline/Railway reservation system
- Software personnel management system
- Credit card processing

- e-book management system
- Recruitment system
- Foreign trading system
- Conference management system
- BPO management system
- Library management system
- Student information system

LIST OF EXPERIMENTS:

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

Total : (L:45+P:15) 60 PERIODS

TEXT BOOKS:

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, First Edition, Mc Graw-Hill International Edition, 2014.

REFERENCES:

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

e-RESOURCES:

1. https://codingee.com/introduction-to-object-oriented-software-engineering/
2. https://archive.nptel.ac.in/courses/106/105/106105224/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the software process and compare software models for a given case study.
CO2	Describe requirement analysis, design and specification for a formal software systems using object modeling techniques.
CO3	Interpret software design process and patterns using model view controller and apply the same for a user interface.
CO4	Explain the types of software testing and test a software process for a given use case diagram.
CO5	Evaluate project management approaches as well as cost and schedule estimation strategies for a software project.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	2	2	1	-	-	-	1	1	2	2	2
CO2	2	3	2	3	2	1	-	-	2	2	3	2	2	2
CO3	2	3	2	1	1	1	-	-	2	2	3	2	2	2
CO4	2	3	2	2	3	1	-	-	2	2	3	2	2	2
CO5	2	3	1	2	2	1	-	-	-	-	-	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT61	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

Mobile Application Development is designed to impart the knowledge on application development framework and tools for creating android applications. It also equips the students to design, implement and deploy applications in mobile devices.

UNIT 1 GETTING STARTED WITH ANDROID 9

Android – Evolution of Android - Android architecture – Features- Core building blocks – Anatomy of android application – Android activity life cycle. Android Toast. Android Widgets: Button – TextView – EditText– RadioGroup -ToggleButton – CheckBox – Spinner –DatePicker - Progress Bar – DialogBox.

UNIT 2 INTENTS, LAYOUTS AND TELEPHONY 9

Intent – Types of Intent - Launching Activities using Intents. Layout: Relative Layout -Table Layout – Linear Layout – ListView – GridView – CardView. Android Telephony: Phone call –send Mail- Send SMS.

UNIT 3 MENUS, NOTIFICATION AND MULTIMEDIA 9

Menus –Option Menu – Adding and Updating menu items – Handling menu items. Android Notification. Multimedia in Android: Android camera – Android Audio player – Android Video player.

UNIT 4 DATABASE AND CONTENT PROVIDERS 9

Storage types in Android - Android SQLite Database - Firebase Login – Firebase authentication. Parsing in android – Android JSON parser – Connecting Android with MySQL using API - Android Google Map – Finding Currentlocation.

UNIT 5 HYBRID APP DEVELOPMENT 9

Apache Cordova– Architecture of Apache Cordova – Building simple App using Apache Cordova- Publish the app on app store: Monetizing, promoting and distributing applications. React Native: Overview and its features.

Total : 45 Periods

TEXT BOOKS:

1. Reto Meier, “Professional Android 4 Application Development”, Wiley India Pvt. Ltd, New Delhi - 2014.
2. John M. Wargo, “Apache Cordova API Cookbook”, Pearson Education – 2015.

REFERENCES:

1. ZiguardMedneiks, Laird Dornin G, Blake Meike and Masumi Nakamura, “Programming Android”,O’Reily,2013.
2. Anubhav Pradhan and Anil V Deshpande, “Composing Mobile Apps”, First Edition, Wiley India Pvt. Ltd,2014.
3. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Manning Publications, 2012.

e-RESOURCES:

1. https://nptel.ac.in/courses/106/106/106106147/, "Mobile Computing – Starting Android Programming", Professor Pushpendra Singh, IIT- Madras.
2. https://nptel.ac.in/courses/106/106/106106222/, "Introduction to Modern Application Development", Prof. Madhavan Mukund, Prof. AbhijatVichare and Prof. Aamod Sane, IIT- Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Develop mobile application for the given user requirement using android development framework and tools.

CO2 Create android applications using views, layouts, intents and SMS Manager API to send SMS and E-mails.

CO3 Create menu, notifications and multimedia features for the applications using android Notification Manager and Multimedia APIs.

CO4 Create databases for the applications to store and retrieve data using SQLite and Firebase.

CO5 Create mobile applications using standard web technologies such as HTML5, CSS3 and JavaScript for androidand iOS platforms.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	3	2	1	1	1	-	-	-	-	2	3	-
CO2	1	2	3	2	1	1	1	-	-	-	-	2	3	-
CO3	1	2	3	2	1	1	1	-	-	-	-	2	3	-
CO4	1	2	3	2	1	1	1	-	-	-	-	2	3	-
CO5	1	2	3	2	1	1	1	-	-	-	-	2	3	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT62	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The principles of computation and communication models in distributed systems are the main topics of this course. Additionally, students will be able to comprehend the problems associated with synchronization and data collecting in distributed systems. The students will learn about distributed mutual exclusion, distributed deadlock detection methods, agreement protocols, and fault tolerance strategies in distributed systems. Students will also be able to comprehend the fundamental ideas behind cloud computing models.

UNIT 1 INTRODUCTION **8**

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems 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 2 LOGICAL TIME AND GLOBAL STATE **10**

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 – Snapshot Algorithms for FIFO Channels.

UNIT 3 DISTRIBUTED MUTEX AND DEADLOCK **10**

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 4 CONSENSUS AND RECOVERY **10**

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

UNIT 5 CLOUD COMPUTING **7**

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 : 45 Periods

TEXT BOOKS:

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Indian Edition, McGraw Hill Publishers, 2017

REFERENCES:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.

e-RESOURCES:

1. https://library.iitbbs.ac.in/e-resources-a2z.php?page=21
2. https://onlinecourses.nptel.ac.in/noc21_cs87/preview

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of distributed systems and discuss its challenges and applications.

CO2 Solve synchronization and state consistency problems using clock synchronization, message ordering paradigms and state recording algorithms

CO3 Discuss resource sharing techniques in distributed systems

CO4 Apply working model of consensus and reliability of distributed systems for a given environment.

CO5 Explain Cloud Computing, its Characteristics, Deployment Models, and Service Models.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	3	-	1	-	-	-	-	-	-	3	2
CO2	1	3	2	1	-	1	-	-	-	-	-	-	3	2
CO3	2	2	1	3	-	1	-	-	-	-	-	-	3	2
CO4	1	2	2	3	-	1	-	-	-	-	-	-	3	2
CO5	3	3	1	2	-	1	-	-	-	-	-	-	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL61	MOBILE APPLICATION DEVELOPMENT LABORATORY	L T P C 0 0 2 1

Preamble:

Mobile Application Development equips the students to design, implement and deploy various applications in mobile devices. Students can design and develop useful applications for android platforms with interactive user interfaces using application frameworks and inbuilt APIs.

LIST OF EXPERIMENTS

1. Setting up Android Platform, Android Virtual Device and create application to display Welcome message.
2. Build a score keeper app that gives a user the ability to keep track of the score of two different teams playing a game of choice. Include different Buttons which can be clicked for different events in the game to add points.
3. Create a Musical Structure App to store and present the user with the library of songs available in different categories of classical and Melodies. Write code to play the song chosen by the user from the library of music.
4. Create an application to calculate the electricity bill and create an appropriate alert message as well as send the value to the given mobile number using SMS.
5. Write an android program to demonstrate a Menu 'File' with New and Open as menu items. Give toast messages on click of each menu item.
6. Create an application to fetch the current Location information (Latitude and longitude) and display it in the alert message.
7. Write an android program to implement the following operations using SQLite Database.
    - Create the SQLite Database Object.
    - Execute the CRUD Operations required for the application
    - Close the database.
8. Develop an application to implement phone number Verification by OTP using Firebase in Android
9. Create an application to extract employee information from the JSON message and load it in UI.
10. Develop any one of the following mobile application using android
    - Education Quiz App
    - Tour Guide App
    - News Feed App

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Develop mobile applications using android widgets, layout managers, event listeners, listview, menus,activities and intents for the given problem statements.

CO 2 Implement an android application to track the current location of a mobile user using GPS.

CO 3 Develop an android application for storing and updating data using SQLite and Firebase database.

CO 4 Create an application to extract information from the given JSON message using JSON objects.

CO 5 Develop an application to send and receive messages using SMS Manager.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	3	1	-	1	-	1	-	-	2	3	2
CO2	2	2	3	3	1	-	1	-	1	-	-	2	3	2
CO3	2	2	3	3	1	-	1	-	1	-	-	2	3	2
CO4	2	2	3	3	1	-	1	-	1	-	-	2	3	2
CO5	2	2	3	3	1	-	1	-	1	-	-	2	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL62 **MINI PROJECT** **L T P C**
0 0 6 3

Preamble:

This course enhances the knowledge acquired in information technology to do a mini project, which allows the students to come up with new innovative techniques or algorithms and programs expressing their ideas in a novel way. It helps the students in preparing mini project reports and to face reviews and viva voce examination.

NOTE:

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design and develop computer code. Demonstrate the novelty of the project through the results and outputs.

TOTAL: 60 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Apply engineering fundamentals to analyze domain specific Issues to identify problem statement with objective and scope.

CO2 Investigate the identified problem and review state of the art literature survey to synthesis system requirements

CO3 Identify the risk/impact/technique and interpret the suitable standards related to the problem statement and design appropriate procedures/methods.

CO4 Develop modules using discipline specific tools and implement the modules to achieve valid conclusion.

CO5 Prepare documents related to their findings for detailed presentation, Defend the findings and conclude with oral / written presentation.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCL06 **COMMUNICATION SKILLS LABORATORY** **L T P C**

(Fifth / Sixth Semester) **0 0 2 0**

Preamble :

Communication Skill is a life skill necessary for all students of Engineering and Technology. The course Communicative Skills Laboratory aims at developing effective oral and written communication to facilitate their success in competitive examinations, and recruitment screening thereby ensuring professional success and progress.

UNIT 1 RECEPTIVE SKILLS 6

LISTENING & READING – Developing Listening & Reading Skills - Comprehension and Analysis – Listening & Reading for Main Idea - Specific Information - Cloze Test- Rearranging words and sentences

UNIT 2 PRODUCTIVE SKILLS 8

SPEAKING & WRITING - Group Discussion and Practice – Mock GD - Structure – Types - Techniques - Keywords -Vital qualities - Attitude and Opinion - Expository and Persuasive Paragraphs – Picture Description

UNIT 3 ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS 4

Orientation to International English Language Testing System (IELTS) and other Competitive Examinations – MCQs

UNIT 4 CAREER SKILLS 6

Types of Interviews - FAQ's - Mock Interviews - Body Language - Team Work - Managing Time - Managing Stress - Negotiation Skills - Networking – Profile Creation (Linked in, Portfolio)

UNIT 5 VERBAL ABILITY 6

Synonyms and Antonyms - Idioms and Phrases - Sentence Construction and Improvement- Paraphrasing - Contextual Vocabulary - Verbal Analogy

TOTAL: 30 PERIODS

REFERENCES:

1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
2. Koneru Aruna 'Professional Communication' MC Graw Hill Education, Chennai, 2008.
3. Upadhyay Meenakshi & Arun Sharma 'Comprehension Interpersonal & Communication Skills for General Studies Civil Services Preliminary Examination' MC Graw Hill Education, New Delhi, 2012.

e. RESOURCES :

1. https://www.teachingenglish.org.uk/article/email-writing
2. http://www.oxforddictionaries.com/words/writing-job-applications
3. https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers
4. www.cambridgeenglish.org

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Respond quickly and correctly to questions from different types of scripts, exhibiting good comprehension and analyzing skills

CO2 Participate effectively in formal group discussions and prepare professional e mails, persuasive and expository paragraphs to establish and meet organizational needs and goals.

CO3 Fare well in IELTS and other English language assessment segments of competitive examinations within the stipulated time.

CO4 Write effective résumés, and face interviews with communicative competence and confidence, with a good knowledge of career skills .

CO5 Select appropriate vocabulary and idiomatic expressions, identify errors in syntax, and arrange sentences to make meaningful paragraphs, without any aid.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	3	-	-	-	-	3	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	3	3	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	1	-	-
CO 4	-	-	-	-	-	-	-	-	3	3	-	1	-	-
CO 5	-	-	-	-	-	-	-	-	-	3	-	1	-	-
Mapping Average	-	-	-	-	3	-	-	-	3	3	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT71	ECONOMICS AND MANAGEMENT FOR ENGINEERS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to understand the concepts of Economics with respect to the demand and supply analysis. This course makes the students to analyze the theory of production and the analysis of the cost parameter by using the Elasticity. This course will enable the students to manage and plan the situation with the help of the available strategies to support the decision making process.

UNIT 1 INTRODUCTION TO ECONOMICS **9**

Introduction to Economics – Scope of Economics – Positive and Normative Science – Methodology of Economics – Economic Laws - Economy and its basic problems: Economy and its working – Kindsof economy systems – Basic problems of economy.

UNIT 2 DEMAND AND SUPPLY ANALYSIS **9**

The Law of Demand – The Law of Supply – Elasticities of Demand and Supply: Price Elasticity of Demand - Price Elasticity and Consumption Expenditure- Cross Elasticity of Demand – Income Elasticityof Demand – The Elasticity of Price Expectations – The uses of Elasticity– Price Elasticity of Supply.

UNIT 3 THEORY OF PRODUCTION AND ANALYSIS OF COST **9**

Meaning of Production – Production concepts – Production Function – Laws of Production – Cost Concepts - Short-Run Cost Output Relations – Long Run Cost output relations – Economics of Scale

UNIT 4 INTRODUCTION TO MANAGEMENT **9**

Management: An Overview – Management Defined – Managerial skills – Managerial roles – Management responsibilities – Management functions. Evolution of Management: Classical approaches to Management – Contemporary Management Perspectives.

UNIT 5 PLANNING **9**

Planning and Forecasting: Importance of Planning – Principles of effective Planning – Planning process – Types of Plans. Strategic Planning: Strategic Planning process – Rational decision making.

Total : 45 Periods

TEXT BOOKS:

1. D.N.Dwivedi, “Principles of Economics”, Second Edition, Vikas Publishing House (P) Limited, NewDelhi, 2012.
2. J.S.Chandan, “Management Concepts and Strategies”, Vikas Publishing House (P) Limited, NewDelhi, Reprint 2009.

REFERENCES:

1. Ranbir Singh,“ Principles of Engineering Economics and Management”, S .K.Kataria& Sons, New Delhi, 2013.
2. Manish Varshney and VidhanBanerjee,“Engineeringand Managerial Economics”,First Edition, CBSPublishers and Distributors Pvt. Ltd., 2015.

e-RESOURCES:

1. http://nptel.ac.in/courses/110101005/, Prof.Trupti Mishra, S.J.M. School of Management, IITMumbai, Managerial Economics.
2. https://nptel.ac.in/courses/122106031/slides/3_1s.pdf, Dr.M.Thenmozhi, Professor, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain how to use economics principles to solve economic problems in engineering disciplineby satisfying the economic laws.

CO2 Discuss the demand and supply process for a market analysis using Price elasticity, Cross elasticity and Income elasticity.

CO3 Interpret short run and long run costs in the process of production for carrying out a business.

CO4 Apply managerial skills to make decisions and solve problems for achieving organizationalobjectives.

CO5 Express the principles of effective planning for survival and success of all organizations usingstanding and single use planning methods.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	2	1	1	-	1	-	-	-	2
CO2	2	3	2	2	-	2	1	1	-	1	-	-	-	2
CO3	2	3	2	2	-	2	1	1	-	1	-	-	-	2
CO4	2	3	2	2	-	2	1	1	-	1	-	-	-	2
CO5	2	3	2	2	-	2	1	1	-	1	-	-	-	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITT72	NETWORK SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

This course on network security aims at exploring the various cryptographic algorithms deployed in offeringconfidentiality, integrity, authentication and non repudiation. It also focuses on basic concepts of networks, authentication methods, Protocols, standards, Intrusion Detection and Prevention Mechanisms and Firewalls.

UNIT 1 FOUNDATION& NUMBER THEORY 10

Services, Mechanisms and attacks-the OSI security architecture-Network security model- Classical Encryption techniques-.FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic- Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT 2 BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 10

Data Encryption Standard-Block cipher Design principles- block cipher modes of operation-Advanced Encryption Standard (AES) - Triple DES-Blowfish. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography. Case Study: Encrypt and decrypt the message transfer between two users using RSA algorithm.

UNIT 3 HASH FUNCTIONS AND DIGITAL SIGNATURES 8

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA512 - Digital signature and authentication protocols –DSS – EI Gamal – Schnorr. Case Study: Authenticate the sensitive file transfer between two users using DSS.

UNIT 4 SECURITY PRACTICE & SYSTEM SECURITY 8

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs – SET for E- Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems. Case Study: Create your own Virus.

UNIT 5 E-MAIL, IP & WEB SECURITY 9

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP-Security: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3-Exportability-Encoding-Secure Electronic Transaction (SET).Case Study: Detection of Phishing Email.

Total : 45 Periods

TEXT BOOKS:

1. William Stallings, " Cryptography and Network Security", 7th Edition, Pearson Education, March 2017.(UNIT I,II,III,IV).
2. Charlie Kaufman, Radia Perlman, Mike Speciner and Ray Perlner "Network Security", 3th Edition, Prentice Hall of India, 2022.(UNIT V).

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", WileyPublications, 2003.

e-RESOURCES:

1. www.williamstallings.com/Extras/Security-Notes/
2. https://www.slideshare.net/gangadhar9989166446/network-security-cryptography-full-notes
3. https://nptel.ac.in/courses/106/105/106105031/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify the major types of threats and develop strategies to protect organization information assets fromcommon attacks using classical cryptographic techniques.

CO2 Encrypt and decrypt information for a given message using symmetric and asymmetric algorithms.

CO3 Analyze existing authentication and key agreement protocols and choose appropriate protocols for agiven message based on the needed functionality.

