DEPARTMENT OF MATHEMATICS
ANNA UNIVERSITY, CHENNAI

VISION

We, at the Department of Mathematics, Anna University, Chennai, shall strive constantly to

- Achieve excellence in Mathematics education by providing high quality teaching, research and training in Mathematics to all our students to significantly contribute in the fields of Mathematics, Computer Science and all related Engineering fields.
- Contribute to the quality Human Resource Development in Mathematics and Computer Science through our effective Masters and Research Programmes.

MISSION

- To provide strong Mathematical background to Engineering Students to cope up with the needs of emerging technologies both at National and International levels.
- To popularize and to project the proper perspective of Mathematics and Computer Science towards attracting young talents to take up teaching and research careers in Mathematical Sciences.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.Sc. COMPUTER SCIENCE (5 YEARS INTEGRATED)

REGULATIONS - 2019

CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. To make the students to be knowledgeable and competitive in the field of Computer Science to take up career or higher studies.
2. To ensure the students have good understanding in the fundamental and core concepts of computer science that would give strong theoretical foundation.
3. To ensure the students are aware of the cutting edge technologies currently being used in industries and provide them a platform to learn the same.
4. To ensure the students work on multiple academic projects pertaining to different domains, to have strong knowledge in the respective domain.
5. To ensure this academic programme provides them learning to take leadership positions in the industry and also initiate businesses offering innovative solutions and ability to identify, formulate and solve diverse industrial problems/software design and development process.

2. PROGRAMME OUTCOMES (POs):

After going through the five years of study, our Computer Science Post-Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.
2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design a system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments &collect, analyze and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the efficiency of the system.
6	The Engineer and society	Conduct themselves to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interaction with industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multi-disciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of the Integrated M.Sc. (Computer Science) program the student will have following program specific outcomes.

1. The ability to solve algorithmically and implementing them with efficient code.
2. The ability to have in depth knowledge in the fundamentals of Computer Science, to solve and implement new practices in Research and Development.
3. The ability to learn new technologies or apply new knowledge as needed, using appropriate learning strategies.
4. The ability to work productively as computer professionals by: demonstrating with effective communication, technical skills and adhering the high ethical standards in the profession.

4. PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	✓	✓	✓	✓	✓				✓	✓		✓
II	✓	✓	✓	✓						✓		
III	✓		✓	✓	✓	✓						
IV	✓							✓	✓	✓	✓	✓
V	✓			✓		✓	✓	✓	✓	✓	✓	✓

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

Mapping of Course Outcome and Programme Outcome

		Course Name	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
YEAR 1	Semester 1	Communicative English					✓	✓		✓		✓		✓
		Calculus	✓	✓										
		Applied Physics	✓				✓		✓					
		Digital Systems	✓	✓	✓	✓			✓		✓			
		Problem Solving and C Programming	✓	✓										
		Communication Skill Laboratory				✓	✓			✓	✓	✓		✓
		C Programming Laboratory	✓	✓	✓	✓					✓			
	Semester 2	Technical Communication					✓	✓		✓		✓		✓
		Transform Techniques and Partial Differential Equations	✓	✓										
		Chemistry of Materials	✓				✓		✓					
		Object Oriented Programming in C++	✓											
		Data Structures	✓	✓										
		Computer Architecture	✓	✓										
		Data Structures Laboratory	✓	✓		✓					✓			
YEAAR 2	Semester 3	Logic and Abstract Algebra	✓	✓										
		Combinatorics and Graph Theory	✓	✓	✓				✓					
		Microprocessor and Applications	✓	✓	✓	✓					✓			
		Operating Systems	✓		✓									
		Signals and Systems	✓	✓			✓							
		Operating Systems Laboratory	✓		✓	✓					✓			
		Python Programming Laboratory	✓		✓	✓					✓			
	Semester 4	Probability and Statistics	✓	✓			✓							
		Theory of Computation	✓	✓	✓									
		Database Management Systems	✓	✓			✓							
		Java and Internet Programming	✓											
		Computer Networks	✓	✓	✓	✓					✓			
		Java and Internet Programming Laboratory	✓		✓	✓					✓			
		Database Management Systems Laboratory	✓	✓		✓					✓			
		Computational Laboratory using R	✓	✓	✓	✓					✓			

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

		Course Name	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
YEAR 3	Semester 5	Cryptography and Data Security	✓		✓									
		Software Engineering	✓		✓		✓							
		Data Warehousing and Mining	✓	✓	✓	✓					✓			
		Design and Analysis of Algorithm	✓	✓	✓		✓		✓					
		Elective-I	✓		✓									
		Elective-II	✓											
		Audit-I						✓		✓	✓			✓
		Software Development Laboratory	✓		✓	✓					✓			
	Semester 6	Operations Research	✓	✓	✓		✓							
		Principles of Compiler Design	✓											
		Web Technology	✓		✓		✓							
		Artificial Intelligence	✓		✓		✓		✓					
		Elective-III	✓											
		Compiler Design Laboratory	✓			✓					✓			
		Mini Project	✓	✓	✓	✓					✓			✓
YEAR 4	Semester 7	Industrial Project	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
	Semester 8	Advanced Statistical Methods for Computing	✓	✓										
		Big Data Analytics	✓		✓		✓							
		Distributed and Cloud Computing	✓	✓	✓		✓		✓					
		Environmental Science and Engineering				✓			✓	✓				✓
		Elective –IV	✓											
		Open Elective-I	✓					✓			✓			✓
		Audit – II						✓		✓	✓			
		Creative and Innovative Project	✓		✓	✓				✓	✓		✓	✓

		Course Name	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
YEAR 5	Semester 9	Numerical Methods	✓	✓			✓							
		Internet Of Things	✓	✓	✓		✓							
		Advanced Machine Learning	✓	✓	✓	✓	✓				✓			
		Elective-V	✓											
		Elective-VI	✓											
		Open Elective-II	✓					✓						✓
		Numerical Methods Laboratory	✓			✓					✓			
		Internet Of Things Laboratory	✓	✓	✓	✓					✓		✓	
	Semester 10	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.Sc. COMPUTER SCIENCE (FIVE YEARS INTEGRATED)

REGULATION 2019

CHOICE-BASED CREDIT SYSTEM

CURRICULA AND SYLLABI

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5152	Communicative English	FC	3	0	0	3	3
2.	MA5151	Calculus	FC	4	0	0	4	4
3.	PH5152	Applied Physics	FC	4	0	0	4	4
4.	XC5151	Digital Systems	PCC	3	0	2	5	4
5.	XC5152	Problem Solving and C Programming	PCC	3	0	0	3	3
PRACTICAL								
6.	HS5161	Communication Skill Laboratory (Language)	FC	0	0	4	4	2
7.	XC5161	C Programming Laboratory	PCC	0	0	4	4	2
			TOTAL	**17**	**0**	**10**	**27**	**22**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5252	Technical Communication	FC	3	0	0	3	3
2.	MA5251	Transform Techniques and Partial Differential Equations	FC	4	0	0	4	4
3.	CY5253	Chemistry of Materials	FC	4	0	0	4	4
4.	XC5251	Object Oriented Programming in C++	PCC	3	0	2	5	4
5.	XC5252	Data Structures	PCC	3	0	0	3	3
6.	XC5253	Computer Architecture	PCC	3	0	0	3	3
PRACTICAL								
7.	XC5261	Data Structures Laboratory	PCC	0	0	4	4	2
			TOTAL	**20**	**0**	**6**	**26**	**23**

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5351	Logic and Abstract Algebra	PCC	4	0	0	4	4
2.	XC5351	Combinatorics and Graph Theory	PCC	4	0	0	4	4
3.	XC5352	Microprocessor and Applications	PCC	3	0	2	5	4
4.	XC5353	Operating Systems	PCC	3	0	0	3	3
5.	XC5354	Signals and Systems	PCC	4	0	0	4	4
PRACTICAL								
6.	XC5361	Operating Systems Laboratory	PCC	0	0	4	4	2
7.	XC5362	Python Programming Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5451	Probability and Statistics	PCC	4	0	0	4	4
2.	XC5451	Theory of Computation	PCC	4	0	0	4	4
3.	XC5452	Database Management Systems	PCC	3	0	0	3	3
4.	XC5453	Java and Internet Programming	PCC	3	0	0	3	3
5.	XC5454	Computer Networks	PCC	3	0	2	5	4
PRACTICAL								
6.	XC5461	Java and Internet Programming Laboratory	PCC	0	0	4	4	2
7.	XC5462	Database Management Systems Laboratory	PCC	0	0	4	4	2
8.	XC5463	Computational Laboratory using R	PCC	0	0	4	4	2
			TOTAL	**17**	**0**	**14**	**31**	**24**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	XC5501	Cryptography and Data Security	PCC	4	0	0	4	4
2.	XC5551	Software Engineering	PCC	3	0	0	3	3
3.	XT5551	Data Warehousing and Mining	PCC	3	0	2	5	4
4.	XC5552	Design and Analysis of Algorithms	PCC	4	0	0	4	4
5.		Program Elective - I	PEC	3	0	0	3	3
6.		Program Elective - II	PEC	3	0	0	3	3
7.		Audit Course - I*	AC	2	0	0	2	0
PRACTICAL								
8.	XC5561	Software Development Laboratory	PCC	0	0	4	4	2
			TOTAL	**22**	**0**	**6**	**28**	**23**

***Audit Course is Optional**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	XC5651	Operations Research	PCC	4	0	0	4	4
2.	XC5601	Principles of Compiler Design	PCC	3	0	0	3	3
3.	XT5651	Web Technology	PCC	3	0	0	3	3
4.	XC5652	Artificial Intelligence	PCC	4	0	0	4	4
5.		Program Elective - III	PEC	3	0	0	3	3
PRACTICAL								
6.	XC5611	Compiler Design Laboratory	PCC	0	0	4	4	2
7.	XC5612	Mini Project	EEC	0	0	4	4	2
			TOTAL	**17**	**0**	**8**	**25**	**21**

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICAL								
1.	XC5711	Industrial Project	EEC	0	0	32	32	16
			TOTAL	**0**	**0**	**32**	**32**	**16**

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5851	Advanced Statistical Methods for Computing	PCC	4	0	0	4	4
2.	XT5851	Big Data Analytics	PCC	3	0	2	5	4
3.	XT5852	Distributed and Cloud Computing	PCC	3	0	2	5	4
4.	GE5851	Environmental Science and Engineering	PCC	3	0	0	3	3
5.		Program Elective - IV	PEC	3	0	0	3	3
6.		Open Elective - I	OEC	3	0	0	3	3
7.		Audit Course – II*	AC	2	0	0	2	0
PRACTICAL								
8.	XC5811	Creative and Innovative Project	EEC	0	0	4	4	2
			TOTAL	**21**	**0**	**8**	**29**	**23**

*** Audit course is Optional**

SEMESTER IX

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5951	Numerical Methods	PCC	4	0	0	4	4
2.	XT5951	Internet Of Things	PCC	3	0	0	3	3
3.	XC5951	Advanced Machine Learning Techniques	PCC	3	0	2	5	4
4.		Program Elective - V	PEC	3	0	0	3	3
5.		Program Elective - VI	PEC	3	0	0	3	3
6.		Open Elective - II	OEC	3	0	0	3	3
PRACTICAL								
7.	MA5961	Numerical Methods Laboratory	PCC	0	0	4	4	2
8.	XT5961	Internet Of Things Laboratory	PCC	0	0	4	4	2
			TOTAL	**19**	**0**	**10**	**29**	**24**

SEMESTER X

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICAL								
1.	XC5011	Project Work	EEC	0	0	36	36	18
			TOTAL	**0**	**0**	**36**	**36**	**18**

TOTAL CREDITS: 217

FOUNDATION COURSES (FC)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS5152	Communicative English	FC	3	3	0	0	3
2	MA5151	Calculus	FC	4	4	0	0	4
3	PH5152	Applied Physics	FC	4	4	0	0	4
4	HS5161	Communication Skill Laboratory (Language)	FC	4	0	0	4	2
5	CY5253	Chemistry of Materials	FC	4	4	0	0	4
6	HS5252	Technical Communication	FC	3	3	0	0	3
7	MA5251	Transform Techniques and Partial Differential Equations	FC	4	4	0	0	4

PROGRAM CORE COURSES (PCC)

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	XC5151	Digital Systems	PCC	5	3	0	2	4
2	XC5152	Problem Solving and C Programming	PCC	3	3	0	0	3
3	XC5161	C Programming Laboratory	PCC	4	0	0	4	2
4	XC5251	Object Oriented Programming in C++	PCC	5	3	0	2	4
5	XC5252	Data Structures	PCC	3	3	0	0	3
6	XC5253	Computer Architecture	PCC	3	3	0	0	3
7	XC5261	Data Structures Laboratory	PCC	4	0	0	4	2
8	MA5351	Logic and Abstract Algebra	PCC	4	4	0	0	4
9	XC5351	Combinatorics and Graph Theory	PCC	4	4	0	0	4
10	XC5352	Microprocessor and Applications	PCC	5	3	0	2	4
11	XC5353	Operating Systems	PCC	3	3	0	0	3
12	XC5354	Signals and Systems	PCC	4	4	0	0	4
13	XC5361	Operating Systems Laboratory	PCC	4	0	0	4	2
14	XC5362	Python Programming Laboratory	PCC	4	0	0	4	2
15	MA5451	Probability and Statistics	PCC	4	4	0	0	4
16	XC5451	Theory of Computation	PCC	4	4	0	0	4
17	XC5452	Database Management Systems	PCC	3	3	0	0	3
18	XC5453	Java and Internet Programming	PCC	3	3	0	0	3
19	XC5454	Computer Networks	PCC	5	3	0	2	4
20	XC5461	Java and Internet Programming Laboratory	PCC	4	0	0	4	2
21	XC5462	Database Management Systems Laboratory	PCC	4	0	0	4	2
22	XC5463	Computational Laboratory using R	PCC	4	0	0	4	2
23	XC5501	Cryptography and Data Security	PCC	4	4	0	0	4

24	XC5551	Software Engineering	PCC	3	3	0	0	3
25	XT5551	Data Warehousing and Mining	PCC	5	3	0	2	4
26	XC5552	Design and Analysis of Algorithms	PCC	4	4	0	0	4
27	XC5561	Software Development Laboratory	PCC	4	0	0	4	2
28	XC5651	Operations Research	PCC	4	4	0	0	4
29	XC5601	Principles of Compiler Design	PCC	3	3	0	0	3
30	XT5651	Web Technology	PCC	3	3	0	0	3
31	XC5652	Artificial Intelligence	PCC	4	4	0	0	4
32	XC5611	Compiler Design Laboratory	PCC	4	0	0	4	2
33	MA5851	Advanced Statistical Methods for Computing	PCC	4	4	0	0	4
34	XT5851	Big Data Analytics	PCC	5	3	0	2	4
35	XT5852	Distributed and Cloud Computing	PCC	5	3	0	2	4
36	GE5851	Environmental Science and Engineering	PCC	3	3	0	0	3
37	MA5951	Numerical Methods	PCC	4	4	0	0	4
38	XT5951	Internet Of Things	PCC	3	3	0	0	3
39	XC5951	Advanced Machine Learning Techniques	PCC	5	3	0	2	4
40	MA5961	Numerical Methods Laboratory	PCC	4	0	0	4	2
41	XT5961	Internet Of Things Laboratory	PCC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl.No	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1	XC5612	Mini Project	0	0	4	2	6
2	XC5711	Industrial Project	0	0	32	16	7
3	XC5811	Creative and Innovative Project	0	0	4	2	8
4	XC5011	Project Work	0	0	36	18	10
					Total Credits:	**38**	

PROGRAM ELECTIVE COURSES (PEC)

ELECTIVE I

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	XT5071	.NET Programming	PEC	3	3	0	0	3
2	MA5071	Linear Algebra	PEC	3	3	0	0	3
3	XT5072	Information Coding Techniques	PEC	3	3	0	0	3
4	XT5073	Human Computer Interface	PEC	3	3	0	0	3
5	XT5074	Open Source Systems	PEC	3	3	0	0	3

ELECTIVE II

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	XC5071	High speed networks	PEC	3	3	0	0	3
2	XC5072	Unix Internals	PEC	3	3	0	0	3
3	XT5075	Database Tuning	PEC	3	3	0	0	3
4	XT5076	Software Project Management	PEC	3	3	0	0	3
5	XT5077	Personal Software Processes	PEC	3	3	0	0	3

ELECTIVE III

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	XT5078	Visualization Techniques	PEC	3	3	0	0	3
2.	XT5079	Digital Image Processing	PEC	3	3	0	0	3
3.	XC5073	Network Programming	PEC	3	3	0	0	3
4.	XT5080	Soft Computing	PEC	3	3	0	0	3
5.	XC5074	Natural Language Processing	PEC	3	3	0	0	3
6.	XT5081	Information Security	PEC	3	3	0	0	3

ELECTIVE IV

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	XT5082	Adhoc and Sensor Networks	PEC	3	3	0	0	3
2.	XT5083	Information Retrieval Techniques	PEC	3	3	0	0	3
3.	XT5084	Semantic Web	PEC	3	3	0	0	3
4.	XT5085	Performance Evaluation of System and Networks	PEC	3	3	0	0	3
5.	XT5086	Bio Informatics	PEC	3	3	0	0	3
6.	XT5087	Total Quality Management	PEC	3	3	0	0	3

ELECTIVE V

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	XT5088	3G & 4G Wireless Networks	PEC	3	3	0	0	3
2.	XC5075	Computational Linguistics	PEC	3	3	0	0	3
3.	XT5089	Mobile and Pervasive Computing	PEC	3	3	0	0	3
4.	XC5076	Computer Vision	PEC	3	3	0	0	3
5.	XC5077	Biometrics	PEC	3	3	0	0	3

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

ELECTIVE VI

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	XT5090	Multimedia Information Storage and Retrieval	PEC	3	3	0	0	3
2.	XT5091	Game Programming	PEC	3	3	0	0	3
3.	XT5092	Augmented Reality and Virtual Reality	PEC	3	3	0	0	3
4.	XC5078	Pattern Recognition	PEC	3	3	0	0	3
5.	XT5093	Multimedia Tools and Techniques	PEC	3	3	0	0	3
6.	XC5079	Software Testing and Quality Assurance	PEC	3	3	0	0	3

OPEN ELECTIVES COURSES (OEC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5891	Graph Theory	OEC	3	3	0	0	3
2.	MA5991	Statistical Methods	OEC	3	3	0	0	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL.NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	AX5091	English for Research Paper Writing	2	0	0	0	5/8
2.	AX5092	Disaster Management	2	0	0	0	
3.	AX5093	Sanskrit for Technical Knowledge	2	0	0	0	
4.	AX5094	Value Education	2	0	0	0	
5.	AX5095	Constitution of India	2	0	0	0	
6.	AX5096	Pedagogy Studies	2	0	0	0	
7.	AX5097	Stress Management by Yoga	2	0	0	0	
8.	AX5098	Personality Development through Life Enlightenment Skills.	2	0	0	0	
9.	AX5099	Unnat Bharat Abhiyan	2	0	0	0	
					Total Credits:	0	

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

SUMMARY

	M.Sc. COMPUTER SCIENCE (FIVE YEARS INTEGRATED)											
	Subject Area	Credits per Semester										Credits Total
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	FC	13	11	-	-	-	-	-	-	-	-	24
2.	PCC	9	12	23	24	17	16	-	15	15	-	131
3.	PEC	-	-	-	-	6	3	-	3	6	-	18
4.	OEC	-	-	-	-	-	-	-	3	3	-	6
5.	EEC	-	-	-	-	-	2	16	2	-	18	38
6.	Non Credit/Audit course	-	-	-	-	✓	-	-	✓	-	-	-
	Total Credit	**22**	**23**	**23**	**24**	**23**	**21**	**16**	**23**	**24**	**18**	**217**

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

HS5152 **COMMUNICATIVE ENGLISH** **L T P C**
3 0 0 3

OBJECTIVES:

- To give more practice in using the four basic language skills – reading, writing, listening and speaking
- To learn to communicate in both oral and written form in a formal context
- To interpret graphical information and make inferences
- To critically evaluate online content and comprehend the message

UNIT I **9**

Listening –Listening for information – Filling in details – Speaking – Self introduction – Describing a place – Reading – Reading for comprehension – Skimming and scanning – Writing – Descriptive writing – Place description – Picture description - Grammar – Adjectives – Comparative adjectives – Grammar – Tenses – Simple present – Simple past

UNIT II **9**

Listening – Listening to lectures / talks – Note taking – Identifying main and supporting points - Speaking – Asking questions –Reading – Reading to summarise – Understanding an article / news report – Writing – Paragraph writing – Coherence – cohesion - Grammar – Question tags – Prepositions – Vocabulary – One word substitutes

UNIT III **9**

Listening – Dialogic listening – Listening for details – Speaking – Conversation – Formal & informal conversation – Small talk – Roleplay – Reading – Intensive reading - Inferring from charts / graphs/tables – Writing – channel conversion – transferring information from other data forms to written form – Grammar –– subject – verb agreement – Indirect questions – Wh- questions - Vocabulary – Prefixes - Suffixes

UNIT IV **9**

Listening –Active listening – Empathetic listening – Speaking – Describing a product & its features – Telephone conversation – Asking for information or clarification etc – Reading – User manual – Product specifications – Comprehending the technical details – Writing – Product descriptions – Letter writing – Official letters – Letter of enquiry / complaint etc. – Letter to Dean – Asking for some help - Grammar –Tenses – Present perfect – Past perfect – Vocabulary – Numerical compounds

UNIT V **9**

Listening – Critical & Evaluative listening – Summarising the details – Speaking – small group discussions – agreeing & disagreeing – Reading – Critical reading – online content – social media posts –differentiating between fact v opinion – Writing – Essay writing – cause & effect - Evaluative essays – Grammar – Connectives –Future forms - Vocabulary – Homonyms & Homophones – Idioms

TOTAL: 45 PERIODS

OUTCOMES

By the end of the course students would have

- Gained more practice in using four language skills – listening, speaking, reading and writing
- Learnt to communicate in both oral and written form in formal and informal context
- Known how to interpret graphical images and infer the message in them
- Learnt how to critically evaluate online content and understand the message

REFERENCES:

1. Sudharshana N.P &C.Savitha. “ENGLISH FOR TECHNICAL COMMUNICATION” (Units 1-7). Cambridge: Cambridge University Press, 2016.
2. Mindscapes, Department of English, Anna University, Chennai, Orient Blackswan, 2012.
3. Sood S.C.et al, “Developing Communication Skills: Oral Communication and Reading Comprehension, Writing Skills and Workbook.” Manohar, New Delhi: 2007.
4. Sasikumar V., P.KiranmayiDutt and GeethaRajeevan, Listening and Speaking II New Delhi:Foundation Books, 2007.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

MA5151 **CALCULUS** **L T P C**
4 0 0 4

OBJECTIVES:

- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I LIMITS AND CONTINUITYOF FUNCTIONS 12

Representation of functions - Power functions- Exponential functions - Inverse functions - Logarithmic functions - Trigonometric functions- polynomials and rational functions- New functions from old functions -Tangent problem - numerical limit - Limit of a function - One-sided limits - Limit Laws - Limits at infinity and Infinite Limits (Horizontal & Vertical Asymptotes) - Continuity - left and right continuity - Types of discontinuities - Intermediate Value theorem.