CO4 Classify firewall-based solutions against security threats and employ access control techniques for theexisting computer platforms UNIX and Windows using network securityapplications.

CO5 Solve security problems related to e-mail, IP and Web in practical systems using securitytechniques.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	1	1	1	-	-	-	1	2	1
CO2	2	3	2	3	-	1	1	1	-	-	-	1	2	1
CO3	2	3	2	3	-	1	1	1	-	-	-	1	1	1
CO4	2	3	2	2	-	2	1	1	-	-	-	1	1	1
CO5	2	3	2	3	-	2	1	1	-	-	-	1	2	1

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22HST71	HUMAN VALUES AND PROFESSIONAL ETHICS	L	T	P	C
		1	0	0	1

Pre-requisites: Universal Human Values

Preamble

Universal Human Values is a life skill necessary for all students of Engineering and Technology. The course aims to identify the values and skills, and to realize the need, basic guidelines, content and process of value education. Professional Ethics For Engineers deals with the human values, integrity and work ethics in the common world. This course is mainly concerned about the theories of ethics, which form the basis for the understanding and responsibility of the various groups encountered in Engineering.

UNIT 1 INTRODUCTION TO UNIVERSAL HUMAN VALUES 3

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration– Mechanism for self-exploration. Continuous Happiness and Prosperity- Basic Human Aspirations and its requirements for fulfillment of Human Aspirations understanding and living in harmony at various levels.

UNIT 2 HARMONY IN ONESELF, FAMILY AND SOCIETY 3

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationships. Trust and Respect- values of relationship. Difference between intention and competence. Difference between respect and differentiation

UNIT 3 HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 3

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics. Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.

UNIT 4 ENGINEERING ETHICS 3

Senses of Engineering Ethics– Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles –Professional responsibility - Moral reasoning - Theories about right action – Self-interest – Self respect – Duty ethics – Customs and religion.

UNIT 5 ENGINEERING AS SOCIAL EXPERIMENTATION 3

Engineering as experimentation – Engineers as responsible experimenters – Role of codes- Codes of Ethics – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE) – A balanced outlook on law - Safe exits -The Bhopal gas tragedy and Challenger case study.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. Gaur R R, Sangal R, Bagaria G P, "A Foundation Course in Human Values and Professional Ethics". 3rd Revised Edition, 2023
2. Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", PHI Learning Pvt. Ltd, New Delhi, 2017.

REFERENCES:

1. Banerjee B P, "Foundations of Ethics and Management", Excel Books. 2005.
2. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.
3. Subramanian R, "Professional Ethics", Oxford university press, 2017.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Relate the significance of value inputs in a classroom and start applying them in their life and profession.

CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.

CO3 Interpret the value of harmonious relationships based on the trust and respect in their life and profession.

CO4 Discuss the ethical issues related to Engineering.

CO5 Discuss Engineer's work in the context of its impact on society.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	-	2	3	2	2	-	-	2	-	-
CO 2	-	-	-	-	-	3	-	3	1	-	-	2	-	-
CO 3	-	-	-	-	-	2	2	3	3	3	-	2	-	-
CO 4	1	2	-	-	-	3	-	2	-	-	-	2	-	-
CO 5	2	2	1	-	-	3	2	2	-	-	-	2	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL71	NETWORK SECURITY LABORATORY	L T P C 0 0 2 1

Preamble:

This laboratory course is intended to expose the students to different cipher techniques and to implement algorithms like DES, RSA, MD5, SHA-1 using Java programming language/Python programming language.

LIST OF EXPERIMENTS

1. Implement the following Substitution & Transposition Techniques
   a) Caesar Cipher
   b) Playfair Cipher
   c) Hill Cipher
2. Implement the following algorithms
   a) DES
   b) RSA Algorithm
   c) Diffiee-Hellman
   d) MD5
   e) SHA-1
2. Implement the Signature Scheme - Digital Signature Standard
3. Demonstrate how to provide secure data storage, secure data transmission and for creating digitalsignatures (GnuPG).
4. Setup a honey pot and monitor the honeypot on network (KF Sensor)
5. Installation of root kits and study about the variety of options
6. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler)
7. Demonstrate intrusion detection system (ids) using any tool (snort)

TOTAL: 45 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1	Implement and test symmetric and asymmetric cipher techniques using Java/Python.
CO2	Implement digital signature standard and verify the authentication process using Java/Python.
CO3	Implement and test digital signature standard using GnuPG
CO4	Implement and test honey pot using KF Sensor.
CO5	Implement and test IDS and WEP, WPA using snort and Net stumbler respectively

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	1	1	1	2	1	1	-	1	1	-
CO2	2	3	3	3	1	1	1	2	1	1	-	1	1	-
CO3	2	3	3	3	3	1	1	2	1	1	-	1	2	-
CO4	2	3	3	3	3	1	1	2	1	1	-	1	2	-
CO5	2	3	3	3	3	1	1	2	1	1	-	1	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22MCT07 INDIAN CONSTITUTION AND TRADITIONAL KNOWLEDGE L T P C
2 0 0 0

Preamble:
The course provides basic information on Indian Constitution and Indian Traditional knowledge. This is essential for all citizens and especially for engineers so that they become aware of Indian polity and governance. This also reminds the citizen about their obligation, adherence and up keeping of Constitutional rights.

UNIT 1 **6**
Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy - Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT 2 **6**
Governor: Role and Position, CM and Council of ministers, State Secretariat: organisation, Structure and Functions District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

UNIT 3 **6**
Panchayatraj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 4 **6**
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

UNIT 5 **6**
Basic structure of Indian Knowledge System- Modern Science and Indian Knowledge – Philosophical Tradition - Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) – Indian Artistic Tradition.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. M.Rajaram, Indian Constitution, New Age International, 2009
2. V.Sivaramakrishnan(Ed.) Cultural Heritage of India (CourseMaterial),Bharatiya Vidya Bhavan, Mumbai. 5th Edition,2014

Course Outcomes: Upon completion of the course, students will be able to:
- CO1. Describe the emergence and evolution of Indian Constitution, structure and composition of Indian Constitution and federalism in the Indian context.
- CO2. List the functions of Centre, States and District Administrations, Fundamental rights needed to develop human personality in free society.
- CO3. Identify different levels of Panchayat Raj system and its working.
- CO4. Elaborate the role of Election Commission and its power to conduct free and fair election throughout India.
- CO5. Develop a broad understanding of Indian society and intercultural literacy through cultural immersion.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO5	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	2	2	2	2	-	2	-	-
CO2	-	-	-	-	-	3	2	2	2	2	-	2	-	-
CO3	-	-	-	-	-	3	2	2	2	2	-	2	-	-
CO4	-	-	-	-	-	3	2	2	2	2	-	2	-	-
CO5	-	-	-	-	-	3	2	2	2	2	-	2	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITL81 **INTERNSHIP** **L T P C**
0 0 6 2

Pre-requisites: -

Preamble

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important, as employers are looking for employees who are properly skilled and have awareness about the industry environment, practices, and culture. The internship is structured, short-term, supervised training often focused on particular tasks or projects with defined time scales.

GUIDELINE FOR REVIEW AND EVALUATION

Students have to undergo four to Six-week practical training in IT related organizations of their choice but with the prior approval from the institution. At the end of the training student will submit a report as per the prescribed format to the department. The student shall make a power point presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.

Evaluation of Project Report and Viva voce examination: 100 marks

(The student will be evaluated based on the report and the viva voce examination by an internal examiner)

Total: 45 Periods

Course Outcomes: Upon completion of this course, students will be able to:

CO1: Apply the acquired knowledge in the development of software and systems to solve the real-life problems.

CO2: Solve the given problems with the perception of living and nonliving systems.

CO3: Apply the Computing and IT concepts to solve the engineering problems.

Mapping of Cos with POs and PSOs

Cos/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	3	3	3	2	2	3	3
CO2	3	3	3	3	3	3	2	3	3	3	2	2	3	3
CO3	3	3	3	3	3	3	2	3	3	3	2	2	3	3

1-Slight(Low), 2-Moderate(Medium), 3-Substantial (High).

22ITL82	PROJECT WORK	L T P C 0 0 20 10

Preamble:

This course develops the ability to solve a specific problems in-depth insight into the concepts, principles, formulation of the projects and network technique right from its identification and literature review till the successful solution of the same. It also trains the students in preparing project reports and to face reviews and viva voce examination.

NOTE:

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 prepare 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: 180 PERIODS

Course Outcomes: Upon completion of the course, students will be able to:

CO1 Apply engineering fundamentals to analyze domain specific Issues to identify problem statement with objective and scope.

CO2 Investigate the identified problem and review state of the art literature survey to synthesis system requirements.

CO3 Identify the risk/impact/technique and interpret the suitable standards related to the problem statement and design appropriate procedures/methods.

CO4 Develop modules using discipline specific tools and implement the modules to achieve valid conclusion.

CO5 Prepare documents related to their findings for detailed presentation, Defend the findings and conclude with oral / written presentation.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	2	2	2	3	3	3	3	3	3
CO2	2	3	3	3	2	2	2	2	3	3	3	3	3	3
CO3	2	3	3	3	3	2	2	2	3	3	2	3	3	3
CO4	2	3	3	3	3	3	2	2	3	3	3	3	3	3
CO5	2	3	3	3	2	3	2	3	3	3	2	3	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE11	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

Pre-requisites : Python Programming

Preamble:

The main aim of this course to outline an overview of exploratory data analysis. To implement data visualization using Matplotlib.To perform univariate data exploration and analysis.To apply bivariate data exploration and analysis.To use Data exploration and visualization techniques for multivariate and time series data.

UNIT 1 EXPLORATORY DATA ANALYSIS 9

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

UNIT 2 EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations. Case study: Perform EDA on wine Quality Data set.

UNIT 3 UNIVARIATE ANALYSIS 9

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

UNIT 4 BIVARIATE ANALYSIS 9

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

UNIT 5 MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Timebased indexing – Visualizing – Grouping – Resampling. Case study: Perform Time Series Analysis and apply the various Visualization techniques.

Total : 45 Periods

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017.
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008.

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.

e-RESOURCES:

1. https://analyticsindiamag.com/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of exploratory data analysis and data transformation techniques for merging, reshaping and pivoting using software tools of EDA.

CO2 Implement the data manipulation, indexing and selection using Panda's Matplotlib for wine quality data set.

CO3 Apply univariate data exploration and analysis for a given data.

CO4 Apply bivariate data exploration and analysis for the given scenario.

CO5 Apply Data exploration and visualization techniques for multivariate and time series data using Pandas.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	3	3	1	-	-	2	2	3	2	2	2
CO2	2	2	2	3	3	1	-	-	3	2	2	2	2	2
CO3	2	3	2	2	3	1	-	-	2	2	2	1	2	2
CO4	2	2	2	2	3	1	-	-	3	2	2	1	2	2
CO5	2	2	3	2	1	1	-	-	1	2	2	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE12	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

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

UNIT 1 INTRODUCTION **9**

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

UNIT 2 CONTENT-BASED RECOMMENDATION SYSTEMS **9**

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

UNIT 3 COLLABORATIVE FILTERING **9**

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

UNIT 4 ATTACK-RESISTANT RECOMMENDER SYSTEMS **9**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms. Case Study : Attack for tampering with recommender systems.

UNIT 5 EVALUATING RECOMMENDER SYSTEMS **9**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures. Case Study : Accuracy metrics like Receiver Operated Characteristic curves.

Total : 45 Periods

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

REFERENCES:

1. M. Chiang, Networking Life, Cambridge, 2010. (Chapter 4).
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed

e-RESOURCES:

1. https://www.witpress.com/Secure/elibrary/papers/1845641523/1845641523005FU1.pdf
2. https://freevideolectures.com/course/4694/nptel-e-business/54

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of recommender systems and discuss data similarity measures using Python.
CO2 Demonstrate machine-learning and data-mining algorithms in recommender systems data sets.
CO3 Identify Collaborative Filtering in carrying out performance evaluation of recommender systems based on the metrics
CO4 Explain the process of detecting attacks on recommender systems and simulate an attack for tampering with recommender systems.
CO5 Discuss evaluating paradigms, accuracy metrics and limitations of recommender systems.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	2	1	1	-	-	1	-	-	1	2	2
CO2	1	2	2	3	1	1	-	-	-	-	-	1	2	2
CO3	2	3	2	3	1	1	-	-	2	-	-	1	2	2
CO4	3	2	3	2	1	1	-	-	2	-	-	2	2	2
CO5	1	1	3	2	1	1	-	-	-	-	-	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE13 **NEURAL NETWORKS AND DEEP LEARNING** **L T P C**
3 0 0 3

Pre-requisites : Transforms and Partial Differential Equations, Probability and Queueing Theory

Preamble

Artificial Neural Networks are the computational models inspired by the human brain. Many of the recent advancements have been made in the field of Artificial Intelligence, including Voice Recognition, Image Recognition, and Robotics using Artificial Neural Networks. These biological methods of computing are considered to be the next major advancement in the Computing Industry. ANN are the biologically inspired simulations performed on the computer to perform certain specific tasks like clustering, classification, pattern recognition, etc. The ANN is the very useful model and the ANN could be applied in problem-solving and machine learning. Thus, their ability to learn by example makes them very flexible and powerful.

UNIT 1 INTRODUCTION TO NEURAL NETWORKS 9

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network- Case Study: regression model in Keras.

UNIT 2 ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Auto associative 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 3 THIRD-GENERATION NEURAL NETWORKS 9

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression- Case Study: Image Classifier using CNN in TensorFlow/Keras.

UNIT 4 DEEP FEEDFORWARD NETWORKS 9

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-Case Study: Feed Forward Network in TensorFlow/Keras.

UNIT 5 RECURRENT NEURAL NETWORKS 9

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

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow”, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.
3. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.

e-RESOURCES:

1. http://videolectures.net/deeplearning2015_montreal/
2. https://www.youtube.com/channel/UC9OeZkIwhzfv-_Cb7fCikLQ/videos

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of artificial neural networks and important terminologies and build the regression model using supervised learning method.

CO2 Analyze and evaluate the types of associative memory models with respect to strengths, limitations, and computational properties.

CO3 Apply third-generation neural networks to solve complex tasks and challenges in real time applications and interpret the results to make decisions and insights.

CO4 Implement regularization techniques to improve model generalization, robustness, and performance in deep learning applications.

CO5 Demonstrate proficiency in implementing and training recurrent neural networks for Sentiment Analysis using deep learning frameworks and libraries.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	3	1	-	-	2	1	-	-	2	3
CO2	3	1	2	1	-	-	1	-		1	-	2	3	3
CO3	3	3	3	3	3	1	-	-	2	1	-	-	3	2
CO4	3	3	3	3	3	-	-	-	2	-	2	3	3	3
CO5	1	1	3	2	3	-	-	-	2	-	-	-	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE14	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

Text analysis is a machine learning technique used to automatically extract valuable insights from unstructured text data. Companies use text analysis tools to quickly digest online data and documents, and transform them into actionable insights. Speech analysis is the process of analyzing voice recordings or live customer calls to contact centers with speech recognition software to find useful information and provide quality assurance.

UNIT 1 NATURAL LANGUAGE BASICS 9

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

UNIT 2 TEXT CLASSIFICATION 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model –FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models. Case study: Use a transformer for implementing classification.

UNIT 3 QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems. Case study: Design a chatbot with a simple dialog system.

UNIT 4 TEXT-TO-SPEECH SYNTHESIS 9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems. Case study: Convert text to speech and find accuracy.

UNIT 5 AUTOMATIC SPEECH RECOGNITION 9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems. Case study: Design a speech recognition system and find the error rate.

Total : 45 Periods

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.
2. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018

REFERENCES:

1. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.

e-RESOURCES:

1. https://nptel.ac.in/courses/106101007,”Natural Language Processing”, Prof. Pushpak Bhattacharyya, IIT Bombay.
2. https://nptel.ac.in/courses/106105158,” Natural Language Processing”,Prof. Pawan Goyal, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain existing and emerging deep learning architectures for text and speech processing
CO2 Classify the features of text documents using text classification algorithms
CO3 Develop question-answering systems, chatbots and dialogue systems for a given application.
CO4 Apply deep learning based text to speech systems to develop a speech synthesizer for a given application.
CO5 Develop a speech recognition system for a given application using deep learning models.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	3	-	-	-	1	2	1	2	1	1
CO2	3	1	2	1	3	-	-	-	2	2	1	3	3	2
CO3	2	2	1	3	1	-	-	-	3	3	1	2	3	3
CO4	2	1	1	1	2	-	-	-	2	1	2	2	3	1
CO5	1	3	2	2	1	-	-	-	3	2	1	1	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE15	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble:

This course aims to inform the changes in business through utilization of predictive models that provide insight into the outcome of proposed changes.

UNIT 1 INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration.

UNIT 2 BUSINESS INTELLIGENCE 9

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

Case Study: Perform data pre-processing operations i) Handling Missing data ii) Normalization

UNIT 3 BUSINESS FORECASTING 9

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

Case Study: Perform bivariate and multivariate analysis on the dataset.

UNIT 4 HR & SUPPLY CHAIN ANALYTICS 9

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

UNIT 5 MARKETING & SALES ANALYTICS 9

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

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. R N Prasad, Seema Acharya, Fundamentals Of Business Analytics, 2016, Wiley Publications
2. Foster Provost, Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly Media, Inc. 2013

e-RESOURCES:

1. Business Analytics For Management Decision, IIT Kharagpurhttps://nptel.ac.in/courses/110105089
2. Business Analysis for Engineers, IIT Madras. https://nptel.ac.in/courses/110106050

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the real world business problems with models and validate the solutions.

CO2 Identify the business processes for extracting Business Intelligence.

CO3 Develop predictive analytics model for business fore-casting using machine learning techniques.

CO4 Apply HR and supply chain analytics to make a prediction of the demand.