UNIT II DIFFERENTIALCALCULUS 12

Derivatives of a function - Derivative of polynomial and exponential functions - Differentiation rules - Derivative of trigonometric functions - Functions fail to be differentiable - Relationship between continuity and differentiability - Chain rule - Implicit differentiation - Derivative of logarithmic functions - logarithmic differentiation -- Derivative of hyperbolic functions – Maxima and minima - Mean value theorem - L'Hospital Rule - Polar coordinate system - Differentiation in polar coordinates

UNIT III SEVERALVARIABLECALCULUS 12

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

UNIT IV INTEGRAL CALCULUS 12

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

UNITV MULTIPLEINTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

OUTCOMES:

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

- As similate idea so flimits and continuity and an ability to calculate with the mandapply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Familiarizetheideasofdifferentialequationsandfacilityinsolvingsimplestandard examples

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES:

1. Bali N., GoyalM. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi,2014.
3. Greenberg M.D., “Advanced Engineering Mathematics”, Pearson Education, 2nd Edition, 5th Reprint, New Delhi, 2009.
4. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 43rd Edition, New Delhi, 2014.
5. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, 3rd Edition, New Delhi, 2007.
6. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, New Delhi,2008.
7. Narayanan S. and Manicavachagom Pillai T.K., “Calculus"VolumeIand II,S.Viswanathan Publishers Pvt. Ltd., Chennai,2007.
8. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi,2007.
9. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., 11thReprint, New Delhi, 2010.

PH5152 **APPLIED PHYSICS** **L T P C**
4 0 0 4

OBJECTIVES:

- To introduce and teach the concepts of properties of matter and thermal physics
- To make the students to understand the aspects of acoustics and ultrasonics
- To equip the students on the aspects of quantum principles
- The basic aspects of semiconductor physics and devices are introduced
- The students will be introduced the concepts of photonics and fiber-optics principles

UNIT I PROPERTIES OF MATTER AND THERMAL PHYSICS 12

Elasticity- Hooke’s law - relationship between three types of modulus of elasticity (qualitative) – stress -strain diagram – Poisson’s ratio – bending of beams - bending moment – depression of a cantilever –Young’s modulus by non-uniform bending- I-shaped girders. Thermal Physics - modes of heat transfer- thermal conductivity –Lee’s disc method - conduction through compound media - thermal expansion – thermal stress – laws of thermodynamics –entropy.

UNIT II ACOUSTICS AND ULTRASONICS 12

Characteristics of sound - classification of sound- intensity of sound - decibel – Acoustics - Sabine’s formula- derivation using growth and decay method – absorption coefficient and its determination – factors affecting acoustics of buildings and their remedies. Ultrasonics – production by magnetostrictionand piezoelectric methods - acoustic grating – applications of ultrasonic waves.

UNIT III QUANTUM PHYSICS 12

Black body radiation – Planck’s theory (derivation) – Photoelectric effect – Compton effect. theory and experimental verification – matter waves –Schrondingerwave equation in one dimension: time independent and time dependent equations – particle in a infinitely deep square well potential – finite well potential – tunnelling through barrier – applications.

UNIT IV SEMICONDUCTOR PHYSICS 12

Energy bands in solids – intrinsic and extrinsic semiconductors - distribution of quantum states in the energy band (qualitative) – Fermi-Dirac statistics – carrier concentration in an intrinsic semiconductor – carrier concentration in n-type semiconductor – variation with temperature and impurity - semiconductor devices: diode, BJT, FET,MOSFET.

UNIT V PHOTONICS AND FIBREOPTICS 12

Spontaneous and stimulated emission - population inversion – Nd:YAG, CO2, semiconductor lasers - homojunction and heterojunction lasers - industrial applications. Principle and propagation of light in optical fibres – numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - fibre optical communication system.

TOTAL: 60 PERIODS

OUTCOMES:

After completing this course, the students should able to

- Understand the concepts of properties of matter and thermal physics
- Apply the concepts of acoustics and ultrasonics
- Appreciate the importance of quantum physics
- Make use of photonic and fiber-optic devices.

REFERENCES:

1. G.Keiser, “Optical fiber communications”, McGraw HillCo.,New York, 1995.
2. Gaur R.K. and Gupta S.L., “Engineering Physics”, Dhanpat Rai Publications,Mumbai, 2013.
3. N.Garcia and A.Damask, “Physics for Computer Science Students”, Springer,New York, 2012.
4. Palanisamy, P. K. “Engineering Physics”, SCITECH Publications,Chennai, 2012.
5. Paul Tipler and Gene Mosca, Physics for Scientists and Engineers, W.H. Freeman,New York, 2007.
6. Pillai, S. O., “Solid State Physics”, New Age International Publishers,New Delhi, 2009.
7. Raymond Serway, John Jewett, “Physics for Scientists and Engineers”, Bostan, Brooks/Cole,2014.

XC5151 DIGITAL SYSTEMS L T P C

3 0 2 4

OBJECTIVES:

- To introduce the basic concept of digital and binary systems
- To give fundamentals of Boolean algebra and logic gates
- To give students the concept of digital logic design
- To give students the basic tools for the design and implementation of digital modules and subsystems
- To reinforce theory and techniques taught in the classroom through project assignments

UNIT I NUMBER SYSTEMS AND BINARY CODES 9

Introduction to Digital Systems - Binary Numbers – Number Systems and Conversions – Complements – Signed Binary Numbers - Binary Arithmetic – Binary Codes – BCD and other Weighted Codes, Excess-3, Gray Code – Binary Logic.

UNIT II BOOLEAN ALGEBRA AND LOGIC GATES 9

Basic Definitions – Axiomatic Definitions of Boolean Algebra - Basic Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Other Logic Operations – Digital Logic Gates – Integrated Circuits – TTL – MOS – CMOS Circuits.

UNIT III GATE - LEVEL MINIMIZATION 9

Karnaugh Map Method – Four Variable Map – Five Variable Map – Product-of-Sums Simplification – Don't Care Conditions – NAND and NOR Implementations - Other Two- Level Implementations – QuineMcCluskey Method – Exclusive OR function.

UNIT IV COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design of combinational circuits - Binary Adder- Subtractor – Decimal Adder - Binary Multiplier – Magnitude Comparator – Decoders – Encoders - Multiplexers – Demultiplexers - Read Only Memories – Programmable Logic Array – Programmable Array Logic.

UNIT V SEQUENTIAL LOGIC 9

Sequential Circuits – Storage Elements: Latches and Flip-Flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure - Registers – Shift Register – Counters – Ripple Counter – Synchronous Counter.

TOTAL: (45+30) 75 PERIODS

OUTCOMES:

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

- Apply knowledge of math, science and engineering
- Describe design constraints of digital systems.
- Design digital circuitry, analyze and interpret data
- Combinational logic design implementation.
- Sequential logic design implementation and Design for testability

REFERENCES:

1. Charles H. Roth Jr., "Fundamentals of Logic Design", Jaico Publishing House, 7th edition, Mumbai, 2014.
2. John F.Wakerly, "Digital Design Principles & Practices", Pearson Education, 3rd Edition, Noida, India, 2016.
3. Mano, M.M. and Ciletti, M.D., "Digital Design", Pearson Education, 6th Edition, New Jersey, 2018.
4. Neal S Widmer; Gregory L Moss; Ronald J Tocci, "Digital System: Principles and Applications", 12th edition, Pearson, London, 2018.

XC5152 PROBLEM SOLVING AND C PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To learn fundamentals of computers and its components
- To learn the process of analyzing a problem and find solutions
- To learn about the role of algorithms and flowcharts in problem analysis and solution
- To know about fundamentals of structured programming language
- To provide complete knowledge of C language.

UNIT I INTRODUCTION TO COMPUTERS AND PROBLEM SOLVING 9

Computer systems – Inside the system – Representation & Processing data – CPUs – Types of storage devices - Operating systems basics – Networking basics- Creating computer program- Program Planning – Algorithms – Flow charts – Pseudo codes – Programming Paradigms.

UNIT II FUNDAMENTALS OF C PROGRAMMING 7

C Programming fundamentals – Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations.

UNIT III CONTROL STATEMENTS AND FUNCTIONS 9

Decision Making and Branching – Looping statements - Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

UNIT IV ARRAYS AND POINTERS 11

Defining Array –Processing array - Passing array to a function - Multi dimensional array- Pointer declarations- passing pointers to a function - pointers and arrays - operations on pointers - arrays of pointers – passing functions to other functions.

UNIT V STRUCTURES AND UNIONS 9

Defining a structure - Processing a structure - user-defined data type - Structure and pointers – passing structures to a function - self-referential structures – Unions – File handling

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Use flowcharts and pseudo code to represent program modules
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Able to develop logics, which will help them to create programs in C.
- Write C program for simple applications

REFERENCES:

1. Anita Goel , “Computer Fundamentals”, Pearson Education, Noida, 2010.
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, Second Edition, 2011.
3. Dromey,R.G, “How to solve it by Computer”, Pearson Education, New York, 2008.
4. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Pearson Education, Second Edition, Noida, 2006.
5. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Noida, Pearson Education, 2015
6. Peter Norton, “Introduction to Computers”, Seventh Edition,TataMcGrawHill, New Delhi, 2012.
7. Programming with C, Schaum’s Outlines Series, Third Edition, Tata McGraw Hill, 2010.
8. Yashavant P. Kanetkar , “Let Us C” , 13th Edition, BPB publications,New Delhi, 2013.

HS5161 COMMUNICATION SKILLS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To develop the students’ language ability to a level that enables them to use English in their professional and academicenvironment
- To improve the communication skills of students seeking a career in IT industry

1. Listening Comprehension focusing on varying elements of vocabulary andstructure
2. Video Comprehension developing combined audio-video receptive skills to deduce meaning from context - Use of online resources – Making shortspeeches
3. Seminar skills - agreeing and disagreeing, clarifying, questioning, persuading, emphasizing, concluding, interrupting; evaluating ideas and actions, presenting solutions, recommending action, comparing and contrasting, probability and possibility, cause and effect, criticizing - Group Discussion Activities on current issues – Presenting yourviewpoints

4. Listening Comprehension of authentic materials – Self-instruction using listening and video materials from the self access language laboratory with comprehension exercises.
5. Use of the Internet to extract authentic materials on specific areas of interest

TOTAL: 60 PERIODS

REFERENCES:

1. Esteras, Santiago Remacha, Infotech: English for Computer Users. Cambridge: Cambridge University Press,2008.
2. Newspapers and Technical Magazines can be used for reference.

XC5161 C PROGRAMMING LABORATORY L T P C
0 0 4 2

1. Input / Output Statements
2. Control functions
3. Functions with Recursions
4. Arrays
5. Pointers
6. Structures and Unions
7. File Handling

TOTAL: 60 PERIODS

HS5252 TECHNICAL COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:

- To develop the essential English language skills needed to present technical information in oral and written form.
- To introduce different types of technical information sensitize learners on the nuances of Technical English
- To equip learners with required skills in English thereby making them employable.

UNIT I **9**

Listening: listening to product descriptions and labeling parts of a machine Speaking- Giving short talk -participating in conversations-Reading-Reading technical texts and completing skimming, scanning and predicting exercises-Writing: Description of a mechanism at rest and in motion- description of a process Grammar & Vocabulary- use of sequence words, use of connectors-speech acts-simple present, present continuous and present perfect forms

UNIT II **9**

Listening: listening to process descriptions and drawing flowchart- Speaking: Giving instructions orally Reading: Reading and comprehending visual input (charts, pie diagrams etc.)Writing: definitions (single sentence and lengthy definitions)-writing a process description- Grammar and Vocabulary: Simple past, past continuous, past perfect forms of the verb, subject and verb concord- the infinitive and imperative forms of the verb

UNIT III **9**

Listening to a technical presentation and taking notes- Speaking: making short technical presentations Reading: Reading Technical passages and making notes-
Writing recommendations- Introduction to formal email/letter writing- Grammar and Vocabulary- Future forms of verbs, modal verbs, adjectival and adverbial forms of words- prefixes and suffixes

UNIT IV **9**

Listening: Viewing group discussions and completing exercises on the conventions of participating in GDs- Speaking: Participating in Group Discussions- Reading- Reading Technical Reports – Writing: Job Applications and drawing up the job resume- summary writing- writing a vision statement- Grammar and Vocabulary- active and passive voice- direct and indirect speech- comparative forms of adjectives- if clauses

UNIT V **9**

Listening to presentations of technical reports- Speaking- Presenting reports orally-Reading comprehension-Technical Reports in Newspapers (Technical Journalism) –Writing – a short report on an accident/survey-Grammar and Vocabulary- Reporting verbs- phrasal verbs- collocations-emotive vs. referenced use of words.

TOTAL : 45 PERIODS

OUTCOMES:

- Gained the essential English language skills needed for presenting technical information in oral and written form.
- Obtained different types of technical information sensitize learners on the nuances of Technical English
- Equipped the learners with required skills in English thereby making them employable.

REFERENCES:

1. English for Technical Communication (for First and Second Semester) Cambridge University Press, Cambridge,2016.

MA5251 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS **L T P C**
4 0 0 4

OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes.
- To introduce Laplace transform techniques which will solve initial and boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic

UNIT I DIFFERENTIAL EQUATIONS **12**

Ordinary differential equations: Second order equation - Complementary solution - Particular integral: Operator Method – Homogenous equation of Euler's and Legendre's type; Partial differential equations: Formation – Solutions of first order equations – Standard types – Singular solutions – Lagrange's Linear equation –– Classification of Partial Differential Equations – Solution of linear equations of higher order with constant coefficients .

UNIT II FOURIER SERIES **12**

Dirichlet"s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval"s identity – Harmonic Analysis.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Method of separation of Variables – Solutions of one dimensional wave equation and one dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems –Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem –– Transform of periodic functions –Application to solution of linear ordinary differential equations with constant coefficients

UNIT V FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval‟s identity.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understanding the ideas of ordinary differential equations and techniques in solving standard examples;
- The students can able to solve the partial differential equations and solution techniques;
- Understanding the Fourier series analysis and solve the problems by using Fourier series;
- To acquaint the student with Fourier series techniques used in solving boundary value problems;
- The understanding of the mathematical principles on Laplace transforms and solution to differential equations using this technique;
- To acquaint the student with Fourier transform techniques used in wide variety of situation apart from its use in solving boundary value problems.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, New Delhi, 2007.
3. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 40th Edition, New Delhi, 2007.
4. Peter V.O‟Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, New Delhi, 2007.
5. Ramana, B.V. “Higher Engineering Mathematics”, Tata McGraw Hill, 11 thReprint, New Delhi , 2010.

CY5253 CHEMISTRY OF MATERIALS L T P C
4 0 0 4

OBJECTIVES:

- To introduce the basic concepts of polyer and its application in the field of electronics
- To impart knowledge on composites and its electrical and electronics applications
- To familiarize the student on dielectric, insulators, semi-conductors, magnetic and nono materials
- To teach about the fabrications of integrated circuits and printed circuit boards
- To inculcate sound understanding about batteries and their applications

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I POLYMER IN ELECTRONICS 12

Basic concepts of polymers, Piezo and pyro electric polymers – Polyvinyl fluoride – Polyvinylidernefluoride – preparation, properties and applications. Conducting polymers – Classifications – Polyparaphenylene and polypyrrole.Potting – potting compounds – potting problems - encapsulation, Photoresists – Positive and negative.

UNIT II COMPOSITES 12

Introduction to composites – Characteristics, Matrix materials – Types – Polymer matrix, metal matrix, ceramic matrix, carbon and graphite matrix material. Reinforcement – fiber, particulates, flakes and whiskers, Classification of composites – Particulates, fibrous and laminated composites – Hybrid composites – Application of composites in electrical and electronic component.

UNIT III SPECIALITY MATERIALS 12

Dielectrics – Characteristics, insulating materials – Characteristics – Polymers– Polyethylene, polytetrafluroethylene – Ceramics – Mica – types – products (sheet mica, mica tapes, mica papers and glass-binded mica) and applications of mica. Glass – Lead glass, Borosilicate glass, silica glass, glass wool - preparation, properties and uses. Magnetic materials – basis of magnetism – Soft and hard magnetic materials. Semiconductors – Extensive and intensive. Metallic solids – Characteristics.Nanomaterials – Properties – Synthesis of nano materials – Sol Gel synthesis – Carbon nano tubes – Nano wires –Applications.

UNIT IV FABRICATION OF INTEGRATED CIRCUITS 12

Introduction – Fabrication – MOS – NMOS, PMOS, CMOS, Ga-As Technologies, Printed circuit boards-Fabrication (Single layer only) – Lamination, printing (photo and screen printing) and mechanical operation.

UNIT V BATTERIES 12

Primary and Secondary – Requirements – Commercial batteries – Dry Cell, acid cells, alkaline batteries (Ni-Cd), Li-ion. Fuels cells – (Hydrogen - oxygen) – UPS.

TOTAL: 60 PERIODS

OUTCOMES:

- Will be familiar in basic concepts in polymer and its application in the field of electronics
- Will be exposed to composites and their constituents
- Will posses in-depth knowledge about speciality materials
- Will be acquaint in the fabrication of integrated circuits and printed circuit boards
- Will be conversant in the theories involved in batteries and its applications

REFERENCES:

1. Dyson R.W. “Specialty Polymer”, Blackie Academic and Professional,Chennai,2006.
2. Jain P.C and Monika Jain, “Engineering Chemistry”, DhanpetRai Publishing Company (P) Ltd., New Delhi,2013.
3. Khanna O.P.,” Material Science” NIH Publications,Maryland,2007.
4. Sharma S.C. “Composite Materials”, Narosa Publishing House, New Delhi,2000.
5. Wong M.N., “Polymer for electronics and photonic applications”, John Wiley,New York, 2006.

XC5251 OBJECT ORIENTED PROGRAMMING IN C++ L T P C
3 0 2 4

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To give introduction about objects and classes
- To understand the concept of inheritance and polymorphism
- Introduction about templates and exception handling
- To give concepts of input and output stream

UNIT I OOP AND C++ FUNDAMENTALS 9

Object-oriented paradigm - Elements of object oriented programming – Characteristics of OOP - C++ operators – data types - Pointers - References - Enumeration – Functions – Function prototype – Default arguments – Inline functions.

UNIT II OBJECTS AND CLASSES 9

Specifying a Classes – Defining Member Functions – Static data member and member function - Array of objects – Object as function argument - Returning Objects – Friend function - pointers to object - This pointer – Constructor and destructor

UNIT III INHERITANCE AND POLYMORPHISM 9

Derived class - Single Inheritance - Multiple Inheritance - Hierarchical Inheritance - Hybrid Inheritance – Virtual base class - Constructors in Derived class – Nesting of classes - Polymorphism – Compile and Run time polymorphism – Function overloading - Operator Overloading – Virtual Functions

UNIT IV TEMPLATES AND EXCEPTION HANDLING 9

Exception handling mechanism – Rethrowing an Exception – Specifying Exceptions – Templates – Class Template – Function Template – Member function template – Non-Type Template arguments - Namespaces

UNIT V INPUT/OUTPUT STREAMS 9

Input / Output operations – I/O stream classes – Unformatted and formatted I/O operations – Manipulators – Overloading the insertion and extraction operators - File input/output – Command line arguments

TOTAL: (45 + 30) 75 PERIODS

OUTCOMES:

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

- Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
- Understand dynamic memory management techniques using pointers, constructors and destructors
- Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
- Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
- Demonstrate the use of I/O stream classes, file handling and command line arguments

REFERENCES:

1. Bhave, “Object Oriented Programming With C++”, Pearson Education, New Delhi, 2004.
2. Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley,4th Edition, New Jershey,2013.
3. Dietel & Dietel, “C++ How to Program”, Fifth Edition, Prentice Hall,New Jershey,2005.
4. Dietel & Dietel, “C++ How to Program”, Ninth Edition, Pearson,New Jershey 2014.
5. Kamthane, ”Object Oriented Programming with ANSI and Turbo C++”, Person Education, New Delhi 2006.

6. Robert Lafore, "Object Oriented Programming in Microsoft C++", 4th Edition, Pearson Education, New Delhi, 2010.
7. Stanley B. Lippman, JoseeLajoie, "C++ Primer", 5th Edition, Pearson Education, New Delhi, 2013.