CO5 Apply analytics for marketing and sales to predict the customers behavior.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	1	1	-	-	-	1	2	1	1	3	2
CO2	3	2	3	2	3	2	-	-	-	3	3	1	3	3
CO3	2	2	3	1	1	-	-	-	1	2	1	1	3	2
CO4	5	2	3	2	3	2	-	-	-	3	3	1	3	3
CO5	2	2	3	1	1	-	-	-	1	2	1	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE16	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

The main aim of this course is to make understand the basics of image processing techniques for computer vision, to learn the techniques used for image pre-processing, to discuss the various object detection techniques and to understand the various Object recognition mechanisms.

UNIT 1 INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures- Case Study: T-pyramid of an image

UNIT 2 IMAGE PRE-PROCESSING 9

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models – Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration – Case Study: Deriving the quad tree representation of an image using the homogeneity criterion of equal intensity

UNIT 3 OBJECT DETECTION USING MACHINE LEARNING 9

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures-Case Study: Geometric transforms such as Rotation, Change of scale, Skewing, Affine transform calculated from three pairs of corresponding points and Bilinear transform calculated from four pairs of corresponding points.

UNIT 4 FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- Deep Face solution by Facebook - FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition-Case Study: motion analysis using moving edges, and apply it to your image sequences and Facial Detection and Recognition.

UNIT 5 VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3 –Case Study: Event detection in video surveillance system

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs93/preview
2. https://appsilon.com/object-detection-yolo-algorithm/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain image processing techniques in computer vision and video analysis for the T-pyramid of an image.
CO2	Discuss pre-processing techniques for image smoothing, edge detection, line detection and restoration using the homogeneity criterion of equal intensity.
CO3	Perform geometric transformation on objects from three and four pairs of corresponding points using IoU, R-CNN and YOLO..
CO4	Explain the process involved in face recognition and gesture recognition and apply motion analysis for an image.
CO5	Elaborate on deep learning-based video analytics using ResNet and GoogleNet architectures for video surveillance systems .

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	2	2	1	-	1	3	3	2	1	3	3
CO2	2	2	3	3	3	1	-	1	3	2	1	1	3	3
CO3	1	2	2	2	3	1	-	1	1	2	1	2	3	3
CO4	1	2	3	2	3	1	-	1	2	2	2	3	3	3
CO5	3	2	1	3	2	1	-	1	2	1	1	3	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE17	COMPUTER VISION	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to expose the concepts of Computer Vision seeks to generate intelligent and useful descriptions of visual scenes and sequences and of the objects that populate them, by performing operations on the signals received from video cameras.

UNIT 1 INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization- Case study: Contour analysis, Bolb detection

UNIT 2 FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods- Case study: Image segmentation using Graphcut / Grabcut

UNIT 3 FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion- Case study: Fourier, Hough, Extract ORB Image features, Feature matching, cloning

UNIT 4 3D RECONSTRUCTION 9

Shape from X - Active rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedosos- Case study: Creating Depth map from stereo images

UNIT 5 IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets- Case Study: Object Detection and Tracking using Kalman Filter, Camshift

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012

e-RESOURCES:

1. https://opencv.org/opencv-free-course
2. https://docs.opencv.org

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts, theories and methods in image processing and computer vision

CO2 Interpret basic and some advanced image processing techniques in Open CV

CO3 Apply 2D feature-based based image alignment, segmentation and motion estimations.

CO4 Apply 3D image reconstruction techniques

CO5 Develop innovative image processing and computer vision applications

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1	1	-	-	-	2	1	3	2	2	3
CO2	3	3	3	2	3	-	1	-	2	1	2	2	3	3
CO3	3	3	2	2	3	-	-	-	1	1	2	2	3	2
CO4	2	3	3	2	3	-	-	-	2	1	2	3	2	2
CO5	2	3	3	2	2	2	-	-	3	1	2	3	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE18	BIG DATA AND ANALYTICS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The course covers foundational techniques and tools required for big data analytics. It focuses on concepts, principles and techniques applicable to any technology environment and industry and establishes a baseline for additional real-world experience. It provides an in-depth knowledge on managing big data applications, giving insight on real-world big data management.

UNIT 1 FUNDAMENTALS OF BIG DATA 9

Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data – Big Data Analytics Lifecycle - Enterprise Technologies and Big Data Business Intelligence. Case Study: Identifying data characteristics and types of data.

UNIT 2 STORING AND PROCESSING BIG DATA 9

Big Data Storage Concepts: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, CAP Theorem, ACID, BASE - Big Data Processing Concepts: Parallel Data Processing, Distributed Data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in Realtime Mode - Big Data Storage Technology: On-Disk Storage Devices, In-Memory Storage Devices.

UNIT 3 BIG DATA ANALYSIS 9

Quantitative Analysis – Qualitative Analysis – Data Mining – Statistical Analysis – Machine Learning – Semantic Analysis – Visual Analysis – Case Study : Correlation – Regression – Time Series Plot – Clustering – Classification.

UNIT 4 ANALYTICS MODELS – PREDICTIVE MODELING 9

Introduction – Data Models – Computing Models. Predictive Modeling for Unstructured Data: Introduction – Applications of Predictive Modeling – Featured Engineering – Pattern Mining.

UNIT 5 APPLICATIONS FOR BIG DATA ANALYTICS 9

Big Data Analytics for Financial Services and Banking: Introduction – Customer insights and marketing analysis – Sentiment Analysis – Predictive Analytics – Model Building – Fraud detection and Risk Management – Integration of Big Data Analytics into operations. Big Data Analytics and Recommender Systems: Introduction – Background – Overview – Evaluations of Recommenders – Issues.

Total : 45 Periods

TEXT BOOKS:

1. C.S.R. Prabhu, Aneesh SreevallabhChivukula, Aditya Mogadala, Rohit Ghosh, L.M. Jenila, “Big Data Analytics: Systems, Algorithms, Applications”, First edition, Springer, 2019.
2. Paul Buhler, Wajid Khattak, Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Second Edition, Prentice Hall, 2016.

REFERENCES:

1. Anil Maheshwari, “Data Analytics” , First Edition, Tata Mcgraw Hill, 2017.
2. Venkat Ankam, “Big Data Analytics”, First Edition, Packt Publishing Limited, 2016.
3. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, First Edition, Wiley, 2015

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc16_mg06, “Introduction to Data Analytics”, Dr. Nandan Sudarsanam, Dr. Balaraman Ravindran, IIT- Madras.
2. https://nptel.ac.in/courses/106104135/48, “Big Data”, Prof.ArnabBhattaacharya, IIT-Kanpur

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify the type of data based on the characteristics of datasets, compare trivial data with big data and explain the lifecycle of data analytics for real world applications.

CO2 Discuss the storage and processing techniques for big data and apply them for a given scenario using Hadoop.

CO3 Analyze big data using quantitative, qualitative and machine learning approaches and implement regression, clustering and classification algorithm for a given big data application.

CO4 Compare data models and computing models used for data analytics and apply predictive modeling for processing unstructured data.

CO5 Develop analytical models for financial services, banking and recommender systems using marketing analysis, sentiment analysis and predictive analysis.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	-	1	-	-	-	-	-	1	3	-
CO2	2	3	3	2	-	1	-	-	-	-	-	1	3	-
CO3	1	3	1	2	-	1	-	-	-	-	-	1	2	-
CO4	1	3	2	3	-	1	-	-	-	-	-	1	3	-
CO5	1	3	2	3	-	1	-	-	-	-	-	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE21	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisites :- Database Management Systems

Preamble

Cloud computing involves delivering different types of services over the Internet. From software and analytics to secure and safe data storage and networking resources, everything can be delivered via the cloud. It became a hot issue for its advantages such as "reduce costs", "increase business flexibility" and/or "provide business continuity". Nowadays, all of the legacy systems are being moved to the cloud platform and its demand is increasing day by day. In future, all web or mobile applications will be available on the cloud.

UNIT 1 CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT 2 VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices-Case study:Open source cloud workstations.

UNIT 3 VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories-Case study:Creating a container using Docker.

UNIT 4 CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack-Case study: GAE launcher to launch the web applications.

UNIT 5 CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://nptel.ac.in/courses/106105167," Cloud computing", Prof. Soumya Kanti Ghosh, IIT Kharagpur

2. https://nptel.ac.in/courses/106104182,"Cloud Computing and Distributed Systems", Dr.Rajiv Misra, IIT Patna.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the cloud architecture models, infrastructure and design challenges in the cloud.

CO2 Discuss the concept of virtualization and its types in cloud environment.

CO3 Explain the virtualization infrastructure and create a container using Docker.

CO4 Develop and deploy services on the cloud and set up a cloud environment using Google App Engine,Amazon AWS and Microsoft Azure.

CO5 Identify the security challenges in the cloud environment and secured data storage using Identity and Access Management.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	-	1	-	1	-	-	-	1	3	3
CO2	3	2	2	3	-	1	-	1	-	-	-	1	3	3
CO3	2	3	2	3	-	1	-	1	-	-	-	1	3	3
CO4	1	2	3	3	2	1	-	1	-	-	-	1	3	3
CO5	2	3	3	3	2	1	-	1	-	-	-	1	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE22	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

Pre–requisites : -

Preamble:

This course enables the student to understand the XML fundamental concepts, definition of XML document structure, web service that offer functionality over the web and set of architectural concepts used for the development and integration of services as SOA. This course makes the students to define "service" and "architecture" and establishes a strong understanding of the concepts needed to have an effective working knowledge of SOA methodologies, modeling, design, SOA technologies, orchestration and architectural frameworks.

UNIT 1 INTRODUCTION TO XML & WEB SERVICES 9

XML document structure – URIs and XML namespace–Defining structure in XML documents using DTD and schemas–XML schemas reuse–Document navigation and transform –Introduction to Web services–Software as a Service–Definition of Web Services–Characteristics of Web Services – Service interface and implementation–Service Orientation Architecture – Web service technology stack –Quality of Service– Web service interoperability–Web service vs. Components – Impact and shortcoming of Web service

UNIT 2 EVOLUTION, EMERGENCE OF WEB SERVICES & SOA FUNDAMENTALS 9

Evolution of distributed computing – Core distributed computing technologies – client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM – Challenges in Distributed Computing, role of J2EE and XML in distributed computing – Characteristics of SOA – Anatomy of SOA – Principles of Service orientation.

UNIT 3 WEB SERVICE ARCHITECTURE & SERVICE DESCRIPTION 9

Web Services Architecture – Web services Architecture and its characteristics – core building blocks of web services – standards and technologies available for implementing web services – web services communication – basic steps of implementing web services –Describing Web Services – WSDL introduction – nonfunctional service description – WSDL1.1 vs. WSDL 2.0 – WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type – limitations of WSDL.

UNIT 4 SERVICE DISCOVERY & MESSAGING PATTERNS 9

Service discovery – UDDI–The Emergence of SOAP – Understanding SOAP Specifications – Anatomy of a SOAP Message – SOAP Encoding – SOAP Message Exchange Model – SOAP Communication – SOAP over HTTP – SOAP Message Exchange Patterns

UNIT 5 BUILDING SOA–BASED APPLICATION 9

Service Oriented Analysis and Design – Service Modeling – WS–BPEL – WS–Coordination – WS–Policy – WS–Security – SOA support in J2EE

Total : 45 Periods

TEXT BOOKS:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou, 2008.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley Publishing Inc., 2004.
3. Thomas Erl, "Service Oriented Architecture: Concepts,Technology,and Design", Pearson Education, 2005.

REFERENCES:

1. F.P. Coyle, "XML, Web Services, and the Data Revolution", Pearson Education.
2. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
3. S. Chatterjee, J. Webber, "Developing Enterprise Web Services", Pearson Education.

e–RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105167/," Cloud Computing XML Basics", Prof Soumya Kanti Ghosh, IIT – Kharagpur.
2. https://nptel.ac.in/courses/106/105/106105167/," Cloud Computing Web Services, Service oriented Architecture", Prof Soumya Kanti Ghosh, IIT – Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Describe how the XML and web service technologies stack used to define, locate, implement, and make Web services interact with each other.
CO2	Identify the evolution and emergence of Internet-enabled technologies that supports the SOA platforms.
CO3	Construct web service architecture using WSDL, SOAP and UDDI for business applications.
CO4	Identify the Service discovery function that allows agents to use each other's services and its exchanging mechanism.
CO5	Discuss the web service specification like WS-BPEL, WS-Coordination, WS-Policy, and WS-Security to build secure vs. interaction SOA based applications

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3	-	1	-	-	-	-	-	-	2	2
CO2	2	3	2	3	-	1	-	-	-	-	-	-	2	2
CO3	3	3	3	3	-	1	-	-	-	-	-	2	3	2
CO4	2	2	3	3	-	1	-	-	-	-	-	2	3	2
CO5	2	2	3	3	-	1	-	-	-	-	-	-	3	2

1 – Slight (Low), 2 – Moderate (Medium), 3 – Substantial (High).

22ITE23 CLOUD SERVICES MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble

This course enables the student to understand Cloud Service Management terminology, definition & concepts. Compare and contrast cloud service management with traditional IT service management. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems.

UNIT 1 CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

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

Case Study: Create a Cloud Organization in AWS/Google Cloud.

UNIT 2 CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, and Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

UNIT 3 CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

Case Study: Create alerts for usage of Cloud resources

UNIT 4 CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

Case Study: Create Billing alerts for your Cloud Organization.

UNIT 5 CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

Case Study: Compare Cloud cost for a simple web application across AWS, Azure and GCP.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105223/,"Google Cloud Computing Foundation Course",Prof. Soumya Kanti Ghosh, IIT Kharagpur.
2. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Demonstrate the Cloud Service Management terminology, definition & concepts.

CO2 Identifying the Cloud Strategy Fundamentals to reduce risk and eliminate issues associated with Cloud Service Architecture.

CO3 Explain about the Cloud Service Operations in Cloud Service Management.

CO4 Illustrate the Pricing models for Cloud Services.

CO5 Define the Cloud Governance by measuring the value of Cloud Services, to solve real world problems.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	1	1	-	-	-	2	1	3	2	2	2
CO2	3	1	2	3	2	-	-	-	1	2	3	1	2	2
CO3	1	1	3	1	3	-	-	-	3	3	1	1	2	2
CO4	1	1	1	2	3	-	-	-	2	3	3	1	2	2
CO5	1	3	3	2	2	-	-	-	1	3	1	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE24	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble:

This course aims to provide a sound knowledge and understand the need and various research methods used in design. To explore the various Tools used in UI & UX and creating a wireframe and prototype.

UNIT 1 FOUNDATIONS OF DESIGN **9**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy-case study: Hands on design thinking process for a new product.

UNIT 2 FOUNDATIONS OF UI DESIGN **9**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides- case study: Designing a responsive layout for an societal application.

UNIT 3 FOUNDATIONS OF UX DESIGN **9**

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

UNIT 4 WIREFRAMING, PROTOTYPING AND TESTING **9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT 5 RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE **9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture-case study: Create a sample pattern library for that product

Total : 45 Periods

TEXT BOOKS:

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022.
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021.

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’Reilly 2020.
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018.
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, Third Edition, 2015.

e-RESOURCES:

1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Describe the divergent and convergent, brainstorming & game storming, observational empathy techniques of design thinking process with a real time product.
CO2	Develop UI design for a given application using UI elements.
CO3	Develop UX design using tools and methodologies for the given business goals
CO4	Apply Wireframe to create UX design Prototype and test for usability.
CO5	Identify problem statements and research methods and explain the information architecture in UI and UX design.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	3	1	1	-	-	3	3	2	1	2	2
CO2	2	3	1	3	2	1	-	-	1	2	2	2	2	2
CO3	1	3	3	2	2	1	-	-	2	3	1	2	2	2
CO4	1	2	3	3	1	1	-	-	3	2	1	3	2	2
CO5	1	2	3	2	1	1	-	-	2	1	1	1	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE25	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The student must be able to gain a deeper understanding of test automation and the related technologies, focus on large testing domains, and comprehend a wide range of testing facets.

UNIT 1 FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing, Case Study: testing an e-commerce web/mobile application (www.amazon.in).

UNIT 2 TEST PLANNING 9

The Goal of Test Planning, High Level Expectations,Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics, Case Study: Test the e-commerce application and report the defects in it.

UNIT 3 TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle, Case Study: Develop the test plan and design the test cases for an inventory control system.

UNIT 4 ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications, Case Study: Test the performance of the e-commerce application.

UNIT 5 TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports, Case Study: Automate the testing of e-commerce applications using Selenium.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_cs91/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs81/preview

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the concepts of software testing and the need for software testing.
CO2	Design Test planning and different activities involved in test planning.
CO3	Design effective test cases that can uncover critical defects in the application.
CO4	Explain performance testing in a agile environment and test the performance of a e-commerce application..
CO5	Automate the software testing using Selenium and TestNG.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	1	2	1	-	-	1	1	3	2	2	3
CO2	2	3	1	1	1	1	-	-	2	2	1	2	2	3
CO3	2	2	1	3	1	1	-	-	1	3	1	2	3	2
CO4	2	1	3	2	1	1	-	-	1	1	1	2	1	2
CO5	2	2	1	3	1	1	-	-	1	3	2	1	1	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE26	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to understand the fundamentals of web application security and focus on wide aspects of secure development and deployment of web applications. This course makes the students to learn how to build secure APIs and learn the basics of vulnerability assessment and penetration testing. This course will enable the students to get an insight about Hacking techniques and Tools

UNIT 1 FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation. Case study: Study basic concepts of web application security

UNIT 2 SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM). Case study: Identify the vulnerabilities using OWASP ZAP tool.