XC5252 DATA STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

- To learn the concepts of array, stack and Queue and its applications
- To learn about linked list, circular linked list, to implement stack and queue using linked list
- To understand the concept of graph and trees, its representation and its application
- To learn the concept of advanced tree structures
- To learn the systematic way of solving problems, various methods of organizing large amounts of data and to efficiently implement the different data structures and solutions for specific problems

UNIT I STACKS AND RECURSION 9

Arrays and its representations – Stacks and Queues – Applications of Stack and Queue – Recursion.

UNIT II LINKED LISTS 9

Linked lists – Linked list based implementation of Stacks and Queues - Circular Linked lists - Linked list based polynomial addition.

UNIT III GRAPHS AND TREES 9

Graphs: Introduction, application of Graphs, C Representation of Graphs, Minimum Spanning Tree, Graph Traversal, Binary Trees – Binary tree representation – Traversal, Binary Search Tree - Threaded Binary Tree - Binary Heap Tree.

UNIT IV ADVANCED TREE STRUCTURES 9

AVL trees – Red-black trees – B trees – 2-3 trees - 2-3-4 trees – Trie trees.

UNIT V SORTING AND SEARCHING 9

Bubble sort - Selection sort - Binary tree sort - Heap sort - Simple Insertion sort - Shell sort -Linear Search – Binary Search – Tree Searching – Hashing - Open Addressing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- understand the properties of various data structures
- identify the strengths and weaknesses of different data structures
- understand the concept of various non-linear data structures
- understand the properties of advanced tree structures
- design and employ appropriate data structures for solving computing problems

REFERENCES:

1. Adam Drozdek, "Data Structures and Algorithms in C++",4th Edition Cengage Learning,Boston,2012.
2. Ellis Horowitz, SartajSahni, and Dinesh Mehta, "Fundamentals of Data structures in C++", Galgotia Publications, New Delhi – 2009.
3. Langsam Y., Augenstein M. and Tenenbaum A. M. – " Data Structures using C and C++.", (Second Edition) Prentice Hall of India, New Delhi – 2015.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

4. Michael T. Goodrich, Roberto Tamassia, David M. Mount ,"Data Structures and Algorithms in C++", John Wiley & Sons,New Jersey, 2010.
5. Seymour E. Goodman, S. T. Hedetniemi, "Introduction to the design and analysis of algorithms", 2nd Edition, McGraw-Hill, New York,1977.

XC5253 COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

- To understand the structure, function and characteristics of computer systems
- To understand the design of the various functional units and components of computers
- To identify the elements of modern instructions sets and their impact on processor design
- To explain the function of each element of a memory hierarchy
- To identify and compare different methods for computer I/O

UNIT I STRUCTURE OF COMPUTERS 9

Functional Units – Basic Operational Concepts – Performance and Metrics – Bus Strutures – Characteristics and Functions – Instruction Cycle – Addressing Modes and Formats – Register Reference Instructions – Input & Output Instructions.

UNIT II ARITHMETIC AND LOGIC UNIT 9

Binary Addition and Subtraction – Binary Multiplication and Division – Booth Algorithm – Fixed Point Representations – Floating Point Representation – Floating Point Arithmetic Operations – Arithmetic Pipelining – Bit-Sliced ALU

UNIT III CONTROL UNIT 7

Hardwired and Micro programmed Control – Control Memory – Address Sequencing – Micro instruction Sequencing - Macro instruction Execution - Program Control

UNIT IV MEMORY ORGANIZATION 10

Memory Operations – Memory Hierarchy – Main Memory – Associative Memory -Auxiliary memory – Virtual Memory – Cache Memory – Memory Array – Secondary Storage – Memory Management Hardware.

UNIT V INPUT OUTPUT ORGANIZATION AND ADVANCED ARCHITECTURE 10

Peripheral Devices – I/O Interface – Modes of Data Transfer – Interrupt Driven I/O – DMA – Serial Communication – Asynchronous Data Transfer – RISC – CISC - Parallel Processing – Vector and Array Processing.

TOTAL: 45 PERIODS

OUTCOMES:

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

- understand basic structure of computer.
- perform computer arithmetic operations.
- understand control unit operations.
- design memory organization that uses banks for different word size operations.
- understand the concept of cache mapping techniques
- understand the concept of I/O organization.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES:

1. Douglas E. Comer, "Essentials of Computer Architecture", 1st Edition, Pearson, London, 2007
2. Miles Murdocca, Vincent Heuring, "Computer Architecture and Organization: An integrated approach", Wiley, New Jersey, 2013.
3. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education,London , 2007.
4. Subrata Ghoshal, "Computer Architecture and Organization: From 8085 to Core2 Duo and beyond", 1st Edition, Pearson, London 2011
5. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson Education, London,2006.

XC5261 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

1. Arrays and structures in C
2. Implementation of Stack using Arrays & Pointers
3. Infix to Postfix Conversion & Infix to Prefix Conversion
4. Evaluation of Postfix Expression
5. Implementation of Queue using Arrays & pointers
6. Linked list, Circular Linked list
7. Representations of Graphs
8. Binary Search Tree & its Traversals
9. Insertion sort, Selection Sort, Binary Tree Sort, Heap Sort
10. Sequential Search and Binary Search
11. Index based search

TOTAL: 60 PERIODS

MA5351 LOGIC AND ABSTRACT ALGEBRA

L	T	P	C
4	0	0	4

OBJECTIVES:

- To introduce Mathematical Logic to understand the equivalence of statements and normal forms.
- To acquaint the students with Inference Theory and predicate calculus.
- To introduce relations and functions in setts to understand partial order and partition.
- To provide exposure to Algebraic structures.
- To explain the lattice structure and Boolean Algebra

UNIT I MATHEMATICALLOGIC I **12**

Statements – Truth tables – Connectives – Equivalences – Implications – Functionally complete set of connectives – Normal forms.

UNIT II MATHEMATICAL LOGIC II 12

Predicate Calculus – Proof methods and strategy - Inference theory for statement calculus and predicate calculus – Mathematical Induction.

UNIT III RELATIONSAND FUNCTIONS 12

Relations – Relation Matrix and the graph of a relation – Transitive closure and Warshall's algorithm - Equivalence relations – Functions – Composition – Inverse of a function.

UNIT IV GROUPS 12

Groups – Definitions and Examples – Subgroups and Homomorphism – Cosets and Lagrange's theorem – Normal Subgroups.

UNIT V LATTICES 12

Posets – Lattices – Properties of Lattices – Lattices as Algebraic System – Some Special Lattices – Boolean algebra.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Apply mathematical logic to understand the equivalence and implication of the statements.
- Apply logical inference theory to find the validity of the argument or proof of theorem.
- Understand relations and functions and their composition in applying mapping related problems.
- Apply Boolean laws in solving combinatorial circuit related problems.

REFERENCES:

1. Doerr Alan W., "Applied Discrete Structures for Computer Science", Galgotia Publications Pvt. Ltd., New Delhi, 1997.
2. Kolman, Busby and Ross, "Discrete Mathematical Structures", PHI Learning Pvt. Ltd., 6th Edition, New Delhi, 2009.
3. Rosen K.H., "Discrete Mathematics and its Applications", Tata McGraw Hill Book Company, 7th Edition, New Delhi, 2012.
4. Tremblay J.P. and Manohar, R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Publishing Company, New Delhi, 1997.

XC5351 COMBINATORICS AND GRAPH THEORY L T P C
4 0 0 4

OBJECTIVES:

- To introduce fundamental principles of Combinatorial Counting techniques
- To explain generating functions and their utility in solving recurrence relations
- To introduce graph models with basics and tree structures
- To explain the significance of graph connectivity and graph traversability
- To provide the basic theory of Matching, Planar graphs and Graph Coloring

UNIT I FUNDAMENTAL PRINCIPLES OF COUNTING 12

The Rules of Sum and Product – Permutations – Combinations – Bnomial Theorem – Combinations with repetition – Pigeonhole principle – The principle of Inclusion and Exclusion – Generalizations of the principle – Derangements.

UNIT II GENERATING FUNCTIONS AND RECCURENCE RELATIONS 12

Generating functions – Partitions and integers – The exponential generating function – The summation operator – The first-order linear recurrence relation – The second order linear homogeneous recurrence relation with constant coefficients – The method of generating functions.

UNIT III INTRODUCTIN TO GRAPHS AND TREES 12

Graphs and Graph models - Connected Graphs – Common classes of graphs – Multigraphs and digraphs – Degree of a vertex – Degree Sequence - Graph Isomorphism – Graph Isomorphism as Relation – Bridges – Trees – Minimum Spanning Tree Problem.

UNIT IV CONNECTIVITY AND TRAVERSABILITY 12

Cut-vertices – Blocks – Connectivity – Eulerian Graphs – Hamiltonian Graphs

UNIT V MATCHING, PLANARITY AND COLORING 12

Matchings – Planar Graphs – Vertex Coloring – Edge Coloring

TOTAL: 60 PERIODS

OUTCOMES:

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

- Apply the fundamental principles of counting techniques in combinatorial related problems.
- Solve recurrence relations which appear in many context of Computer Science and Combinatorics.
- Apply the structural ideas of Trees and graph isomorphism in solving real world problems.
- Apply the graph connectivity and graph traversability in many traversal and graph construction problems.
- Apply matching, planarity and coloring ideas in many circuit layout and partitioning problems.

REFERENCES:

1. Alan Tucker, “Applied Combinatorics”, John Wiley & Sons Inc., 6th Edition, New York, 2012.
2. Douglas B. West, “Introduction to Graph Theory”, Prentice Hall, 2th Edition, New Jersy, 2001.
3. Gary Chartrand and Ping Zhang, “Introduction to Graph Theory”, Tata McGraw-Hill, New Delhi, 2006.
4. Grimaldi R.P., “Discrete and Combinatorial Mathematics”, Pearson Education Pvt. Ltd., 5th Edition, Singapore, 2004.
5. Rosen K.H., “Discrete Mathematics and its Applications”, Tata McGraw Hill Book Company, 7th Edition, New Delhi, 2012.

XC5352 MICROPROCESSOR AND APPLICATIONS L T P C
3 0 2 4

OBJECTIVES:

- To know about the architecture and related aspects of 8085.
- To know about the architecture and related aspects of 16-bit processor 8086.
- Learn to write simple programs for both 8086 and 8085 processors
- To develop an in-depth understanding of interfacing techniques
- To understand about different interfacing IC’s available

UNIT I INTRODUCTION AND INTEL 8085 9

Architecture – Instruction format - addressing modes – Simple Program - Basic timing Diagram - Input/ Output – Interrupt system –based system design.

UNIT II 16 – BIT PROCESSORS(INTEL8086) 9

Intel 8086: Architecture – addressing modes and Instruction format interfacing of memory & I/O device – odd and even addressed blanks – storing/retrieval of 16 bit data at an odd address – Simple Programs.

UNIT III INTRODUCTION TO MICRO CONTROLLERS 9

Introduction to Intel 8-bit and 16-bit microcontrollers – 8051 – comparisons to microprocessors - on chip D/A and A/D facilities – Watchdog timer – Capabilities of bit-wise manipulation – real time clock – automatic process control / instrumentation applications case studies – cross assemblers.