UNIT 3 SECURE API DEVELOPMENT 9

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

UNIT 4 VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

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 Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT 5 HACKING TECHNIQUES AND TOOLS 9

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

Total : 45 Periods

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.

e-RESOURCES:

1. https://nptel.ac.in/courses/106106234/," NOC:Systems and Usable Security, Prof. Neminath Hubballi - IIT Indore.
2. https://nptel.ac.in/courses/106106146/,"NOC:Privacy and Security in Online Social Media, Prof. Ponnurangam Kumaraguru - IIIT Delhi.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify security threats and Vulnerability issues in web application.
CO2 Apply the security principles in developing a reliable web application.
CO3 Analyze the skill to design and develop Secure Web Applications that use Secure APIs.
CO4 Identify the importance of carrying out vulnerability assessment and penetration testing.
CO5 Interpret the skill to think like a hacker and to use hackers tool sets.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2	1	3	1	-	-	-	-	-	1	1	1
CO2	2	1	2	1	3	1	-	-	-	-	-	-	1	2
CO3	1	1	1	2	3	1	-	-	-	-	-	1	2	2
CO4	1	2	1	1	2	1	-	-	-	-	-	-	1	2
CO5	1	2	2	2	2	1	-	-	-	-	-	1	1	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE27	DEVOPS	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

This course discusses about DevOps terminology, different Version control tools, Integration/ Continuous Testing/ Continuous Deployment, Configuration management using Ansible, cloud-based Devops tools.

UNIT 1 INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github, case study: Create Maven Build pipeline in Azure.

UNIT 2 COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT 3 CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace, case study: Create CI pipeline using Jenkins.

UNIT 4 CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, case study: Create an Ansible playbook for a simple web application infrastructure.

UNIT 5 BUILDING DEVOPS PIPELINES USING AZURE 9

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

Total: 45 Periods

TEXT BOOKS:

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014.

REFERENCES:

1. Hands-On Azure Devops: 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 by Mitesh Soni.
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

e-RESOURCES:

1. https://www.jenkins.io/user-handbook.pdf
2. https://maven.apache.org/guides/getting-started/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the actions performed through Version control tools like Git.
CO2	Explain Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
CO3	Illustrate jenkins configuration to work with java,git and maven.
CO4	Demonstrate an ansible playbook for a simple web application infrastructure.
CO5	Determine the benefits and drive the adoption of cloud-based Devops tools to solve real world problems.

Mapping of COs with POs and PSOs

Cos/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	-	-	-	-	-	-	-	2	-
CO2	3	3	3	2	3	-	-	-	-	-	-	-	2	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-	2	-
CO4	3	3	3	2	3	-	-	-	-	-	-	-	2	-
CO5	3	3	3	2	3	-	-	-	-	-	-	-	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High), '-' - no correlation.

22ITE28	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

This course describes about the semantics of programming languages, data types, and basic statements, object-orientation, concurrency, and event handling and non-procedural programming paradigms.

UNIT 1 SYNTAX AND SEMANTICS 9

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

UNIT 2 DATA, DATA TYPES, AND BASIC STATEMENTS 9

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

UNIT 3 SUBPROGRAMS AND IMPLEMENTATIONS 9

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

UNIT 4 OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 9

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

UNIT 5 FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 9

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES

1. https://nptel.ac.in/courses/106102067 ,”Principles of Programming Languages, Prof. S. Arun Kumar V , IIT Delhi**”**
2. https://www.geeksforgeeks.org/introduction-of-programming-paradigms/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Examine the correctness of the grammar using parsing.
CO2	Analyze arithmetic expressions,type conversions,boolean expressions,assignment statements in programming languages..
CO3	Determine methods and functions for solving problems in programming languages.
CO4	Apply design and implementation concepts for object oriented programming.
CO5	Explain functional programming languages and Develop programs with Scheme, ML, and Prolog.

Mapping of COs with POs and PSOs

Cos/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	2	1	1	2	-	-	-	-	2	3	3
CO2	3	3	3	2	2	1	2	-	-	-	-	2	3	3
CO3	3	3	3	2	2	1	2	-	-	-	-	2	3	3
CO4	3	3	3	3	2	2	2	-	-	-	-	2	3	3
CO5	3	3	3	3	3	3	2	2	-	-	-	2	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High), '-' - no correlation.

22ITE32 **VIRTUALIZATION**

L	T	P	C
3	0	0	3

Pre-requisites : Computer Networks

Preamble

This course focus on cloud computing models for enabling ubiquitous, convenient, on demand access to a shared computing resources. It also enables the students to understand the benefits, risk and recommendations for cloud security implications from technical perspective. In addition to this, the course provides an understanding of pros and cons of different approaches to virtualization enabling students to gain research competence from industry.

UNIT 1 INTRODUCTION TO VIRTUALIZATION **9**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors – case study Shrink and extend virtual disk.

UNIT 2 SERVER AND DESKTOP VIRTUALIZATION **9**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization- Case study Desktop Virtualization using Chrome Remote Desktop.

UNIT 3 NETWORK VIRTUALIZATION **9**

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture-WAN Virtualization – Case study Create a VLAN in CISCO packet tracer.

UNIT 4 STORAGE VIRTUALIZATION **9**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID – Case study Create RAID 5 volume.

UNIT 5 VIRTUALIZATION TOOLS **9**

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study Install Guest OS on that VMWARE.

Total : 45 Periods

TEXT BOOKS:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

REFERENCES:

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

e-RESOURCES:

1. Cloud Computing, By Prof. Soumya Kanti Ghosh | IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc23_cs89
2. Distributed Systems,By Prof. Rajiv Misra | IIT Patna, https://onlinecourses.nptel.ac.in/noc23_cs72

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the technological aspects of Virtualization along with virtualization terminologies and the types of virtualization.
CO2	Apply virtualization concepts at server, client and desktop level using Chrome Remote Desktop
CO3	Describe the concept of network virtualization and apply the same to create a VLAN using CISCO packet tracer.
CO4	Explain storage virtualization with its types and apply memory virtualization to create RAID 5 volume.
CO5	Apply virtualization tools and create VMWare using Amazon AWS or IBM PowerVM and install guest OS.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	1	3	2	1	-	-	-	1	-	1	1	3
CO2	3	2	2	1	2	2	-	-	-	2	-	3	3	2
CO3	3	2	1	3	1	1	-	-	-	2	-	3	3	3
CO4	1	1	2	3	3	2	-	-	-	3	-	1	3	2
CO5	1	3	2	3	1	3	-	1	-	1	-	3	3	1

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE34	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

Pre-requisites : Database Management Systems

Preamble

The student must be able to understand the basic concepts of data warehouse architecture, OLAP technology, partitioning strategy and the roles of process manager & system manager.

UNIT 1 INTRODUCTION TO DATA WAREHOUSE 9

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse-Case Study: Design data ware house for real time applications.

UNIT 2 ETL AND OLAP TECHNOLOGY 9

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP-Case Study: Data exploration and integration with WEKA.

UNIT 3 META DATA, DATA MART AND PARTITION STRATEGY 9

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT 4 DIMENSIONAL MODELING AND SCHEMA 9

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Datawarehouse Tools - Case Study: Analyse the dimensional Modeling.

UNIT 5 SYSTEM & PROCESS MANAGERS 9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing- Case Study: Implementation of warehouse testing.

Total : 45 Periods

TEXT BOOKS:

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.

REFERENCES:

1. Paul Raj Ponniah, “Data warehousing fundamentals for IT Professionals”, 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

e-RESOURCES:

1. http://nptel.ac.in/courses/106106093/31, “Introduction to Data warehousing and OLAP”, Prof. Dr.S.Srinath, IIT-Madras.
2. https://www.coursera.org/professional-certificates/data-warehouse-engineering

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the architectural components and classification of a Data warehouse and demonstrate the design of data warehouse for a real time application.

CO2 Compare OLTP and OLAP operations and apply OLAP operations with its types for data exploration and integration using WEKA tool.

CO3 Discuss about metadata and the need for data mart in the design of data warehouse for a partitioning strategy.

CO4 Interpret the dimensions for modeling a data warehouse along with its schema for a given problem.

CO5 Outline the roles of process manager and system manager and test the same for a data warehouse.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2	1	-	-	-	-	-	3	2	3
CO2	3	2	2	2	2	1	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	2	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	1	-	-	-	-	-	3	3	3
CO5	3	2	2	2	-	2	-	-	-	-	-	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE35	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

Pre-requisites : Database Management Systems

Preamble:

The students can able to Characterize the functionalities of logical and physical components of storage, Describe various storage networking technologies, Identify different storage virtualization technologies, Discuss the different backup and recovery strategies, Understand common storage management activities and solutions

UNIT 1 STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT 2 INTELLIGENT STORAGE SYSTEMS AND RAID 5

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

UNIT 3 STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT 4 BACKUP, ARCHIVE AND REPLICATION 12

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

UNIT 5 SECURING STORAGE INFRASTRUCTURE 6

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

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. G. Somasundaram, Alok Shrivastava, Information Storage and Management, EMC Education Series, Wiley, Publishing Inc., 2011.

2. Gustavo Santana, Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond, Cisco Press; 1 edition, 2013

e-RESOURCES:

1. https:// https://www.sciencedirect.com/topics/computer-science/storage-technology
2. https://ecomputernotes.com/fundamental/input-output-and-memory/explain-secondary-storage-devices

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
CO2	Illustrate the usage of advanced intelligent storage systems and RAID
CO3	Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
CO4	Explain the different role in providing disaster recovery and remote replication technologies
CO5	Infer the security needs and security measures to be employed in information storage management

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	1	3	3	1	-	-	1	1	1	3	2	2
CO2	3	1	2	3	3	1	-	-	3	2	3	2	2	3
CO3	1	1	3	2	2	1	-	-	3	1	1	2	2	3
CO4	3	2	1	2	2	1	-	-	1	1	3	1	3	2
CO5	1	3	2	1	2	1	-	-	1	2	3	1	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE36	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

The main aim of this course is to make understand the need for SDN and its data plane operations, to understand the functions of control plane, to comprehend the migration of networking functions to SDN environment, to explore various techniques of network function virtualization and to comprehend the concepts behind network virtualization

UNIT 1 SDN: INTRODUCTION **9**

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane- Case Study: Virtualbox/Mininet Environment for SDN.

UNIT 2 SDN DATA PLANE AND CONTROL PLANE **9**

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers – Case Study: mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

UNIT 3 SDN APPLICATIONS **9**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking-Case Study: Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

UNIT 4 NETWORK FUNCTION VIRTUALIZATION **9**

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture-Case Study: end-to-end network service with two VNFs using vim-emu.

UNIT 5 NFV FUNCTIONALITY **9**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV –Case Study: Installing OSM and onboard and orchestrate network service.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017

e-RESOURCES:

1. https://www.kathara.org
2. http://mininet.org

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Describe the SDN architecture for Virtualbox/Mininet Environment using SDN Data plane, control plane and application plane.
CO2	Identify the functions of the data plane and control plane for SDN controller and use Wireshark to capture and visualize the OpenFlow messages.
CO3	Design and develop SDN applications with security measures for L2 learning switch, Traffic Engineering and Firewall.
CO4	Discuss the concepts of network virtualization for two VNFs using vim-emu.
CO5	Explain NFV infrastructure, management and orchestration for OSM compared with SDN.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	3	1	3	-	-	-	2	3	1	3	2	2
CO2	2	1	2	2	3	-	-	-	2	2	2	2	2	2
CO3	2	2	2	3	3	-	-	-	3	1	1	2	2	2
CO4	1	2	3	2	3	-	-	-	2	2	2	2	2	2
CO5	3	2	1	3	2	-	-	-	2	1	1	3	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE37	STREAM PROCESSING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

Introduce Data Processing terminology, definition & concepts. Define different types of Data Processing Explain the concepts of Real-time Data processing Select appropriate structures for designing and running real-time data services in a business environment Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT 1 FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges. Case Study : Design and Implement Simple application using MongoDB.

UNIT 2 REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing,Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage.

UNIT 3 DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL – Case Study : Query the designed system using MongoDB.

UNIT 4 EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API - Case Study : Create a Event Stream with Apache Kafka.

UNIT 5 REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication - Case Study : Create a Real-time Stream processing application using Spark Streaming

Total : 45 Periods

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCES:

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

e-RESOURCES:

1. https://nptel.ac.in/courses/106105174
2. https://nptel.ac.in/courses/106105175

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the applicability and utility of streaming algorithms.
CO2 Describe and apply current research trends in data-stream processing.
CO3 Analyze the suitability of stream mining algorithms for data stream systems.
CO4 Program and build stream processing systems, services and applications.
CO5 Solve problems in real-world applications that process data streams.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	1	-	-	-	2	3	1	2	1	3
CO2	2	1	1	2	2	-	-	-	3	2	2	3	1	2
CO3	3	1	2	3	3	-	-	-	2	2	1	1	2	2
CO4	2	1	3	3	3	-	-	-	3	3	1	1	1	2
CO5	3	3	1	2	2	-	-	-	3	3	2	3	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE38	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

This course is aimed at enabling the students to understand the cloud computing terminology, definition, security design and architectural consideration for cloud. It grooms the students to understand the identity access control mechanism and enable them to monitor and audit cloud application for security. It imparts students to follow the best practice for cloud security using various security design patterns.

UNIT 1 FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures. Case Study: Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm present in Cloud Sim

UNIT 2 SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key. Case Study: Implement symmetric key based encryption algorithm to protect the messages on communication.

UNIT 3 ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention. Case Study :Simulate a secure file sharing using a Cloud Sim.

UNIT 4 CLOUD SECURITY DESIGN PATTERN 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT 5 MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management. Case Study: Simulate log forensics using Cloud Sim.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://www.geeksforgeeks.org/cloud-computing-simulation-using-cloudsim/
2. https://www.youtube.com/watch?v=44IBhZwa4ZM

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify the essential security services to be applied in cloud environments.

CO2 Explain the security challenges faced in cloud architecture for different strategies.

CO3 Illustrate the policy grants permitted and procedure available to identify and verify the access mechanisms in cloud.

CO4 Explain the Secure design patterns that eliminate the accidental insertion of vulnerabilities into code and to mitigate the consequences of these vulnerabilities in the cloud.

CO5 Interpret the compliance program's detection mechanisms like auditing and monitoring in finding risks that have been escalated or in detecting new risks.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	1	2	-	-	-	1	1	1	3	3	1
CO2	1	3	2	3	1	-	-	-	2	2	3	2	3	1
CO3	3	2	2	3	2	-	-	-	3	1	1	2	2	3
CO4	2	1	2	3	3	-	-	-	3	2	3	3	1	1
CO5	1	3	3	1	1	-	-	-	2	3	3	2	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE41	ESSENTIALS OF ETHICAL HACKING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble:

This course aims to explore the concepts of knowledge required to protect against the hacker for the information in a system, web service and wireless networks. Students are able to understand the issues relating to ethical hacking and to employ network defense measures for the information security.

UNIT 1 INTRODUCTION TO HACKING 9

Introduction to Hacking – Penetration Test – Vulnerability Assessments versus Penetration Test – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories and Types of Penetration Tests – Vulnerability Assessment Reports. Case study : Use security tools in Kali Linux to assess the vulnerabilities.

UNIT 2 INFORMATION GATHERING AND SCANNING 9

Information Gathering Techniques – Active and Passive Information Gathering –Traceroute – ICMP Traceroute – TCP Traceroute – UDP Traceroute – Enumerating and Fingerprinting the Web servers – DNS, SNMP, SMTP Enumeration – Target Enumeration and Port Scanning Techniques. Case Study: Understand the network protocols and port scanning techniques using Kali Linux.

UNIT 3 NETWORK ATTACKS 9

Vulnerability Data Resources – Network Sniffing – Types of Sniffing – MITM Attacks – ARP Attacks – Denial of Service Attacks –DNS Spoofing – ARP Spoofing Attack – DHCP Spoofing – Remote Exploitation –Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication. Case study: Demonstrating the MITM attack using ARP Poisoning using Kali Linux.

UNIT 4 EXPLOITATION 9

Introduction to Metasploit – Reconnaissance, Port Scanning with Metasploit – E–Mails with Malicious Attachments – Browser Exploitation – Post–Exploitation – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper. Case studies: Understand the Metasploit and Exploitations.

UNIT 5 WIRELESS AND WEB HACKING 9

Wireless Hacking – Aircrack– Cracking the WEP – Evil Twin Attack – Web Hacking – Brute Force and Dictionary Attacks – Types of Authentication – Captcha Validation Flaw – Captcha RESET Flaw – Authentication Bypass Attacks – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) – CSRF – SSRF Attacks.

Total : 45 Periods

TEXT BOOKS:

1. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2017.
2. Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.

REFERENCES:

1. Jon Erickson , “Hacking: The Art of Exploitation”, Second Edition, Rogunix, 2008.
2. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, 1 st Edition, 2014.
3. DafyddStuttard, Marcus Pinto,“The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws”, 2nd Edition, 2011.

e-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105217/, “Ethical Hacking”, Prof. Indranil Sengupta, IIT Kharagpur.
2. https://www.edureka.co/blog/ethical-hacking-tutorial/, “Introduction to Cyber security and Ethical Hacking”.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Discuss the vulnerabilities across any computing system using penetration testing.

CO2 Explain the Foot printing, scanning and Enumeration method of reconnaissance about the target systems in a network.

CO3 Analyze active and passive sniffing, DNS, ARP, DHCP spoofing techniques in the network systems.

CO4 Analyze the Metasploit, Browser and post Exploitations for hacking the information from a system.

CO5 Identify vulnerabilities/threats/attacks in system, wireless and web services.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	3	1	1	-	3	-	1	-	-	2	2
CO2	2	2	1	3	-	1	-	3	-	1	-	-	2	2
CO3	2	2	1	3	1	1	-	3	-	-	-	-	2	2
CO4	2	2	1	3	1	1	-	3	-	-	-	-	2	2
CO5	2	2	1	3	-	1	-	3	-	-	-	-	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE42	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

This course aims to explore basics of digital forensics and techniques and understanding digital crime and investigation, digital forensic readiness, use of forensics tools for iOS devices and use of forensics tools for Android devices.

UNIT 1 INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase. Case Study: Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.

UNIT 2 DIGITAL CRIME AND INVESTIGATION 9

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

UNIT 3 DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT 4 iOS FORENSICS 9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud. Case Study**:** Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups. Process and parse records from the iOS system.

UNIT 5 ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling. Case Study: Extract installed applications from Android devices. Extract diagnostic information from Android devices through the adb protocol. 8. Generate a unified chronological timeline of extracted records,

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

e-RESOURCES:

1. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section---references
2. https://uou.ac.in/sites/default/files/slm/MIT(CS)-202.pdf

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain about the concepts of digital forensics and techniques.

CO2 Discuss digital crime with offense for investigation strategies.

CO3 Identify the Frameworks, Standards and Methodologies for digital forensics.

CO4 Summarize the iOS Fundamentals to process and parse records from the iOS system.

CO5 Illustrate the android basics to identify and extract digital evidence from Android devices.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	2	1	1	-	2	1	1	3	3	2	2
CO2	3	3	3	3	3	1	-	2	2	2	1	2	2	2
CO3	3	3	2	3	1	1	-	2	3	2	1	1	2	2
CO4	3	1	2	2	3	1	-	2	1	3	3	2	2	2
CO5	1	3	2	3	2	1	-	2	2	3	2	3	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE43	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites : Computer Networks

Preamble

The main aim of this course is to understand the concepts of Social Networks with respect to the Privacy and Security issues in Social Networking. This course makes the students to develop semantic web related simple applications and discuss the prediction of human behavior in social communities. This course will enable the students to describe the Access Control, Privacy and Security management of social networks

UNIT 1 FUNDAMENTALS OF SOCIAL NETWORKING 9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security. case study: Develop semantic web related simple applications.

UNIT 2 SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networkedworld. case study: Investigate Address Privacy and Security issues in Social Networking

UNIT 3 EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

UNIT 4 PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties. case study: the prediction of human behavior in social communities.

UNIT 5 ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

Total : 45 Periods

TEXT BOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.

e-RESOURCES:

1. https://nptel.ac.in/courses/106106239/, "Social Network analysis", Prof. Tanmoy Chakraborty, IIT –Delhi.
2. https://nptel.ac.in/courses/106106169/, "Social Networks: The challenge", Prof. Sudharshan Iyengar, IIT –Ropar.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain semantic web related applications using Social Network Analysis.
CO2 Identify the Address Privacy and Security issues in Social Networking.
CO3 Illustrate the methods and tools to detecting communities of social networks.
CO4 Explain the human behavior and privacy issues in social network communities.
CO5 Demonstrate the access control ,authentication, and authorization techniques in Social Network.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	3	2	-	-	-	3	2	1	2	3	3
CO2	2	2	2	3	3	-	-	-	1	2	2	3	3	3
CO3	2	1	1	3	2	-	-	-	1	2	1	1	1	3
CO4	3	3	3	3	2	-	-	-	1	1	1	1	2	1
CO5	1	3	2	2	2	-	-	-	1	1	3	1	2	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE44	CYBER SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

Cyber security is the practice of protecting electronic information by mitigating information risks and vulnerabilities. Information risks can include unauthorized access, use, disclosure, interception, or data destruction.

UNIT 1 INTRODUCTION **9**

Introduction to Cyber Security and Cybercrime: Definition - Cybercrime and Information Security- Cybercriminals- Classifications of Cybercrimes- Cybercrime: The Legal Perspectives- Cybercrimes: An Indian Perspective - Cybercrime and the Indian ITA 2000- A Global Perspective on Cybercrimes.

UNIT 2 CYBER OFFENCES **9**

Types of Attacks - Social Engineering- Cyberstalking- Cyber cafe and Cybercrimes, Botnets- Attack Vector-Cloud Computing. Introduction, Proliferation of Mobile and Wireless Devices- Trends in Mobility - Credit Card Frauds in Mobile and Wireless Computing Era- Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices- Authentication Service Security- Attacks on Mobile/Cell Phones.

UNIT 3 TOOLS **9**

Proxy servers and Anonymizers-Phishing-Password cracking-Keyloggers and Spywares-Virus and Worms-Trojan Horses and Backdoors- Steganography- DoS and DDoS attacks-SQL Injection-Buffer Overflow-Attacks on wireless networks- Case study: Brute-force attacks on the Linux server using Hydra.

UNIT 4 INTRUSION DETECTION **9**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort. Case study: Real-time network traffic analysis and data pocket logging using Snort.

UNIT 5 INTRUSION PREVENTION **9**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

Total : 45 Periods

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011 (Unit 1,2 and 3).
2. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015 (Units 4 and 5)

REFERENCES:

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011.

e-RESOURCES:

1. https://owasp.org/www-project-top-ten/
2. https://nptel.ac.in/courses/106105031,” Cryptography and Network Security”, Dr. Debdeep Mukhopadhyay, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the basics of cyber security, cyber crime and cyber law and legal perspectives based on Indian ITA 2000.
CO2 Classify the attacks in wired and wireless computing.
CO3 Apply tools to launch the attacks in networks.
CO4 Explain intrusion techniques to detect intrusion using snort.
CO5 Apply intrusion prevention techniques to prevent intrusion using firewalls.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	1	-	1	-	-	-	-	1	-	2	2
CO2	1	3	1	3	2	1	-	-	-	-	-	-	2	2
CO3	2	1	1	1	-	1	-	-	-	-	1	-	2	2
CO4	3	3	2	2	2	1	-	-	-	-	-	-	2	2
CO5	3	2	1	1	1	1	-	1	-	-	1	-	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE45 ENGINEERING SECURE SOFTWARE SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble

The course covers the importance and need for software security. Students can learn about various software attacks. This course intends to learn about secure software design and to understand the risk management in secure software development. The students can classify the working of tools related to software security.

UNIT 1 NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks – Case study: Implement the SQL injection attack

UNIT 2 SECURE SOFTWARE DESIGN 9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles– Case study: Implement the Buffer Overflow attack

UNIT 3 SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management- Case Study: eBay Risk Management System with Progress Corticon

UNIT 4 SECURITY TESTING 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing - Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection
- Tools for Penetration Testing - Case Study: Penetration test using kali Linux

UNIT 5 SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice - Case study: Facebook Data breach 2021

Total : 45 Periods

TEXT BOOKS:

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006

REFERENCES:

1. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005
2. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs30/preview
2. https://www.softwaretestinghelp.com/penetration-testing-guide/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Classify stack based and Heap based Low-Level Memory attacks outlining the software assurance and security.

CO2 Explain the security principles using SQUARE process Model and Threat model in software development.

CO3 Discuss the Risk management processes with risk mitigation, evaluation and assessment and identify the extent of risk.

CO4 Identify Penetration testing techniques related to software security in the testing phase of software development.

CO5 Explain the security frameworks to assess their capability maturity state and to address the procedural, technical and human aspects of information security governance and management process.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	-	2	1	1	2	1	-	2	2	2
CO2	2	2	2	3	-	2	1	1	2	1	-	2	2	2
CO3	1	2	2	2	-	2	1	1	1	1	-	1	2	2
CO4	2	3	-	2	-	2	1	1	2	1	-	2	2	2
CO5	2	1	-	2	-	2	1	1	2	1	-	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE46 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble:

This course answers how Block chain and Crypto currency works and the difference between them and address the security issues, anonymous nature of their users and price determination.

UNIT 1 INTRODUCTION TO BLOCKCHAIN **9**

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

Case Study: Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules

UNIT 2 BITCOIN AND CRYPTOCURRENCY **9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT 3 BITCOIN CONSENSUS **9**

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.

Case Study: Smart Switch Dapp

UNIT 4 HYPERLEDGER FABRIC & ETHEREUM **9**

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

UNIT 5 BLOCKCHAIN APPLICATIONS **9**

Smart contracts, Truffle Desig and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc.

Case Study: 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.

Total : 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Treccani, A., Lipton, A. Blockchain and Distributed Ledgers: Mathematics, Technology, and Economics – First Edition, Singapore Word Scientific Publishing company.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016

e-RESOURCES:

1. Ethereum Development Resources - https://ethereum.org/en/developers
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analyze the functionalist's of cryptographic techniques used in Blockchain technology.

CO2 Analyze the challenges and technical aspects of crypto currency for the operations of Bitcoin network and its underlying technology.

CO3 Examine the techniques needed to verify the proof of work and mine the Bitcoins with models and use cases.

CO4 Use hyperledger Fabric and Ethereum platform to implement the Block chain Application.

CO5 Examine the role of Blockchain in ensuring the security of distributed ledgers and their contents.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	1	1	-	-	1	-	-	2	3	3
CO2	3	3	2	3	1	1	-	-	2	-	-	2	3	3
CO3	3	3	2	3	2	1	-	-	3	-	-	2	3	3
CO4	3	3	2	2	3	1	-	-	3	-	-	2	3	2
CO5	3	2	2	3	3	1	-	-	2	-	-	2	3	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE47	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

To focus on how cryptographic algorithms and protocols work and how to use them, To build a Pseudorandom permutation, To construct Basic cryptanalytic techniques, To provide instruction on how to use the concepts of block ciphers and message authentication codes.

UNIT 1 INTRODUCTION 9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT 2 FORMAL NOTIONS OF ATTACKS 9

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Inter-relations among the attack model

UNIT 3 RANDOM ORACLES 9

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)- Case Study : Schnorr identification protocol.

UNIT 4 BUILDING A PSEUDORANDOM PERMUTATION 9

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT 5 MESSAGE AUTHENTICATION CODES 9

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols - Case Study : Authentication trees and one-time signatures.

Total : 45 Periods

TEXT BOOKS:

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)

REFERENCES:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3. William Stallings, “Cryptography and Network Security: Principles and Practice”, PHI 3rd Edition, 2006.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs16/preview
2. https://cse.iitpkd.ac.in/courses/cs5613-Cryptography/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Interpret the basic principles of cryptography and general cryptanalysis
CO2	Determine the concepts of symmetric encryption and authentication.
CO3	Identify the use of public key encryption, digital signatures, and key establishment.
CO4	Demonstrate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
CO5	Discuss the use of Message Authentication Codes using Cryptographic Protocols.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	1	-	-	-	2	1	1	2	1	1
CO2	1	3	2	1	2	-	-	-	3	2	2	2	1	3
CO3	1	1	2	3	2	-	-	-	1	1	1	3	1	3
CO4	3	1	2	1	3	-	-	-	3	2	1	2	2	1
CO5	2	3	3	3	3	-	-	-	3	1	1	1	1	1

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE51	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble:

This course is designed to give historical and modern overviews and perspectives on augmented reality and virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of augmented reality and virtual reality systems.

UNIT 1 INTRODUCTION TO AUGMENTED REALITY(AR) 9

History of AR - Augmented reality characteristics – Difference between Augmented Reality and Virtual Reality – AR technological components – Technologies used in AR – Feature Extraction – Hardware components – AR devices – Importance of AR - Real world uses of AR – AR types – Software tools available for AR.

UNIT 2 TECHNOLOGIES NEEDED FOR AUGMENTED REALITY 9

Hardware technology – virtual scenes – 3D objects – AR components – Display – HMD – Eyeglasses – Contact Lenses – significance of AR – AR powered devices – AR application development drawbacks – Compatibility – Performance – AR libraries – Motion tracking – Environmental understanding – Anchors.

UNIT 3 INTRODUCTION TO VIRTUAL REALITY(VR) 9

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

UNIT 4 VR MODELING 9

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

UNIT 5 AUGMENTED REALITY AND VIRTUAL REALITY FOR MICRO LEARNING 9

Micro learning techniques – Utilizing VR for learning – VR for Practical online assessment – VR info graphics – Virtual case considerations - Utilizing AR for learning – Accessible learning – sensible data – elevated learner engagement - VR technology – Components of VR – VR Hardware – VR applications – Civil Engineering – Real Estate – Biology and Medicine – Virtual Mall – VR in Education – Virtual Laboratory – Factory Planning – Automobile Industry.

Total : 45 Periods

TEXT BOOKS:

1. Kaliraj, P., Devi, T. “Innovating with Augmented Reality: Applications in Education and Industry” (P. Kaliraj, Ed.) (1st ed.). CRC Press (2021). Taylor & Francis Group
2. Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2023.
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004

REFERENCES:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
2. Schmalstieg / Hollerer,- “Augmented Reality: Principles & Practice” - Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494

e-RESOURCES:

1. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
2. http://lavalle.pl/vr/book.html
3. https://www.coursera.org/learn/introduction-virtual-reality
4. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013311562184949760563 5_shared/overview
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013608833457627136 6/overview

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the types and choose appropriate tool for designing augmented reality based applications
CO2 Analyze the hardware requirement of AR and explain the use of computer vision concepts for designing AR.
CO3 Describe the working of VR systems and explain the human vision and its implications.
CO4 Categorize and explain different models in VR modeling and choose appropriate modeling technique for a given problem.
CO5 Design and Explain a solution for a given scenario using AR-VR components and micro learning tools.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	1	-	-	-	-	1	1	2	2
CO2	3	3	2	2	2	1	-	-	-	-	1	2	2	2
CO3	3	3	2	2	2	1	-	-	-	-	1	1	2	2
CO4	3	3	2	2	2	1	2	-	-	-	1	2	3	3
CO5	3	3	2	2	2	1	2	-	-	-	1	2	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE52	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to expose the concepts of Multimedia is the major source of information in today's era. Audio, video and image signals require vast amount of data for its representation and storage. This course enables the learner to study the various representations of multimedia such as text, audio, image and video.

UNIT 1 INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning. Case study: Install tools like GIMP.

UNIT 2 MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.
Case study: Install tools like OpenShot.

UNIT 3 MULTIMEDIA AUTHORING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations. Case Study: KompoZer, Aptana Studio.

UNIT 4 ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality. Case study: Origami studio, Lottie.

UNIT 5 MULTIMEDIA APPLICATIONS 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

Total : 45 Periods

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018
3. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021
4. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packet Publishing, 2022

e-RESOURCES:

1. https://itsfoss.com
2. https://www.ucl.ac.uk/slade/know/3396
3. https://opensource.com/article/18/2/open-source-audio-visual-production-tools https://camstudio.org/
4. https://developer.android.com/training/animation/overview (UNIT-IV)
5. https://handbrake.fr

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Classify the bigger picture of the context of Multimedia and its applications
CO2	List the different types of media elements of different formats on content pages
CO3	Outline 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4	Classify different standard animation techniques for 2D, 21/2 D, 3D applications
CO5	Explain the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	3	-	-	-	3	2	1	2	3	2
CO2	3	3	3	3	3	-	-	-	3	3	2	2	3	2
CO3	3	3	3	3	3	-	-	-	3	3	2	3	3	2
CO4	3	3	3	3	3	2	-	-	3	3	3	3	3	3
CO5	3	3	3	3	3	2	-	-	3	3	3	3	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE53	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The student must be able to understand the basic concepts of broad perspective of linear and nonlinear editing, Storytelling styles, audio - video recording and AVID XPRESS DV 4.

UNIT 1 FUNDAMENTALS **9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing- Case Study: Write a Movie Synopsis (Individual/Team Writing)

UNIT 2 STORY TELLING **9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - project files - media management - Case Study: Present team stories in class.

UNIT 3 USING AUDIO AND VIDEO **9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs – Case Study: Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements.

UNIT 4 WORKING WITH FINAL CUT PRO **9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences – Case Study: Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching.

UNIT 5 WORKING WITH AVID XPRESS DV 4 **9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options – Case Study: Post-production: Editing, Sound design, Finishing.

Total : 45 Periods

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, “Digital Video for Dummies”, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, “Editing Digital Video: The Complete Creative and Technical Guide”, Digital Video and Audio, McGraw – Hill 2003.

REFERENCES:

1. Roy Thompson Christopher J. Bowen, “Grammar of the Edit”, Second Edition, 2009, Elsevier Inc.
2. Aaron Goold, “The Video Editing Handbook: For Beginners”, John Goold, 2021.

e-RESOURCES:

1. https://courseware.cutm.ac.in/courses/certificate-in-video-editing/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compare the strengths and limitations of Linear and Nonlinear editing in a digital video.

CO2 Analyze storytelling styles with jump cut, match-cut, l-cut, cutaways, dissolves, split edits in NLE system and mechanics of digital editing using media management process.

CO3 Describe the methods for capturing analog and digital video and techniques to convert tape recording to CDs and VCDs using Movavi video converter software.

CO4 Create a video project to edit a video sequences which involves timeline, testing effects and audio using final cut Pro software.

CO5 Develop and execute a comprehensive post-production workflow, including editing, sound design, and finishing processes for a given project using AVID XPRESS DV4.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	1	1	-	-	-	1	2	-	2	2	3
CO2	2	3	3	3	1	-	-	-	1	2	-	1	3	3
CO3	2	2	3	3	1	-	-	-	3	1	-	1	3	2
CO4	2	2	2	2	1	-	-	-	3	1	-	1	3	3
CO5	2	1	3	3	1	-	-	-	3	2	-	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE55	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

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

UNIT 1 INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing. Case study: Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aid with the branding of the company and how it aids its potential customer segments.

UNIT 2 SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT 3 E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting. Case study: Discuss regarding how an insurance company manages leads.

UNIT 4 SOCIAL MEDIA MARKETING 9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing. Case study: Discuss negative and positive impacts and ethical implications of using social media for political advertising.

UNIT 5 DIGITAL TRANSFORMATION 9

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

Total : 45 Periods

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.