UNIT IV INTERFACING BASICS 9

On controlling/monitoring continuous varying (analog) non-electrical signal using microprocessor/microcontrollers need for interfacing ICs – thumb wheel switch as input devices - single LED, seven segment LED as output devices – interfacing these using both memory mapped I/O and peripheral mapped I/O – D/A, A/D ICs and their signals – sample and hold IC and itsusage.

UNIT V INTERFACING IC'S 9

(i) 8255-Programmable Peripheral Interface along with8085
(ii) 8254 – Programmable Interval Timer along with Intel8086
(iii) Need for the following ICs: (a) 8251 – USART; (b) 8257 – Direct Memory Access Controller; (c) 8259 – Programmable Interrupt Controller; (d) 8279 – Keyboard / Display Interface.
(iv) 8085 and 8051 based industrial automations

TOTAL : (45+30) 75 PERIODS

OUTCOMES:

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

- Learn the internal organization of some popularmicroprocessors/microcontrollers.
- Learn hardware and software interaction and integration.
- Learn the design of microprocessors based systems.
- Learn the design of microcontrollers-based systems.
- Design the processor with appropriate interface selection

REFERENCES:

1. Charles M. Gilmore, "Microprocessor: Principles and Applications", McGraw Hill International, 2nd Edition, New York, 1995.
2. Mohammed Ali Mazidi, Jancie Gillispie Mazidi and Rolin K. Mckinlay, "The 805 Microcontroller and Embedded Systems", Pearson Education Ltd., 2nd Edition, New Delhi, 2007.
3. Mohammed Rafiquzzaman, "Microprocessors – Theory and Applications: Intel and Motorola", Prentice Hall, Rev Edition, New Delhi, 1992-2007.
4. Mohammed Rafiquzzaman, "Microprocessors and Micro-computer Based System Design", CRC Press, 2nd Edition, Boca Raton, 1995.

XC5353 OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To provide a clear understanding of the concepts that underlies operating systems.
- Fundamental concepts and algorithms that will be covered are based on those used in existing commercial operating systems.
- To present these topics in a general setting that is not tied to one particular operating system.
- To understand the concept of file and directory structures
- Throughout the course, practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows, and some instructional operating systems will be studied as well.

UNIT I INTRODUCTION AND PROCESSES 10

Systems –Operating-system Structure – Operating System Operation - Protection and Security - Process Concept – Process Scheduling – Operations on Processes – Inter process communication – Communication in Client – Server Systems.

UNIT II PROCESS MANAGEMENT 10

Threads – Multithreading Models – Threading Issues – Critical-Section Problem – Synchronization Hardware - Semaphores – Classic Problems of Synchronization –– Monitors - CPU scheduler – Scheduling criteria – Scheduling algorithms – Multiple-Processor Scheduling

UNIT III DEADLOCKS, MEMORY MANAGEMENT AND VIRTUAL MEMORY 9

Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection –Recovery from Deadlock – Swapping – Contiguous Memory Allocation – Paging – Page Table - Segmentation – Demand Paging – Page replacement – Allocation of Frames – Thrashing.

UNIT IV FILE SYSTEM 11

File concept – Access methods – Directory structure – File-System Mounting – File Sharing - Protection – File-System Structure – File-System Implementation – Directory Implementation – Allocation Methods – Free-Space Management

UNIT V CASE – STUDY: LINUX AND WINDOWS OPERATING SYSTEMS 5

Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – File Systems – Inter Process Communication - Security – Windows XP – Design Principles – System Component – File system

TOTAL: 45 PERIODS

OUTCOMES:

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

- gain extensive knowledge on principles and modules of operating systems
- understand key mechanisms in design of operating systems modules
- understand process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks
- compare performance of processor scheduling algorithms - produce algorithmic solutions to process synchronization problems
- use modern operating system calls such as Linux process and synchronization libraries

REFERENCES:

1. Andrew S. Tanenbaum, “Distributed Operating Systems”, Pearson Education, 1st Edition, Noida, 2003.
2. Dhamdhere, D.M., “Operating Systems”, Tata McGraw Hill Publication, 3rd Edition, New Delhi, 2012.
3. Pramod Chandra P. Bhatt, “An introduction to Operating Systems: Concepts and Practice”, Prentice Hall of India, 4th Edition, New Delhi, 2013.
4. SibsankarHaldar, Alex A. Aravind, “Operating Systems”, Pearson Education, 1st Edition, Delhi, 2009.
5. Silberschatz, A. Galvin, P.B. and Gagne, G., “Operating System Concepts”, John Wiley, 9th Edition, New Jersey, 2014.
6. William Stallings, “Operating Systems”, Prentice Hall, 8th Edition, New Jersey, 2014.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5354	SIGNALS AND SYSTEMS	L T P C 4 0 0 4

OBJECTIVES:

- To understand the concepts of signals and systems
- To design simple systems for generating and demodulating frequency modulated signals
- To understand analog to digital conversion techniques and coding techniques
- To analyze pulse modulation and multiplexing techniques
- To understand the digital modulation and transmission techniques

UNIT I SIGNALS AND SYSTEM ANALYSIS 12

Classification of Signals and Systems – Convolution – Complex Fourier series – Fourier Transform – Magnitude and Phase Spectrum – Power Spectral Density – LTI System Properties - Impulse Response.

UNIT II ANALOG MODULATION TECHNIQUES 12

Amplitude Modulation – Conventional AM, DSB-SC, SSB-SC, VSB – frequency Modulation – Modulation and Demodulation Principles – Spectrum – Bandwidth – Threshold Effects.

UNIT III ANALOG TO DIGITAL CONVERSION AND CODING TECHNIQUES 12

Sampling – Quantization – Signal to Quantization Noise Ratio – Companding Information – Entropy – Entropy Coding Techniques – Shannon Fano Coding – Huffman Coding.

UNIT IV PULSE MODULATION AND MULTIPLEXING 12

Pulse code Modulation –Delta Modulation –Granular and Slope – Overload Errors – Frequency Division Multiplexing – Time Division Multiplexing – Digital Telephone System.

UNIT V DIGITAL MODULATION AND TRANSMISSION 12

Shift Keying Techniques – Binary ASK, Binary FSK, Binary PSK, QPSK – Modulation and Demodulation Principles – Comparison in terms of Bandwidth and Bit Error Rate.

TOTAL: 60 PERIODS

OUTCOMES:

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

- determine the performance of analog modulation schemes
- determine the performance of systems for generation and detection of modulated analog signals
- determine the performance of analog communication systems
- understand the characteristics of pulse amplitude modulation, pulse position and code modulation systems
- analyze the different shift keying techniques for modulation and transmission

REFERENCES:

1. B.P.Lathi and Zhi Ding, “Modern Digital and Analog Communication Systems”, Oxford University Press, 5th Edition, New York, 2019.
2. H.Taub, D.L Schilling, GoutamSaha, “Principles of Communication Systems”, McGraw Hill Education, 4th Edition, New Delhi, 2017.
3. John G.Proakis, Masoud Salehi, “Fundamentals of Communication Systems”, Pearson Education, Delhi, 2nd Edition, 2008.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5361 OPERATING SYSTEMS LABORATORY L T P C
0 0 4 2

1. Basic LINUX commands
2. Shell programming
3. Filters – grep, sed, awk
4. Introduction to C programming with Linux (cc, Makefile, gdb)
5. File Systems - create, open, read, write, close, lseek, stat
6. Process management - Fork, Exec commands, Wait
7. Semaphores
8. Interprocess Communication
9. Simulation of Deadlock
10. Simulation of Scheduling algorithms

TOTAL: 60 PERIODS

XC5362 PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

- Introduction to Python: functions – control structures – debugging
- Strings : Scope – mutable and immutable objects – recursion
- Classes and files : files and exceptions – classes – list manipulations

TOTAL: 60 PERIODS

MA5451 PROBABILITY AND STATISTICS L T P C
4 0 0 4

OBJECTIVES:

- To introduce the idea of one dimensional and two dimensional random variables and the associated properties of their distribution functions
- To impart knowledge of certain special distribution with examples relating to real time situations.
- To enable them to estimate the value of the parameters involved in the specific distribution from a possible continuum of alternatives
- To give an idea of testing the statistical hypothesis claimed based on a set of data points using standard sampling distributions
- To establish relationship that make it possible to predict one or more variable in terms of others using correlation and regression analysis

UNIT I PROBABILIY DISTRIBUTIONS 12

Probability Basics - Baye's Theorem - Random Variables - Probability Distributions - Continuous Random Variables - Probability Density Functions - Multivariate Distributions - Marginal Distributions - Conditional Distributions - Expected Value of a Random Variable - Moments - Moment Generating Functions - Conditional Expectation

UNIT II SPECIAL DISTRIBUTIONS 12

Discrete Uniform Distribution - Bernoulli Distribution - Binomial Distribution - Poisson Distribution - Uniform Distribution - Gamma, Exponential and Chi Square Distributions - Normal Distribution

UNIT III ESTIMATION THEORY 12

Unbiased Estimators - Efficiency - Consistency - Sufficiency - Robustness -Method of Moments - Method of Maximum Likelihood - Interval Estimation of Means, Differences Between Means, Variances and Ratio of Two variances

UNIT IV HYPOTHESIS TESTING 12

Sampling Distributions- Central Limit Theorem -Testing a Statistical Hypothesis - Tests Concerning Means, Differences Between Means, Variances, Analysis of *r x c* Table - Goodness of Fit

UNIT V REGRESSION AND CORRELATION 12

Linear Regression - Method of Least Squares - Normal Regression Analysis - Normal correlation Analysis - Multiple Linear Regression

TOTAL : 60 PERIODS

OUTCOMES:

- It enables the students to understand the nature and properties of density functions and hence determine the moments and moment generating functions of any random variable
- It helps the students to choose appropriate distribution for the real time problems and hence interpret the analysis mathematically
- It make the students to obtain the value of the point estimators using the method of moments and method of maximum likelihood
- It imparts the knowledge of various test statistics used in hypothesis testing for mean and variances of large and small samples
- It equips the students to determine the regression line using the method of least square and also to calculate the partial and multiple correlation coefficient for the givn set of data points

REFERENCES:

1. Gupta S. C. and Kapoor V. K. (2002), "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, New Delhi, 2002.
2. Jay L. Devore, "Probability and Statistics for Engineers", CENGAGE Learning India Private Ltd., Boston, 2008.
3. John E. Freund ," Mathematical Statistics with Applications", 8th Edition, Pearson Education, New Delhi, 2017.
4. Richard A. Johnson, Irwin Miller and John Freund, "Miller and Freund's Probability and Statistics for Engineers", 8th edition, Pearson Education, New Delhi, 2015.