REFERENCES:

1. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited
2. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning

e-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview
2. www.shiksha.com/online-courses/basics-of-digital-marketing-by-nptel-course-nptel43

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Examine and explore the role and importance of digital marketing in today's rapidly changing business environment
CO2	Explain how digital marketing can be utilized by organizations and how its effectiveness can be measured
CO3	Explain the key elements of a digital marketing strategy
CO4	Study how the effectiveness of a digital marketing campaign can be measured
CO5	Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	1	3	-	-	-	1	2	3	3	3	3
CO2	2	2	2	1	3	-	-	-	1	2	3	3	3	3
CO3	1	1	1	2	2	-	-	-	1	2	1	1	3	2
CO4	3	2	2	3	1	-	-	-	1	3	2	3	2	3
CO5	2	3	1	3	3	-	-	-	2	3	1	2	1	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE56	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main of this course to get a basic idea on animation principles and techniques. To get exposure to CGI, color and light elements of VFX. To have a better understanding of basic special effects techniques. To have a knowledge of state of the art vfx techniques. To become familiar with popular compositing techniques.

UNIT 1 ANIMATION BASICS **9**

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT 2 CGI, COLOR, LIGHT **9**

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model.Case Study: Using Natron, work with color and color grading..

UNIT 3 SPECIAL EFFECTS **9**

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire. Case Study: Using Natron, work with merging of images.

UNIT 4 VISUAL EFFECTS TECHNIQUES **9**

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving. .Case Study: Using Natron, work with Rotopaint.

UNIT 5 COMPOSITING **9**

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP. Case Study: Using Natron, work with stereoscopic composting

Total : 45 Periods

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.

REFERENCES:

1. Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.

e-RESOURCES:

1. https://www.blender.org/features/vfx/
2. https://natrongithub.github.io/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Implement animation in 2D / 3D following the principles and techniques
CO2 Use CGI, color and light elements in VFX applications
CO3 Create special effects using any of the state of the art tools
CO4 Apply popular visual effects techniques using advanced tools
CO5 Use compositing tools for creating VFX for a variety of applications

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	1	-	-	-	1	2	1	1	2	-
CO2	1	3	3	2	1	-	-	-	3	2	2	2	2	-
CO3	2	3	3	2	1	-	-	-	1	2	1	2	2	-
CO4	3	3	2	2	3	-	-	-	3	3	2	2	2	-
CO5	1	2	1	1	2	-	-	-	1	3	2	3	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE57	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

The main aim of this course to know the basics of 2D and 3D graphics for game development, to know the stages of game development, to understand the basics of a game engine, to survey the gaming development environment and tool kits and to learn and develop simple games using Pygame environment.

UNIT 1 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 - Case Study: Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

UNIT 2 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– Case Study: Character design, sprites, movement and character control, Level design: design of the world in the form of tiles along with interactive and collectible objects.

UNIT 3 GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding-Case Study: Design of interaction between the player and the world, optionally using the physics engine.

UNIT 4 OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games-Case Study: Developing a 2D interactive using Pygame, Developing a Puzzle game, Design of menus and user interaction in mobile platforms.

UNIT 5 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.– Case Study: Developing a 3D Game using Unreal, Developing a Multiplayer game using unity

Total : 45 Periods

TEXT BOOKS:

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison Wesley, 2013.
2. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress, 2007.

REFERENCES:

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

e-RESOURCES:

1. https://freecomputerbooks.com/compscGameProgrammingBooks.html
2. https://unity.com/learn

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of 2D and 3d Graphics and conceptualize the theme for a 2D game using color models and animation,.

CO2 Discuss the principles involved in game design applying character design and control for an application.

CO3 Design an interaction between the player and the world, using the physics engine with rendering concepts and algorithms. .

CO4 Discuss gaming environments and frameworks and design a puzzle game with user interactions in mobile platforms..

CO5 Develop 2D and 3D interactive games in Pygame using unity and unreal.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	2	-	-	-	-	-	-	-	2	2
CO2	1	2	2	1	2	-	-	-	-	-	-	-	2	2
CO3	1	1	1	2	1	-	-	-	-	-	-	-	2	2
CO4	3	3	1	3	3	-	-	-	-	-	-	-	2	2
CO5	3	3	2	1	3	-	-	-	-	-	-	-	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE58 MULTIMEDIA DATA COMPRESSION AND STORAGE

L	T	P	C
3	0	0	3

Pre-requisites :-

Preamble

To understand text, image, and video compression techniques with compression algorithms and consistency of data availability in storage devices and the concepts of data streaming services.

UNIT 1 BASICS OF DATA COMPRESSION **9**

Introduction —Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic codingDictionary techniques- Context based compression – Applications – Case Study: Construct Huffman codes for given symbol probabilities

UNIT 2 IMAGE COMPRESSION **9**

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding – Case Study: Write a shell script, which converts all images in the current directory in JPEG.

UNIT 3 VIDEO COMPRESSION **9**

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263 - Case Study: Write a program to split images from a video without using any primitives.

UNIT 4 DATA PLACEMENT ON DISKS **9**

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system - Case Study: Write the code for identifying the popularity of content retrieval from media server

UNIT 5 DISK SCHEDULING METHODS **9**

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams - Case Study: Program for scheduling requests for data streams

Total : 45 Periods

TEXT BOOKS:

1. Khalid Sayood, “Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems”, 2018, 5th Edition.
2. Philip K.C.Tse, “Multimedia Information Storage and Retrieval: Techniques and Technologies”, 2008

REFERENCES:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, “Best’s Guide to Live Stream Video Broadcasting”, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, “Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards”, Taylor& Francis,2019
4. Irina Bocharova, “Compression for Multimedia”, Cambridge University Press; 1st edition, 2009

e-RESOURCES:

1. Audio and Video Compression - https://www.youtube.com/watch?v=rC16fhvXZOo&ab_channel=nptelhrd
2. Basic Image Compression techniques and different image file formats - https://www.youtube.com /watch?v=4-AsEtIpEWg&ab_channel=IITRoorkeeJuly2018.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Examine lossless and lossy compression techniques for text, image, and video compression

CO2 Identify the efficiency of lossless image compression such as JPEG and CALIC with their application in streamlined context and facsimile encoding

CO3 Explore the applications of various compression techniques used in motion pictures

CO4 Identify the best data placement techniques on disks and gain knowledge in hierarchical storage systems.

CO5 Apply and optimize the scheduling methods for disk requests, considering feasibility conditions of concurrent streams.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	2
CO2	3	2	2	1	2	-	-	-	-	-	-	-	2	2
CO3	3	2	2	1	2	-	-	-	-	-	-	-	2	2
CO4	3	2	2	1	1	-	-	-	-	-	-	-	2	2
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE61	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisites: -

Preamble

The Student must be able to understand the basics of Knowledge Engineering, methodologies and modeling for Agent Design and Development ,ontologies and also learn about rule learning.

UNIT 1 REASONING UNDER UNCERTAINTY 9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – case study: Perform operations on Probability Based Reasoning. – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT 2 METHODOLOGY AND MODELING 9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment –case study: Perform Believability Analysis – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT 3 ONTOLOGIES – DESIGN AND DEVELOPMENT 9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT 4 REASONIING WITH ONTOLOGIES AND RULES 9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – case study : Construction of Ontology for a given domain – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT 5 LEARNING AND RULE LEARNING 9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – case study: Implement Rule Learning and refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

Total: 45 Periods

TEXT BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. King, Knowledge Management and Organizational Learning, Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.

e-RESOURCES:

1. https://nptel.ac.in/courses/106106140, "Knowledge Representation and Reasoning**,** Prof. Deepak Khemani IIT Madras"**.**
2. https://nptel.ac.in/courses/106106139, "Introduction to Machine Learning, Dr. Balaraman Ravindran, IIT Madras**".**

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Identify and describe knowledge Engineering and their roles in probability based reasoning operations .
CO2	Apply methodologies and modeling for Agent Design and Development.
CO3	Experiment with ontology development based Concepts as Feature values.
CO4	Explain reasoning with ontologies and rules in Knowledge Engineering
CO5	Utilize Generalization and Specialization Rules for solving a given problem.

Mapping of COs with POs and PSOs

Cos/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	1	1	1	1	-	-	1	2	1	2	1	-
CO2	3	2	3	2	2	-	-	-	2	1	2	1	2	-
CO3	2	2	3	2	3	-	-	-	3	2	2	2	2	-
CO4	2	2	3	1	1	-	-	-	2	2	2	2	2	-
CO5	2	2	2	1	1	-	-	-	2	1	1	1	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High), '-' - no correlation.

22ITE62	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisites :-

Preamble

The concepts of fuzzy sets, fuzzy logic, and the use of heuristics based on human experience are the main topics of this course. It also offers the mathematical foundation needed to implement optimization related to neural network learning and to learn different evolutionary algorithms. Students gain knowledge of neural networks that can generalize from specific examples to provide suitable rules for inference systems.

UNIT 1 INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT 2 NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Back propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks. Case Study : Illustrate the neural network architecture for AI applications

UNIT 3 GENETIC ALGORITHMS 9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function. Case Study : Functionality of Genetic Algorithms in Optimization problems

UNIT 4 NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability. Case Study : Applications of Neuro fuzzy systems

UNIT 5 APPLICATIONS 9

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction. Case Study : Illustrate the intelligent behavior of programs based on soft computing

Total : 45 Periods

TEXT BOOKS:

1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

REFERENCES:

1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018
2. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
3. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.

e-RESOURCES:

1. https://nptel.ac.in/courses/106105173
2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html

Course Outcomes: Upon completion of this course, students will be able to

CO1	Explain the basic principles for fuzzy logic operators and inference mechanisms in Soft computing
CO2	Discuss the Supervised and Unsupervised Learning network architecture for AI applications in Neural Networks.
CO3	Analyze the functionality of Genetic Algorithms in Optimization problems
CO4	Analyze the Adaptive Learning Capability of Neural networks and Fuzzy logic using hybrid techniques.
CO5	Apply the soft computing techniques to illustrate the intelligent behavior of real world problems

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	3	3	-	-	-	3	1	3	2	2	2
CO2	2	3	3	2	3	-	-	-	3	2	3	2	2	2
CO3	1	3	2	2	1	-	-	-	3	1	1	2	2	2
CO4	1	2	1	3	2	-	-	-	3	3	1	1	2	2
CO5	2	3	1	2	1	-	-	-	3	3	3	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE65	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The course provides the foundation on Natural Language Processing concepts. Staring from words as the unit of a language, this course deals with statistical models, word embeddings and sequence modeling using advanced neural architectures. It also illustrates some practical NLP systems like Machine translation, Question Answering systems and chatbots.

UNIT 1 WORDS AND THEIR STATISTICAL MODELS 9

Regular Expressions – Words – Corpora – Text normalization – Minimum edit distance. N-Gram Language Models – N-Grams – Evaluating Language Models – Generalizations and zeros – Smoothing – Kneser-Ney Smoothing – Huge Language Models – Backoff – Perplexity vs. Entropy. Naive-Bayes classifiers –Naive-Bayes as Language Model – Evaluation – Test set and cross validation – Statistical significance testing.

UNIT 2 VECTORS AND EMBEDDINGS 9

Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors– point wise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Word2Vec – Visualizing embeddings – Bias and Embeddings – Evaluating vector models. Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models.

UNIT 3 SEQUENCE LABELING AND DEEP LEARNING ARCHITECTURES 9

English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition. Deep Learning Architectures for sequence modeling – Recurrent Neural Networks – Managing contexts in RNNs: LSTMs and GRUs – Self Attention Networks (Transformers) – Potential harms from Language Models.

UNIT 4 MACHINE TRANSLATION (MT) AND ENCODER-DECODER MODELS 9

Language divergences and Typology – The Encoder-Decoder model –Encoder-Decoder with RNNs – Attention – Beam Search – Encoder-Decoder with Transformers –Practical details on building MT systems – MT evaluation – Bias and ethical issues.

UNIT 5 PRACTICAL NLP SYSTEMS 9

Question Answering: Information Retrieval – IR based Factoid Question Answering – Entity Linking – Knowledge based Question Answering – Using Language Models for Question Answering – Classic QA models – Evaluation of factoid answers.

Chatbots and Dialogue systems – Properties of human conversations – Chatbots – GUS: a simple frame-based dialogue system – Evaluating dialogue systems – Dialogue system design.

Total : 45 Periods

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, 3rdEdition, Pearson Education, New Delhi, 2020.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, O Reilly Media, 2009.

REFERENCES:

1. Li Deng and Yang Liu, ” Deep Learning in Natural Language Processing“,1 st Edition, Springer,2018
2. Christopher Manning and Hinrich Schuetze,” Foundations of Statistical Natural Language Processing”, 1st Edition, MIT Press, London, 2000

e-RESOURCES:

1. https://nptel.ac.in/courses/106101007,”Natural Language Processing”, Prof. Pushpak Bhattacharyya, IIT Bombay.

2. https://nptel.ac.in/courses/106105158," Natural Language Processing",Prof. Pawan Goyal, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Apply formal and statistical models for word processing in NLP.
CO2 Develop word vector embeddings for a given language using neural language models.
CO3 Apply deep learning architectures for modeling sequences in NLP
CO4 Apply encoder-decoders models to build Machine Translation systems for a given application.
CO5 Develop question answering and chatbots for practical applications using NLP models.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	3	-	1	-	-	-	-	-	-	3	1
CO2	3	2	1	3	-	1	-	-	-	-	-	-	3	1
CO3	3	2	1	3	-	1	-	-	-	-	-	-	3	1
CO4	3	2	1	3	-	1	-	-	-	-	-	-	3	1
CO5	3	2	1	3	-	1	-	-	-	-	-	-	3	1

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE66	GAME THEORY	L	T	P	C
		3	0	0	3

Pre-requisites: Probability and Statistics, Data Structures using Python

Preamble

The main aim of this course is to introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets, to formalize the notion of strategic thinking and rational choice by using the tools of game theory, to provide insights into using game theory in 41odeIIing applications, to draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues, to introduce contemporary topics in the intersection of game theory, computer science, and economics and to apply game theory in searching, auctioning and trading.

UNIT 1 INTRODUCTION **9**

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-noncooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games-Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT 2 GAMES WITH PERFECT INFORMATION **9**

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games– Case Study: Prisoner’s dilemma, Pure Strategy Nash Equilibrium.

UNIT 3 GAMES WITH IMPERFECT INFORMATION **9**

Games with Imperfect Information — Bayesian Games — Motivational Examples — General Definitions — Information aspects — Illustrations — Extensive Games with Imperfect — Information — Strategies — Nash Equilibrium —Repeated Games — The Prisoner's Dilemma — Bargaining-Case Study: Extensive Form – Graphs and Trees, Game Trees, Strategic Form – Elimination of dominant strategy.

UNIT 4 NON-COOPERATIVE GAME THEORY **9**

Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games — Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two player, general- sum games — Identifying dominated strategies-Case Study: Minimax theorem, minimax strategies, Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium

UNIT 5 MECHANISM DESIGN **9**

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design with unrestricted preferences–Case Study: imperfect-information games - Mixed Strategy Nash Equilibrium - Finding mixed-strategy Nash equilibria for zero sum games, mixed versus behavioral strategies, Repeated Games

Total : 45 Periods

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.
2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.
3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory. Cambridge University Press, 2007.
4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

REFERENCES:

1. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008
2. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
3. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.
4. William Spaniel, "Game Theory 101: The Complete Textbook", CreateSpace Independent Publishing, 2011.

e-RESOURCES:

1. https://gametheorysociety.org/resources/
2. https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Discuss the notion of a strategic game and equilibria and identify the characteristics of eBay auctions and electricity trading markets..
CO2	Explain the concepts of Games with perfect Information using Nash Equilibrium strategies for prisoner's dilemma application. .
CO3	Identify key strategic aspects of games with imperfect information using Nash Equilibrium for prisoner's dilemma and Bargaining. .
CO4	Identify the applications that need aspects of Bayesian Games in noncooperative game theory.
CO5	Implement a typical Virtual Business scenario using Game theory with unrestricted preferences..

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	-	3	3
CO3	1	1	3	3	3	-	-	-	-	-	-	-	3	3
CO4	2	1	1	1	1	-	-	-	-	-	-	-	3	3
CO5	2	2	3	2	1	-	-	-	-	-	-	-	3	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE67	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble:

This course aims to know the theoretical background of cognition and to understand the link between cognition and computational intelligence and explore probabilistic programming language and to study the computational inference and learning models of cognition.

UNIT 1 PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT 2 COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision-case study: Implementation of reasoning algorithms.

UNIT 3 PROBABILISTIC PROGRAMMING LANGUAGE 9

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

UNIT 4 INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference- case study: Developing an application using conditional inference learning model.

UNIT 5 LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models- case study: Application development using hierarchical model.

Total : 45 Periods

TEXT BOOKS:

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 MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020.

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.

e-RESOURCES:

1. http://nitttrc.edu.in/nptel/courses/video/109104171/L01.html
2. https://library.iitgn.ac.in/resourceguide/subjects/guide.php?subject=150

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the concepts of philosophy, psychology and neuroscience in cognitive science.

CO2 Identify the relationship between the cognition elements and computational intelligence.

CO3 Implement mathematical functions through WebPPL.

CO4 Develop applications using cognitive inference model.

CO5 Develop applications using cognitive learning model.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	2	2	-	-	-	1	1	2	2	2	2
CO2	2	2	1	1	2	-	-	-	3	2	3	1	2	2
CO3	1	3	1	3	3	-	-	-	1	3	1	3	2	2
CO4	2	1	1	2	3	-	-	-	1	2	3	1	2	2
CO5	1	2	3	2	2	-	-	-	1	2	2	2	2	2

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITE68	ETHICS AND AI	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to Study the morality and ethics in AI and Learn ae Ethical initiatives in the field of artificial intelligence. This course makes the students to understand the AI standards and Regulations, social and ethical issues of Robot Ethics and AI and Ethics- challenges and opportunities

UNIT 1 INTRODUCTION **9**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT 2 ETHICAL INITIATIVES IN AI **9**

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization. Case Study: Ethical initiatives in healthcare, autonomous vehicles and defense

UNIT 3 AI STANDARDS AND REGULATION **9**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems. Case Study: Compare the regression model without a bias and with bias

UNIT 4 ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS **9**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy. Case Study: Ethics of Robotics in science and technology

UNIT 5 AI AND ETHICS- CHALLENGES AND OPPORTUNITIES **9**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI. Case Study: Identification on optimization in AI affecting ethics

Total : 45 Periods

TEXT BOOKS:

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

e-RESOURCES:

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2. https://sci-hub.mksa.top/10.1159/000492428

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain about morality and ethics in AI and apply the knowledge for ethical issues and challenges for a real time application.