XC5451 THEORY OF COMPUTATION L T P C
4 0 0 4

OBJECTIVES

- To introduce finite state automata as language acceptor of regular sets.
- To introduce context free grammars and context free languages and their normal forms.
- To explain pushdown automata as the language acceptor of context-free language.
- To demonstrate Turing machine as a mathematical model of language acceptor of recursively enumerable language and computer of computing number theoretic functions.
- To explain the Chomsky hierarchy among the formal languages.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I REGULAR SETS AND FINITE STATE AUTOMATA 12

Finite state automata - Deterministic and non-deterministic model – Languages accepted by Finite State Automata - Regular Expression - Pumping Lemma for regular set.

UNIT II CONTEXT FREE LANGUAGE 12

Grammar - Context Free Grammars - Derivation trees - Simplification of context - Free grammar (only Construction and no proof of equivalence of grammars) - Chomsky normal Form - Greibach Normal Form.

UNIT III PUSH DOWN AUTOMATA AND PROPERTIES OF CONTEXT FREE LANGUAGES 12

Pushdown automata - Push down automata and Context free languages - Pumping lemma for context free languages.

UNIT IV TURING MACHINE AND UNDECIDEABILITY 12

Turing Machine model - Computational languages and functions - Modifications of Turing machines (only description, no proof for theorems on equivalence of the modification) - Problems - Properties of recursive and recursively enumerable languages - Universal Turing Machine and the undecidable problem.

UNIT V THECHOMSKY HIERARCHY 12

Regular grammar - Unrestricted grammar - Context Sensitive languages - Linear bounded automata - Relation between classes of languages.

TOTAL: 60 PERIODS

OUTCOMES

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

- Design finite state automata to accept regular sets.
- Form context free grammar to generate context free language and able to obtain its normal form.
- Design pushdown automata to accept a context free language.
- Design Turing machine to accept recursive enumerable language, to compute number theoretic functions and able to understand the limitation of Turing computing model.
- Understand overall set theoretical relationship of formal languages.

REFERENCES:

1. Hopcroft J.E. and Ullman J.D. “Introduction to Automata Theory, Languages and Computation”, Narosa Publishing House,2002.
2. Hopcroft, J.E., Rajeev Motwani and Ullman, J.D. “Introduction to Automata Theory, Languages, and Computation”, Pearson Education, Second Edition, Harlow, 2014.
3. Mishra K.L.P and Chandrasekaran. N, “Theory of Computer Science: Automata, Languages and Computation”, Prentice Hall of India, Third Edition, New Delhi, 2010.
4. Peter Linz, “An Introduction to Formal Languages and Automata”, Jones and Bartlett Publishers, Fifth Edition, Burlington, 2012.

XC5452 DATABASE MANAGEMENT SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- Comprehend the Fundamental Concepts of Data Base Management Systems
- Data Modeling and mapping using Entity Relationship Model and Enhanced Entity Relationship Model
- Comprehend Fundamental knowledge about Relational Algebra
- Comprehend to work with SQL Queries and need of concurrency control
- Understand the need for Normalization and Normalize Relations

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I INTRODUCTION AND CONCEPTUAL DATA MODELING 9

File Systems – Data Base Management Systems – File Systems vs. DBMS – Architecture of a DBMS – Data Models – Data Modeling using Entity- Relationship Model – Strong Entity – Weak Entity – Unary, Binary and Ternary Relationships – Enhanced Entity Relationship Model – Case Studies

UNIT II RELATIONAL DATA MODELS 9

Relational Data Model – Candidate Key – Primary Key – Foreign Key – Relational Algebra Operations – Select – Project – Cartesian Product – Equality Join – Outer Joins – Division – Set Operations – Tuple Relational Calculus – Domain Relational Calculus – Mapping Entity Relationship Model to Relations–Mapping Enhanced Entity Relationship Model to Relations
– Case Studies

UNIT III STRUCTURED QUERY LANGUAGE 9

Structured Query Language – Data Definition Language – Data Manipulation Language – Transaction Control Language – Join Queries – Nested Queries – Views – Procedure – Function – Triggers – Accessing Relational Database using PHP

UNIT IV NORMALIZATION 9

Functional Dependency – Inference Rules for Functional Dependencies – Need for Database Normalization – First Normal Form – Second Normal Form – Third Normal Form – Boyce- Codd Normal Form – Fourth Normal Form – Fifth Normal Form – Properties of Relational Decomposition – Minimal Cover – Equivalence between Functional Dependencies

UNIT V TRANSACTION MANAGEMENT 9

Introduction to Transactions– Desirable Properties of Transaction – Characterizing Schedules based on Recoverability–CharacterizingSchedulesbasedonSerializability–ConcurrencyControl Techniques – Deadlock – Database Recovery Techniques

TOTAL: 45 PERIODS

OUTCOMES:

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

- Distinguish unary, binary, and ternary relationships and give a common example of each.
- Compare and contrast the object oriented model with the E-R and EER models
- Explain the properties of relations and Discuss the first normal form, second normal form, and third normal form
- Use normalization to decompose our relation with anomalies into well structured relations
- Explain how to select an appropriate file organization by balancing various important design factors

REFERENCES:

1. Abrahan Silberschatz, Henry. F. Korth, S. Sudarsan “Database System Concepts”, McGraw Hill, Sixth Edition, New York, 2009.
2. C J Date, A Kannan, S Swamynathan “An introduction to Database Systems”, Pearson, Eighth Edition, New Delhi, 2015
3. Raghu Ramakrishnan, “Database Management Systems”, McGrawHill, Third Edition, Boston, 2014.
4. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson / Addision Wesley, Seventh Edition, Boston, 2016

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5453 **JAVA AND INTERNET PROGRAMMING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the need for object oriented approach towards programming
- To help understand some fundamental basic concepts behind the Java technology.
- To understand how to use Java to create, access, and support Java applications and applets.
- To discuss the portability features of Java and how they are changing the way Web users access applications at the desktop level.
- To stress the need for security in developing applications

UNIT I JAVA FUNDAMENTALS **9**

Introduction – Objects and Classes – Packages – Inheritance – Interfaces and Inner classes – Exceptions – IO Streams – Text Input and Output – Reading and Writing Binary data – Object Streams and Serialization - JAR files.

UNIT II APPLETS AND GUI **9**

GUI programming fundamentals – Event Handling – Swing components – Layout management – Dialog Boxes – Applet Basics – Life cycle of an Applet – Passing information to Applets – Applet Context – Inter-applet communication – GUI programming using Applets and Frames.

UNIT III THREADING AND NETWORKING **9**

Threading – Multithreading – Concurrency – Synchronization – Socket Connections – UDP, TCP based Sockets – Secure Sockets – Multicast Sockets – URL Connection class– Retrieving Data with URLs – Protocol Handlers – Content Handlers – RMI

UNIT IV MARKUP AND SCRIPTING LANGUAGES **9**

Introduction to HTML 5 – Attributes , Events , Web forms 2.0 , SVG , Audio and Video – DHTML – Client Side Scripting −JavaScript – Cascading style sheets –XML – DTD – XML Schema – DOM – SAX –XSL−AJAX−JSON.

UNIT V SERVER SIDE PROGRAMMING **9**

Database Connectivity – JDBC – Servlets – Java Server Pages – Session Handling−Cookies

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, students would be able to:

- Understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
- Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
- Create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, automatic documentation through comments, error exception handling)
- Ensure security in the applications being developed
- Develop applications that are platform independent, language independent.

REFERENCES:

1. Cay S. Horstmann and Gary Cornell, “Core Java, Vol. 1: Fundamentals”, Sun Microsystems Press, 7th Edition, Santa Clara , 2005.
2. Cay S. Horstmann and Gary Cornell, “Core Java, Vol. 2: Advanced Features”, Prentice Hall PTR, 4th Edition, Upper Saddle River, New Jersey, 2002.
3. Deitel and Deitel, “Internet and World Wide Web : How to program”, Pearson, 5th Edition, Boston, 2012.
4. Deitel and Deitel, “Java – How to program”, Prentice Hall of India, 9th Edition, New Delhi, 2013.
5. Robert W. Sebesta, “Programming the World Wide Web”, Addison-Wesley, 8th Edition, Boston, 2015.

XC5454 **COMPUTER NETWORKS** **L T P C**
3 0 2 4

OBJECTIVES:

- To understand the division of network functionality into layers
- To understand the TCP/IP protocol suite
- To understand the flow of data between the nodes and building blocks of networks
- To Learn flow control and congestion control algorithms
- To understand the network addressing techniques

UNIT I FUNDAMENTALS **9**

Data communication – Network Topologies – INTERNET – Protocols and Standards – Layered Architecture – Responsibilities of the Layers – Addressing – Transmission Media – Multiplexing – Switching.

UNIT II MAC LAYER **9**

Error Detection and Correction – Data link Control – Multiple Access – Wired LAN – Wireless LAN – Connecting Devices

UNIT III NETWORK LAYER **9**

Logical Addressing – IPv4, IPv6, IPv4 to IPv6, CLDR – Protocols – IP ICMP, IGMP, ARP, IGRP – Forwarding – Unicast and Multicast Routing Protocols

UNIT IV TRANSPORT LAYER **9**

Process – To – Process Delivery: UDP, TCP, SCTP – Congestion Control and QOS.

UNIT V APPLICATION LAYER **9**

Layer 7 Protocols – DHCP, DNS, TELNET, E-mail, FEP, WWW and Http, SNMP – Network Security.

TOTAL: (45 + 30)75 PERIODS

OUTCOMES:

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

- identify the components required to build different types of networks
- trace the flow of information from one node to another node in the network
- identify the classes of Network address
- choose functionalities at each layer for different applications
- evaluate the protocols in network layer from QOS perspective

REFERENCES:

1. Andrew S. Tanenbaum," Computer Networks", Pearson, 4th Edition, Harlow, 2011.
2. Behrouz. A. Forouzan, "Data communications and Networking", Fifth Edition, Tata McGraw-Hill Publishers, New York, 2013.
3. Behrouz. A. Forouzan,"TCP/IP Protocol Suite", Tata McGraw-Hill Publishers, 4th Edition, New Delhi, 2010.
4. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet ", Pearson, 3rd Edition, Boston, 2011.
5. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A System Approach", Morgan Kaufmann Publishers, 4th Edition, Amsterdam, 2007.
6. M. Barry Dumas, Morris Schwartz, "Principles of Computer Networks and communications", Pearson, 1st Edition, New Jersey, 2013.
7. W. Richard Stevens, G.Gabrani, "TCP/IP Illustrated, Volume 1", Pearson, Boston, 2009.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5461 JAVA AND INTERNET PROGRAMMING LABORATORY L T P C
0 0 4 2

1. Java Classes and Objects
2. Inheritance and Polymorphism
3. Packages, Interfaces and Exception Handling
4. GUI Programming (Swing, Applets)
5. Multi-threaded Applications
6. Socket Programming in Java
7. RMI
8. Client side scripting(HTML 5,XML,AJAX,JSON)
9. Server side scripting(JDBC,JSP,PHP,ASP.NET)