CO2 Explain the ethical harms and ethical initiatives in AI.

CO3 Discuss about AI standards and Regulations with respect to AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems.

CO4 Analyze the concepts of Roboethics and Morality with professional responsibilities.

CO5 Discuss about the societal issues in AI with National and International Strategies on AI.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	3	1	-	-	3	1	2	1	1	3	1
CO2	2	1	1	2	1	-	-	3	1	2	1	1	3	3
CO3	2	3	1	1	3	-	-	3	2	1	1	2	3	2
CO4	3	1	3	3	2	-	-	3	2	2	3	1	2	1
CO5	3	1	1	3	3	-	-	3	2	3	3	3	1	3

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO01 BASICS OF JAVA PROGRAMMING L T P C
3 0 0 3

Preamble:
The main aim of this course is to develop the understanding of programming using an object oriented language and to impart knowledge on applets to create effective GUI applications.

UNIT 1 OBJECT ORIENTED PROGRAMMING CONCEPTS 9
Object Oriented Paradigm - Objects and classes - Data abstraction and Encapsulation - Inheritance - Polymorphism – Dynamic Binding – Message Communication-Java Evolution – Overview of Java-Constants, Variables and Data types - Operators & Expressions – Decision making: Branching and Looping.

UNIT 2 CLASSES AND OBJECTS 9
Arrays - Classes, Objects and Methods – Constructor -Method Overloading – Inheritance – Method Overriding – static –this – Garbage collection –final

UNIT 3 PACKAGES AND EXCEPTION HANDLING 9
Abstract Classes - Interfaces – Defining, Extending and Implementing Interfaces – Accessing Interface Variables. Packages – Managing Errors and Exceptions.

UNIT 4 IO PACKAGE AND MULTITHREADING 9
String- Managing Input and Output – Input Stream Classes – Output Stream Classes – Character Stream Classes-Multithreaded Programming.

UNIT 5 EVENT HANDLING AND APPLET 9
Event Handling-Delegation Event Model-Event classes-Key event class-Sources of Events-Event Listener Interfaces-Handling Mouse and Keyboard events-Adapter Classes. Applet Class- Applet Initialization and Termination- Applet display and repaint methods-Passing parameters to applet.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. E. Balagurusamy, “Programming with Java A Primer”, Tata McGrawHill, Fifth Edition, 2014.
2. Herbert Schildt, “Java the Complete Reference”, McGraw Hill Education, Ninth Edition, 2014.

REFERENCES:
1. Paul Deitel, Harvey Deitel, “Java How to Program”, Prentice Hall, Tenth Edition, 2014.
2. Cay S.Horstmann and Gary Cornell, “Core Java- Volume I Fundamentals”, Pearson Education, Ninth Edition, 2012.
3. Daniel Liang, “Introduction to Java Programming, Comprehensive Version”, Pearson Education, Ninth Edition, 2014.

e-RESOURCES:
1. http://nptel.ac.in/courses/106106147/, “Java Basics”, Prof. Pushpendra Singh, IIT – Madras.
2. http://nptel.ac.in/courses/106105084/28, “Java – Applets Part:1”, Prof. Indranil Sengupta, IIT – Kharagpur.

Course Outcomes: Upon completion of the course, students will be able to:

1. Demonstrate the knowledge of Object Oriented design principles in solving real world problems.
2. Write object oriented programs using classes and objects.
3. Implement the concept of reusability using interfaces and packages and handle runtime errors using exception handling.
4. Develop concurrent applications using IO packages and multithreading.
5. Design and Implement event driven applications using java applets.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	3	2	3	-	-	-	-	-	-	-	1	-	-
CO2	1	3	2	3	-	-	-	-	-	-	-	1	-	-
CO3	1	3	2	3	-	-	-	-	-	-	-	1	-	-
CO4	1	3	2	3	-	-	-	-	-	-	-	1	-	-
CO5	1	3	2	3	-	-	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO02 **ETHICAL HACKING** **L T P C**
3 0 0 3

Preamble:

This course aims to explore the concepts of knowledge required to protect against the hackerfor the information in a system, web service and wireless networks. Students are able to understand the issues relating to ethical hacking and to employ network defense measures for the information security.

UNIT 1 INTRODUCTION TO HACKING **9**

Introduction to Hacking – Penetration Test – Vulnerability Assessments versus Penetration Test – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories and Types of Penetration Tests – Vulnerability Assessment Reports. Case study:Use security tools in Kali Linux to assess the vulnerabilities.

UNIT 2 INFORMATION GATHERING AND SCANNING **9**

Information Gathering Techniques – Active and Passive Information Gathering –Traceroute – ICMP Traceroute – TCP Traceroute – UDP Traceroute – Enumerating and Fingerprinting the Webservers – DNS, SNMP, SMTP Enumeration – Target Enumeration and Port Scanning Techniques. Case Study: Understand the network protocols and port scanning techniques using Kali Linux.

UNIT 3 NETWORK ATTACKS **9**

Vulnerability Data Resources – Network Sniffing – Types of Sniffing – MITM Attacks – ARP Attacks – Denial of Service Attacks –DNS Spoofing – ARP Spoofing Attack – DHCP Spoofing – Remote Exploitation –Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication. Case study: Demonstrating the MITM attack using ARP Poisoning using Kali Linux.

UNIT 4 EXPLOITATION **9**

Introduction to Metasploit – Reconnaissance, Port Scanning with Metasploit – E–Mails with Malicious Attachments – Browser Exploitation – Post–Exploitation – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper. Case studies: Understand the Metasploit and Exploitations.

UNIT 5 WIRELESS AND WEB HACKING **9**

Wireless Hacking – Aircrack– Cracking the WEP – Evil Twin Attack – Web Hacking – Brute Force and Dictionary Attacks – Types of Authentication – Captcha Validation Flaw – Captcha RESET Flaw – Authentication Bypass Attacks – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) – CSRF – SSRF Attacks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2017.
2. Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.

REFERENCES:

1. Jon Erickson , “Hacking: The Art of Exploitation”, Second Edition, Rogunix, 2008.
2. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, 1st Edition, 2014.
3. DafyddStuttard, Marcus Pinto,“The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws”, 2nd Edition, 2011.

e-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105217/, “Ethical Hacking”, Prof. Indranil Sengupta, IIT Kharagpur.
2. https://www.edureka.co/blog/ethical-hacking-tutorial/, “Introduction to Cyber security and Ethical Hacking”.

Course Outcomes: Upon completion of the course, students will be able to:

1. Discuss the vulnerabilities across any computing system using penetration testing.
2. Explain the Foot printing, scanning and Enumeration method of reconnaissance about the target systems in a network.
3. Analyze active and passive sniffing,DNS, ARP, DHCP spoofing techniques in the network systems.
4. Analyze the Metasploit, Browser and post Exploitationsfor hacking the information from a system.
5. Identify vulnerabilities/threats/attacks in system, wireless and web services.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	3	-	1	-	-	2	-
CO2	2	2	2	3	-	1	-	3	-	1	-	-	2	-
CO3	2	2	2	3	1	1	-	3	-	-	-	-	2	-
CO4	2	2	2	3	1	1	-	3	-	-	-	-	2	-
CO5	2	2	2	3	-	1	-	3	-	-	-	-	2	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO03 **E-COMMERCE AND APPLICATIONS** **L T P C**
3 0 0 3

Preamble

This course focuses on principles of E-commerce from a business perspective, providing an overview of business and technology topics, business models, virtual value chains and social innovation and marketing strategies. In addition, some of the major issues associated with e-commerce-security, privacy, intellectual property rights, authentication, encryption, acceptable use policies, and legal liabilities will be explored. Students will build their own web presence and market it using an online platform

UNIT 1 INTRODUCTION **9**

E-Commerce – Difference between E-Commerce and E-Business - Features of E-Commerce technology – types of E-commerce – Growth of the Internet, Web and Mobile platform – Understanding E-commerce: organizing themes - E-Commerce business models - major Business –to-Consumer (B2C) business models – Major Business–to-Business (B2B) business models – E-Commerce enablers – how ecommerce changes business. Case Study: Identify Key components, strategy, B2B, B2C Models of E-commerce Business model of any e-commerce website

UNIT 2 E-COMMERCE INFRASTRUCTURE **9**

The internet – internet today – future internet infrastructure – web- internet and web – mobile applications – building an E-Commerce presence – choosing software and hardware – other E-Commerce site tools – developing a mobile web site and building mobile applications.

UNIT 3 E-COMMERCE SECURITY AND PAYMENT SYSTEMS **9**

E-Commerce security environment – security threats in E-Commerce environment – technology solutions – management policies, business procedures and public laws – E-Commerce payment systems – electronic billing presentment and payment.

UNIT 4 E-COMMERCE BUSINESS CONCEPTS **9**

Consumers online – Digital commerce marketing and advertising strategies and tools – internet marketing technologies – understanding the costs and benefits of online marketing communications – social marketing – mobile marketing – local and location-based marketing.

UNIT 5 SCM, LEGAL AND ETHICAL ISSUES **9**

Understanding ethical, social and political issues in ecommerce – privacy and information rights – intellectual property rights – governance – public safety and welfare – E-commerce in action: E-tailing business models – service sector: offline and online – online publishing industry – B2B ecommerce and supply chain management. Case study: Present and Future of E- commerce Industry in India.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kenneth C.Laudon, Carol Guercio Traver, “E-commerce business Technology society”, 10th edition, Pearson Education, 2016.
2. P.T.JosephS.J, “E-Commerce An Indian Perspective”, 5th edition, PHI Learning Pvt. Ltd., 2015.
3. Ravi Kalakota, Andrew B. Whinston, “Frontiers of Electronic Commerce”, Pearson Education, 1996.

REFERENCES:

1. Dave Chaffey, “E-Business and E-Commerce Management: Strategy, Implementation and Practice”, 5th edition, Prentice Hall, 2013.
2. IsitaLahiri, Sujit Kumar Ghosh, “Principles of Marketing and E – Commerce”, Pearson Education, 2012.
3. AdeshK.Pandey, "Introduction to E-Commerce and ERP", KatsonBooks , 2012.

e-RESOURCES:

1. http://www.nptel.ac.in/courses/106105084/35, “Electronic Commerce”, Prof. Indranil Sengupta, IIT-Kharagpur.
2. http://onlinevideolecture.com/?course_id=1295, “E-Commerce”, Prof.Saadat Nisar
3. https://e-commerce2018.com/TOC.html

Course Outcomes: Upon completion of the course, students will be able to:

1. Examine the concepts of E-commerce and E-Business and develop B2C and B2B business models for a e-commerce website.
2. Select appropriate infrastructure to develop a mobile website and mobile applications using E-Commerce site tools.
3. Apply the technology solutions, management policies and laws for securing the E-commerce environment.
4. Analyze the impact of digital commerce marketing and advertising strategies in E-Commerce platform.
5. Explain ethical, social and political issues of E-commerce and interpret the present and future of E-Commerce industry in India.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	-	1	-	1	-	1	-	-	-	-
CO2	2	3	2	3	-	1	-	1	-	1	-	-	-	-
CO3	2	3	2	3	-	1	2	1	-	1	-	-	-	-
CO4	2	3	2	3	-	1	2	1	-	1	-	-	-	-
CO5	2	3	2	3	-	1	2	1	-	1	-	-	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO04 BASICS OF ANDROID APPLICATION DEVELOPMENT L T P C
3 0 0 3

Preamble

The main aim of this course is to introduce the students to the structure of android mobile application development frameworks. The courseimparts knowledge on components, layout managers and database for designing android applications.

UNIT 1 BASICS OF JAVA 9

Overview of java– Constants, Variables and Data types –Operators & Expressions – Decision making: Branching and Looping – Classes, Objects and Methods – Arrays–Inheritance –Interface – Exception handling

UNIT 2 INTRODUCTION TO XML 9

XML Introduction – Structuring data –XML namespaces – DTDs – XML Schema documents - XML vocabularies – XSL – XPath – XSLT

UNIT 3 INTRODUCTION TO ANDROID 9

Introduction to Android Operating System: Android Ecosystem – Android versions – Android Activity – Features of Android – Android Architecture–Configuration of Android Environment: Android SDK – Android Development Tools (ADT) –Android Virtual Devices (AVDs)– Emulators – Dalvik Virtual Machine –Steps To Install and Configure Eclipse and SDK– Create the First Android Application– Directory Structure

UNIT 4 ANDROID USER INTERFACE 9

Linear Layout –Absolute Layout –Frame Layout –Relative Layout– Table Layout –View: Text View – Button –Image Button –Edit Text –Check Box –Toggle Button –Radio Button and Radio Group –Progress Bar –Auto complete Text View –Spinner –List View –Grid View Card View–Custom Toast Alert –Date Picker.

UNIT 5 ACTIVITY, MENU AND DATABASE 9

Activity: Intent – Activity life cycle – Broadcast Life cycle – Service –Menus –Option Menu – Adding and Updating menu items – Handling menu items. Android Notification – Introduction to Firebase.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2019.
2. Jeffrey C. Jackson, "Web Technologies- A Computer Science Perspective", Eleventh Impression, Pearson Education in South Asia, 2012.
3. Prasanna Kumar Dixit, "Android", 1st Edition ,Vikas Publishing House, 2014

REFERENCES:

1. B.M. Harwani, "Android Programming Unleashed", 1st Edition, Pearson Education, 2013
2. Ronan Schwarz, Phil Dutson, James Steele, Nelson To,"The Android Developer's Cookbook: Building Applications with the Android SDK", Second Edition, Pearson Education,2013

e-RESOURCES:

1. https://nptel.ac.in/courses/106106147/, "Mobile Computing – Starting Android Programming", Prof. Pushpendra Singh, Prof.SridharIyer, IIT-Madras.
2. https://nptel.ac.in/courses/106106156/, "Introduction to Modern Application Development", Prof. Gaurav Raina, MrTanmai Gopal, IIT-Madras

Course Outcomes: Upon completion of the course, students will be able to:

1. Identify and explain the fundamentals of object oriented programming concepts and decision making statements of java programming.
2. Explain the XML framework.
3. Analyze architecture, features and configuration of Android operating system.
4. Identify the layouts, views, button and notifications of android user interface
5. Demonstrate the knowledge on Android Mobile Operating Systems, database and application.

Mapping of COs with POs and PSOs

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	2	-	1	-	-	-	-	-	1	-	-
CO2	2	3	3	2	-	1	-	-	-	-	-	1	-	-
CO3	2	3	2	2	-	1	-	-	-	-	-	1	-	-
CO4	2	3	3	2	-	1	-	-	-	-	-	1	-	-
CO5	1	3	3	2	-	1	-	-	-	-	-	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO05	WEB ESSENTIALS	L	T	P	C
		3	0	0	3

Pre-requisites :

Preamble

The foundations of web development and internet protocols are the main topics of this course. Students will be shown how the client-server model of Internet programming operates and how scripting languages are used. Students will also be able to build websites using databases.

UNIT 1 WEBSITE BASICS **9**

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 2 WEB DESIGNING **9**

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

UNIT 3 CLIENT-SIDE PROCESSING AND SCRIPTING **9**

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

UNIT 4 SERVER SIDE PROCESSING AND SCRIPTING – PHP **9**

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 5 SERVLETS AND DATABASE CONNECTIVITY **9**

Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions -Sessions – Cookies – Database connectivity - JDBC Creation of simple interactive applications - Case Study : Creation of information retrieval system using web, PHP and MySQL.

Total : 45 Periods

TEXT BOOKS:

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.

REFERENCES:

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

e-RESOURCES:

1. http://www.nptel.ac.in/courses/106105084/, “Internet Technology”, Prof. Indranil Sengupta, IIT-Kharagpur.
2. https://nptel.ac.in/courses/106101163/45/, “Testing of Web Applications and Web Services”, Prof. Meenakshi D’Souza, IIT- Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites.
CO2 Create simple PHP scripts for designing a web application.
CO3 Design and deploy simple web-applications with client side scripting.
CO4 Create simple database applications using PHP with sever side scripting.
CO5 Create a web page dynamically using the database connectivity

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	3	2	-	-	-	-	-	3	-	-
CO2	3	3	3	3	3	2	-	-	-	-	-	3	-	-
CO3	3	3	3	2	3	2	-	-	-	-	-	3	-	-
CO4	3	3	3	3	3	1	-	-	-	-	-	3	-	-
CO5	3	3	3	3	3	1	-	-	-	-	-	3	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITO06	DIGITAL VIDEO EDITING	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The student must be able to understand the basic concepts of broad perspective of linear and nonlinear editing, Storytelling styles, audio - video recording and AVID XPRESS DV 4.

UNIT 1 FUNDAMENTALS **9**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing- Case Study: Write a Movie Synopsis (Individual/Team Writing)

UNIT 2 STORY TELLING **9**

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - project files - media management - Case Study: Present team stories in class.

UNIT 3 USING AUDIO AND VIDEO **9**

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs – Case Study: Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts & agreements.

UNIT 4 WORKING WITH FINAL CUT PRO **9**

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences – Case Study: Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching.

UNIT 5 WORKING WITH AVID XPRESS DV 4 **9**

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options – Case Study: Post-production: Editing, Sound design, Finishing.

Total : 45 Periods

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, “Digital Video for Dummies”, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, “Editing Digital Video: The Complete Creative and Technical Guide”, Digital Video and Audio, McGraw – Hill 2003.

REFERENCES:

1. Roy Thompson Christopher J. Bowen, “Grammar of the Edit”, Second Edition, 2009, Elsevier Inc.
2. Aaron Goold, “The Video Editing Handbook: For Beginners”, John Goold, 2021.

e-RESOURCES:

1. https://courseware.cutm.ac.in/courses/certificate-in-video-editing/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compare the strengths and limitations of Nonlinear editing.
CO2 Identify the infrastructure and significance of storytelling.
CO3 Apply suitable methods for recording to CDs and VCDs.
CO4 Extend the core issues of advanced editing and training techniques.
CO5 Experiment with projects using AVID XPRESS DV 4

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	1	1	-	-	-	1	2	3	2	-	-
CO2	2	3	3	3	1	-	-	-	1	2	2	1	-	-
CO3	2	2	3	3	1	-	-	-	3	1	1	1	-	-
CO4	2	2	2	2	1	-	-	-	3	1	1	1	-	-
CO5	2	1	3	3	1	-	-	-	3	2	1	2	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

Preamble:

This course is aimedtocover the basics of R programming working environment. It also includes concepts involved in importing data, manipulating data for specific needs, running summary statistics and data visualizations through graphs, charts and plots.

UNIT 1 R - FUNDAMENTALS 9

Overview of the R language: Defining the R project, Obtaining R, Generating R codes, Scripts, Comments, Text editors for R, Graphical User Interfaces (GUIs) for R, Packages.

UNIT 2 R - DATA STRUCTURES, CLASSES AND LISTS 9

R Objects and data structures: Variable classes, Vectors and matrices, Data frames and lists, Array and Factors.

UNIT 3 R – MANIPULATIONS 9

Manipulating objects in R: Mathematical operations, Decision making, loops, functions and Strings.

UNIT 4 R - DATA EXPLORATIONS 9

Exploratory Data Analysis: Reading, creating and storing R -CSV file, Excel File, Binary file, XML File - R -Mean,Median,Mode- Regression.

UNIT 5 R – PRESENTATIONS 9

Graphical Representation: R-PIE chart – Bar chart – Box plots-Histograms – line graphs - Scatter plots.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jared P. Lander, “R for Everyone: Advanced Analytics and Graphics”, Pearson Education, 2nd Edition, 2015.

REFERENCES:

1. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design” No Starch Press, 2011.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ma75/preview
2. http://www. cyclisme.arg/tutorial/RI
3. http://www.r-tutor.com/r-introduction

22ITV02	RUBY ON RAILS	L T P C 0 0 2 1

Preamble:

Ruby on Rails revolutionizes web development with its elegant syntax and powerful framework. From rapid prototyping to scalable production applications, Rails streamlines the development process. With its convention over configuration philosophy, Rails empowers developers to focus on creativity and functionality.

UNIT 1 INTRODUCTION TO RUBY 9

Ruby basics: Variables- data types- operators- Control structures- Arrays and hashes- Functions and blocks- Object-oriented programming concepts

UNIT 2 INTRODUCTION TO RAILS 9

Rails Basics: Installation and project setup -MVC (Model-View-Controller) architecture-Routing-Controllers-Views-Models.

UNIT 3 WORKING WITH DATABASES 9

Overview of relational databases- Setting up a database in Rails- CRUD Operations: Creating, reading, updating, and deleting records - ActiveRecord Basics: Understanding migrations- queries using ActiveRecord.

UNIT 4 FRONT END DEVELOPMENT 9

Forms and validations-Introduction to Views- Creating dynamic views in Rails- Working with layouts and partials-Javascript. Styling with CSS: Integrating CSS for basic styling- Adding images and assets.

UNIT 5 BUILDING A FULL-STACK APPLICATION 9

Design and implementation of RESTful APIs- Rails controllers to handle API requests. Case Study: Deploy Rails application to a hosting service (Heroku, AWS, DigitalOcean).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sam Ruby, David B. Copeland, Dave Thomas, “Agile Web Development with Rails 6”, Pragmatic Bookshelf, 2019.

REFERENCES:

1. Obie Fernandez, “The Rails 5 Way”, Addison-Wesley,2017.
2. Michael Hartl, “Ruby on Rails Tutorial: Learn Web Development with Rails”, Addison-Wesley,2016.

e-RESOURCES:

1. https://guides.rubyonrails.org/
2. https://onlinecourses.swayam2.ac.in/aic20_sp37/
3. https://www.railstutorial.org/

22ITV03 STRESS MANAGEMENT AND EMOTIONAL INTELLIGENCE **L T P C 0 0 2 1**

Preamble:

This Course aims at providing the knowledge about the organizational stress and how to cope with the use of emotional intelligence.

UNIT 1 UNDERSTANDING STRESS **9**

What is Stress, Stressors Personal causes of stress - Organizational causes of stress - The General Adaptation Syndrome - Fight or flight response

UNIT 2 SYMPTOMS OF STRESS **9**

Symptoms of stress, The three Ps - Consequences of Stress - Cultural difference causing stress, constructive versus Destructive stress - Episodic versus chronic stress.

UNIT 3 GENERAL STRESS INTERVENTIONS **9**

Types of intervention - General coping strategies - Stress problem solving Sequence - ABCDE problem solving Model.

UNIT 4 STRESS IN INDIVIDUALS **9**

Types of personalities - Transactional Analysis - Locus of Control - Work life Balance.

UNIT 5 EMOTIONAL INTELLIGENCE **9**

Definition History and the measurement of emotional Intelligence - Impact of emotional Intelligence on business environment - Emotional intelligence skills - Business Solution and emotional intelligence.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Fielding Gray, “Stress Management:Techniques On How To Deal With Stress And Anxiety”, Kindle Edition, 2014.
2. Howard E. Book and Steven J. Stein “The EQ Edge: Emotional Intelligence and Your Success”, Wiley, 2011.

REFERENCES:

1. I’M ok-You’re ok – Thomas Harris.M.D.
2. Stress Management & Emotional Intelligence- Daniel Goleman.
3. Ann Edworthy, Managing Stress, Open University Press, Buckingham, Phildephia.

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ge18/preview
2. https://www.classcentral.com/course/swayam-emotional-intelligence-7980
3. https://www.udemy.com/topic/emotional-intelligence/

Preamble:

This course helps students to learn concept of Kotlin, also this course teaches how to develop applications for the Android operating system using Kotlin

UNIT 1 KOTLIN INTRODUCTION 8

Introduction, Overview, Environment Setup, Basic Syntax, Architecture, Variable, Datatypes, Operator, Conditional statements,Loops, Enum.

UNIT 2 ARRAYS, STRINGS AND FUCNTIONS 10

Array- Generic Array, Arrays of Primitives, Create an Array, Createan array using closure, Create an uninitialized array.String- String Equality, String Literals, Elements of string.Kotlin Application-Kotlin on server side, Kotin on Android.Functions- Definition, Recursive Function, Default and Named Argument, Higer order function, Inline function, Vararg parameter in function, Basic Lambdas.Ranges- Integral types Ranges, downTo() function, step() function, until function.

UNIT 3 CLASSES AND OBJECTS 10

Defining Class Hierarchies-Class, Visibility Modifiers, Inner and nested classes, Inheritance. Declaring a Class with nontrivial constructor or properties: Primary Constructor and initializer blocks, Secondary constructor, initializing the superclass in different ways, implementing properties declared in interfaces. Compiler-generated methods: Universal object methods, Data Classes, Class Delegation -Declaring an instance- Object Declaration: Singleton Objects, Annotations

UNIT 4 EXCEPTION HANDLING AND NULL SAFETY 9

Exception Handling: Introduction, try catch, Multiple catch Block, Nested try-catch block, finally Block, throw keyword Null Safety: Nullable Types and Non-Nullable Types, Smart cast, Unsafe and Safe Cast Operator, Elvis Operator

UNIT 5 KOTLIN FOR ANDROID 8

Kotlin on Android, Setting up kotlin for android, Using Kotlin in Android Studio, Auto-Generated Gradle Configuration, Converting Java Code to Kotlin,

TOTAL: 45 PERIODS

TEXT BOOKS:

1. “Kotlin in Action” Dmitry Jemerov, Svetlana Isakova -Manning Publications-2017

REFERENCES:

1. “Kotlin for Android App Development” by Peter Sommerhoff.

e-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp02/preview

22ITM11	FINANCIAL MANAGEMENT	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to expose the concepts in maximizing the return on investment in a way that fulfils the needs of any firm while keeping the risks under control.

UNIT 1 INTRODUCTION TO FINANCIAL MANGEMENT 9

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

UNIT 2 SOURCES OF FINANCE 9

Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc.

UNIT 3 INVESTMENT DECISIONS 9

Investment Decisions: Capital budgeting – Need and Importance – Techniques of Capital Budgeting– Payback -ARR – NPV – IRR –Profitability Index.

Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT 4 FINANCING AND DIVIDEND DECISION 9

Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure.

Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy.

UNIT 5 WORKING CAPITAL DECISION 9

Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.

Total : 45 Periods

TEXT BOOKS:

1. M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill.
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd.

REFERENCES:

1. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,
2. Prasanna Chandra, Financial Management, Theory and Practice, McGraw Hill, 10th Edition.
3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_mg31/preview
2. https://emeritus.org/in/learn/what-is-financial-management/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the financial functions in the decision areas in finance.
CO2 Learn the various sources of Finance
CO3 Describe about capital budgeting and cost of capital.
CO4 Discuss on how to construct a robust capital structure and dividend policy
CO5 Develop an understanding of tools on Working Capital Management.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITM12 **FUNDAMENTALS OF INVESTMENT**

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to introduce the quantitative techniques that apply to investment valuation and management.

UNIT 1 THE INVESTMENT ENVIRONMENT **9**

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

UNIT 2 FIXED INCOME SECURITIES **9**

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT 3 APPROACHES TO EQUITY ANALYSIS **9**

Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT 4 PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES **9**

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

UNIT 5 INVESTOR PROTECTION **9**

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness and activism.

Total : 45 Periods

TEXT BOOKS:

1. Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019.
2. Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, Edition, 2017.

REFERENCES:

1. Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
2. ZviBodie, Alex Kane, Alan J Marcus, PitabusMohanty, Investments, McGraw Hill Education (India), 11 Edition(SIE), 2019

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_mg62/preview
2. https://www.coursera.org/learn/investing-fundamentals

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe the investment environment in which investment decisions are taken.
CO2 Explain how to Value bonds and equities
CO3 Explain the various approaches to value securities
CO4 Describe how to create efficient portfolios through diversification
CO5 Discuss the mechanism of investor protection in India.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	-	3	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	2	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITM13 BANKING, FINANCIAL SERVICES AND INSURANCE

L	T	P	C
3	0	0	3

Pre-requisites :-

Preamble

The main aim of this course is to train the students in various aspects related to banking and its allied areas. Make to understand the objective of preparation of financial statements to the users of financial statements. It includes accounting of Banking, Insurance companies.

UNIT 1 INTRODUCTION TO INDIAN BANKING SYSTEM 9

Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT 2 MANAGING BANK FUNDS / PRODUCTS 9

Liquid Assets - Investment in securities - Advances - Loans. Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes. Designing deposit schemes– Asset and Liability Management – NPA's – Current issues on NPA's – M&A's of banks into securities market.

UNIT 3 DEVELOPMENTIN BANKING TECHNOLOGY 9

Payment system in India – paper based – e payment –electronic banking –plastic money – e-money – forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.

UNIT 4 FINANCIAL SERVICES 9

Introduction – Need for Financial Services – Financial Services Market in India – NBFC — Leasing and Hire Purchase — mutual funds. Venture Capital Financing –Bill discounting –factoring – Merchant Banking.

UNIT 5 INSURANCE 9

Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 –IRDA – Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival – settlement of claim.

Total : 45 Periods

TEXT BOOKS:

1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services, Pearson, Delhi, 2017.
2. Meera Sharma, "Management of Financial Institutions – with emphasis on Bank and Risk Management", PHI Learning Pvt. Ltd., New Delhi 2010.

REFERENCES:

1. Peter S. Rose and Sylvia C. and Hudgins, "Bank Management and Financial Services", Tata McGraw Hill, New Delhi, 2017

e-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/cec20_mg08/preview
2. https://www.coursera.org/courses?query=banking

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the Banking system in India
CO2 Grasp how banks raise their sources and how they deploy it
CO3 Discuss the development in banking technology
CO4 Utilize the financial services in India
CO5 Know the insurance Industry in India

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITM14 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble

Blockchain is a self-sustaining, peer to peer distributed database ledger technology for managing and recording transactions with no central regulatory and ownership involvement. It is like an online bank ledger, open to both parties in a transaction. Blockchain gained increasing importance because of its relevance in facilitating a single shared version of the truth for any digital asset.

UNIT 1 INTRODUCTION TO BLOCKCHAIN 9

Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT 2 INTRODUCTION TO CRYPTOCURRENCY 9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin– Zcash – Smart Contracts – Ricardian Contracts- Deploying smart contracts on a blockchain.

UNIT 3 ETHEREUM 9

Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM),Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network.

UNIT 4 WEB3 AND HYPERLEDGE 9

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT 5 EMERGING TRENDS 9

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

Total : 45 Periods

TEXT BOOKS:

1. Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018
2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018.
3. ArshdeepBahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.

REFERENCES:

1. Andreas M. Antonopoulos ,” Mastering Bitcoin – Programming the Open Blockchain”, O‟Reilly Publication,2017
2. William Mougayar, “The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology”, Wiley Edition, 2016

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify and explain the key benefits of block chain for a business or a network environment.

CO2 Articulate the core components of Bitcoin Network with the necessary scriplets and Design a Bitcoin Wallet.

CO3 Describe Ethereum Eco system, Ethereum Virtual Machine and Encoding schemes and Develop a private network for a given business model.

CO4 Explain the WEB3 and Hyperledge

CO5 Investigate the given business model and critique the strengths and flaws of block chain implementation.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITM15 FINTECH PERSONAL FINANCE AND PAYMENTS

L	T	P	C
3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to introduce the fundamental building blocks of financial technologies and explore the disruptive force of changing payment methods, analyze the changing regulatory landscape, and gain a deeper understanding of Crypto currency, Bitcoin, InsurTech, crowdfunding, peer-to-peer lending.

UNIT 1 CURRENCY EXCHANGE AND PAYMENT 9

Understand the concept of Crypto currency- Bitcoin and Applications -Cryptocurrencies and Digital Crypto Wallets -Types of Cryptocurrencies - Cryptocurrencies and Applications, block chain, Artificial Intelligence, machine learning. Fintech users, Individual Payments, RTGS Systems, Immediate Page 54 of 90 Payment Service (IMPS), Unified Payments Interface (UPI).Legal and Regulatory Implications of Crypto currencies, Payment systems and their regulations.Digital Payments Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues.

UNIT 2 DIGITAL FINANCE AND ALTERNATIVE FINANCE 9

A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering.

UNIT 3 INSURETECH 9

InsurTech Introduction, Business model disruption AI/ML in InsurTech- IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services.

UNIT 4 PEER TO PEER LENDING 9

P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding, Crowdfunding Architecture and Technology, P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations.

UNIT 5 REGULATORY ISSUES 9

FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: Startups RegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection.

Total : 45 Periods

TEXT BOOKS:

1. Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, Createspace Independent Publishing Platform,2016.
2. Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019

REFERENCES:

1. Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016
2. Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016
3. IIBF, Digital Banking, Taxmann Publication, 2016
4. Jacob William, Financial Technology, Create space Independent Pub, 2016
5. LukeSutton,FinancialTechnology:Bitcoin&Blockchain,CreatespaceIndependentPub,2016

e-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_mg20/preview
2. https://www.coursera.org/specializations/wharton-fintech

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the currency exchange and payment
CO2 Identify the digital finance and alternative finance
CO3 Describe the InsurTech
CO4 Identify the Peer to Peer lending
CO5 Discuss the FinTech -regulatory issues

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	2	-	1	-	-	-	-	3	1	-	-
CO2	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	-	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).

22ITM16	INTRODUCTION TO FINTECH	L	T	P	C
		3	0	0	3

Pre-requisites : -

Preamble

The main aim of this course is to set the stage for understanding the FinTech landscape and ecosystem and grappling with the potential direction of future change. Business and regulatory implications of technology for the financial industry and How new technology impacts economies, markets, companies and individuals

UNIT 1 INTRODUCTION **9**

Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT 2 PAYMENT INDUSTRY **9**

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT 3 INSURANCE INDUSTRY **9**

FinTech in Wealth Management Industry-Financial Advice, Automated investing, Socially responsible investing, Fractional Investing, Social Investing. FinTech in Insurance Industry- P2P insurance, On-Demand Insurance, On-Demand Consultation, Customer engagement through Quote to sell, policy servicing, Claims Management, Investment linked health insurance.

UNIT 4 FINTECH AROUND THE GLOBE **9**

FinTech developments - US, Europe and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial institutions collaborating with FinTech companies, The new financial world.

UNIT 5 FUTURE OF FINTECH **9**

How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

Total : 45 Periods

TEXT BOOKS:

1. Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015
2. Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016

REFERENCES:

1. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016
2. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
3. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020
4. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

e-RESOURCES:

1. https://www.edx.org/course/introduction-to-fintech
2. https://nptel.ac.in/courses/110105121

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Learn about history, importance and evolution of Fintech
CO2 Acquire the knowledge of Fintech in payment industry
CO3 Acquire the knowledge of Fintech in insurance industry
CO4 Learn the Fintech developments around the world
CO5 Know about the future of Fintech

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	-	2	-	1	-	-	-	-	3	1	-	-
CO2	2	2	-	2	-	1	-	-	-	-	3	1	-	-
CO3	3	2	-	2	-	1	-	1	-	-	3	1	-	-
CO4	3	3	-	2	-	1	-	1	-	-	3	1	-	-
CO5	3	3	-	2	2	1	-	1	-	-	3	1	-	-

1 - Slight (Low), 2 - Moderate (Medium), 3 - Substantial (High).