TOTAL: 60 PERIODS

XC5462 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C
0 0 4 2

1. Data Definition Language – Create – Alter – Drop – Enforcing Primary Key and Foreign Key Constraints – Data Manipulation Language – Insert – Delete – Update – Transaction Control Language – Commit – Rollback – Save Points
2. Cartesian Product – Equality Join – Left Outer Join – Right Outer Join – Full Outer Join
3. Set Operations – Creating Views – Creating Sequence – Indexing
4. Aggregate Functions – Analytic Functions – Nested Queries
5. Creating Triggers and Stored Procedures
6. Accessing and Updating a Relational Database using PHP
7. Case Studies – Social Networking Applications

TOTAL: 60 PERIODS

XC5463 COMPUTATIONAL LABORATORY USING R L T P C
0 0 4 2

Implement the following using R:

1. Classification and tabulation of data and graphical and diagrammatic presentation of data
2. Perform calculation that measures the central tendency and dispersion of data and implementation of measures of skewness, moments and kurtosis.
3. Determination of point and interval estimations.
4. Regression analysis and Correlation
5. Plotting of various distributions.
6. Implementation of central limit theorem
7. Case study: complete statistical analysis on any real time dataset

TOTAL: 60 PERIODS

XC5501 CRYPTOGRAPHY AND DATA SECURITY L T P C
4 0 0 4

OBJECTIVES:

- To introduce the students the basic number theory concepts and algorithms related to cryptography.
- Learn the existing crypto-systems and develop problem-solving skills for cryptographic problems and applications.
- To introduce the science and study of methods related to data protection in computer and communication systems from unauthorized disclosure and modification
- To show how to develop techniques for verification, identification, key safeguarding schemes and key distribution protocols
- Learn various methods of encrypting data for security purposes

UNIT I INTRODUCTION TO NUMBER THEORY 9

Modular arithmetic – Euclid's algorithm – Extended Euclid's Algorithm - Fermat Theorem – Euler's theorem - Chinese Remainder Theorem, Modular Exponentiation – Groups, Rings and Fields – Galois Fields – Discrete Logarithms – Primality Testing Using Miller-Rabin Algorithm.

UNIT II CONVENTIONAL ENCRYPTION 9

Conventional encryption model – Cryptanalysis and brute force attack – Substitution Techniques – Caesar cipher, Monoalphabetic cipher, Playfair cipher, Hill Cipher, Polyalphabeitc ciphers, one-Time pad – Transposition Techniques

UNIT III BLOCK CIPHERS CRYPTOGRAHY 9

Block Cipher Principles - Feistel Cipher- Data Encryption Standard – Triple DES –Block Cipher Modes of Operation - Advanced Encryption Standard (AES)

UNIT IV PUBLIC KEY CRYPTOGRAPHY 9

Principles of Public Key Cryptosystem - RSA algorithm – Key Management - Diffie - Hellman key exchange – Elgammal Cryptographic System – Elliptic Curve

UNIT V HASH FUNCTION AND DIGITAL SIGNATURES 9

Hash functions – Requirements and Security – SHA-3 – Message Authentication requirements – Message authentication functions – HMAC – CMAC – Digital Signatures – Digital Signature Requirements – Direct Digital Signature – Digital Signature Algorithm.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Explain basic concepts in number theory and apply modular arithmetic in problem solving
- Understand the setups, the protocols, and the security issues of some existing cryptosystems
- Examine the security of a given cryptosystem
- Implement some simple cryptographic schemes.
- Have knowledge about digital signatures and its standards

REFERENCES:

1. Abhijit Das and Veni Madhavan C.E," Public Key Cryptography – Theory and Practices", Pearson Education, New Delhi, 2009.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay "Cryptography & Network Security", TataMcGraw-Hill, Special Indian Edition, New York, 2011.
3. Biham, E., and Shamir, A., "Differential Crypt analysis of the data encryption standard", Springer Verlag, New York, 2012.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

4. Neal Kobilitz, N., “A course in Number Theory and Cryptography”, Springer Verlag, New York, 2012
5. William Stallings “Cryptography and Network Security: Principles and Practice”, Upper Saddle River, Pearson, New Jersey, 2014.

XC5551 SOFTWARE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To assist the student in understanding the basic theory of software engineering, and
- To apply these basic theoretical principles to a group software development project.
- To understand the importance of analysis and design
- To stress the need for testing before deployment
- To familiarize the functions of a software project manager

UNIT I INTRODUCTION 9

Software - Types of software - Software Engineering - Software Process - Software Process Models - Process Activities - Rational Unified Process – Agile Methods – Plan-driven and agile development – Extreme Programming – Agile Project Management.

UNIT II REQUIREMENT ENGINEERING AND SYSTEM MODELING 9

Functional and Non-functional Requirements - Software Requirements document –- Feasibility Study - Requirements elicitation and analysis - Requirements Specification - Requirements Validation - Requirement Management – Context Models – Interaction Models – Structural Models – Behavioral Models – Model-driven Engineering.

UNIT III SOFTWARE DESIGN AND IMPLEMENTATION 9

System Organization - Modular Decomposition – Cohesion - Coupling – Architectural Design Decisions – Architectural Views – Architectural Patterns – Application Architectures – Object-oriented design using UML – Design Patterns – Implementation issues – Open Source Development.

UNIT IV SOFTWARE TESTING AND QUALITY ASSURANCE 9

Test Case Design – Unit Testing – Component Testing - System Testing – Partition Testing – Test-driven Development - Release Testing - User Testing – Software Quality – Quality Planning - Software Standards – Reviews and Inspection – Software Measurement and Metrics.

UNIT V SOFTWARE PROJECT MANAGEMENT 9

Management Spectrum – People - Product – Process - Project – Process and Product Metrics – Estimation for Software Projects – Project Planning - Project Scheduling – Risk Management – Configuration Management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- perform background research and a feasibility study prior to embarking on a development project.
- collect and analyse user requirements using a formalism such as UML, including business process modeling.
- translate end-user requirements into system and software requirements, using e.g. UML.
- identify and apply appropriate software architectures and patterns to carry out high level design of a system.
- work in a team to implement a project plan, URD, SRD and ADD, by developing detailed designs and code.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES :

1. Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, “Software Engineering”, Prentice Hall India, New Delhi, 2009.
2. Pankaj Jalote, ”Software Engineering : A Precise Approach”, Wiley India, New Delhi, 2011.
3. Pressman, R.S. “Software Engineering: A Practitioner Approach”, 7th Edition Revised, McGraw Hill, Chennai, 2010.
4. Sommerville, I. “Software Engineering”, 9th Edition, Pearson Education, Chennai, 2011.
5. Sommerville, I. “Software Engineering, Global Edition”, 10th Edition, Pearson Higher Education, New Jersey, 2016.

XT5551 DATA WAREHOUSING AND MINING L T P C
3 0 2 4

OBJECTIVES:

- To Create a clean, consistent repository of data within a data warehouse for large corporations
- To explore how data warehousing are explored in business analytics
- To utilize various techniques developed for data mining to discover interesting patterns in large databases
- To expose students to the important functionalities of data mining
- To understand the applications of data mining and its trends

UNIT I DATA WAREHOUSING 9

Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata

UNIT II BUSINESS ANALYSIS 7

Reporting and Query tools and Applications - Online Analytical Processing (OLAP) – Need for OLAP - Multidimensional Data Model – OLAP Guidelines – Categories of OLAP tools – Patten and Models.

UNIT III DATA PREPROCESSING & ASSOCIATION RULE MINING 11

Data Mining: Data Mining Functionalities – Steps in Knowledge Discovery process – Major issues in data mining. Data Objects and Attribute Types - Basic Statistical Descriptions of Data - Data Visualization - Measuring Data Similarity and Dissimilarity. Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation. Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods- Frequent Itemset Mining Methods - Pattern Evaluation Methods.

UNIT IV CLASSIFICATION & CLUSTER ANALYSIS 9

Classification: Basic Concepts - Decision Tree Induction - Bayes Classification Methods - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy. Cluster Analysis – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Evaluation of Clustering.

UNIT V OUTLIER DETECTION, APPLICATIONS AND TRENDS 9

Outlier Detection: Outliers and Outlier Analysis - Outlier Detection Methods - Statistical Approaches - Proximity-Based Approaches - Clustering-Based Approaches - Classification-Based Approaches. Mining Complex Data Types - Other Methodologies of Data Mining - Data Mining Applications - Data Mining Trends .

TOTAL: (45+30) 75 PERIODS

OUTCOMES:

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

- understand why there is a need for data warehouse in addition to traditional operational database systems
- design a OLAP data model and understand the process required to construct
- find some interesting rules along with preprocessing techniques in real time dataset
- understand the details of different algorithms made available and commercial data mining software
- obtain hands-on experience with some popular data mining tools.

REFERENCES:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, 27th Reprint, New York, 2013.
2. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, New Delhi, 2006.
3. Jiawei Han and Micheline Kamber "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, Reprinted, Amsterdam, 2012.
4. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, New Delhi, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, Chennai, 2007.

XC5552 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To introduce asymptotic notations and growth of functions for understanding of running time of algorithms.
- To explain the design of sorting algorithms with correctness and complexity.
- To provide details of design, correctness and the complexity of fundamental Graph Algorithms.
- To introduce string matching algorithms with correctness and complexity
- To explain classification of problems based on the computational complexity

UNIT I ANALYZING ALGORITHMS **12**

Algorithms – Analyzing algorithms – Designing algorithms – Growth of functions Recurrences

UNIT II SORTING **12**

Insertion sort – Quick sort – Divide and Conquer – Merge sort – Heap sort – Lower bounds for sorting.

UNIT III GRAPH ALGORITHMS **12**

Representations of graphs – Breadth-first search – Depth-first search – Minimum spanning tree – The algorithms of Kruskal and Prim – Shortest paths – Dijkstra's algorithm.

UNIT IV STRING MATCHING **12**

The naïve string-matching algorithm – String matching with finite automata – The Knuth-Morris – Pratt algorithm

UNIT V NP COMPLETENESS **12**

Polynomial time – The complexity class NP – NP-Completeness – Reducibility – NP-Complete problems – CLIQUE and Traveling salesman problem.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Describe the complexity of algorithm with appropriate asymptotic notations.
- Use efficient sorting algorithms with comparison as the basic operation for solving sorting problems.
- Use the fundamental graph algorithms in solving optimization problems.
- Use efficient string matching algorithms in string matching problems.
- Able to recognize the complexity class of the given computational problems.

REFERENCES:

1. Baase, S. Computer Algorithms: Introduction to Design and Analysis, 3rd Edition, Addison and Wesley, Boston, 2008.
2. Cormen, T.H., Leiserson, C.E. and Rivest, R.L. Introduction to Algorithms, 2nd Edition, Prentice Hall of India, New Delhi (2009).
3. Levitin, A., Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education (Asia) Pvt. Ltd., Chennai, 2011.

XC5561 SOFTWARE DEVELOPMENT LABORATORY L T P C
0 0 4 2

1. Feasibility Study
2. Requirements Engineering
3. Requirements Analysis
4. Software Design using UML
5. Software Implementation
6. Software Testing

A mini project comprising of the above mentioned phases of software development.

TOTAL: 60 PERIODS

XC5651 OPERATIONS RESEARCH L T P C
4 0 0 4

OBJECTIVES:

- To introduce Linear Programming and their methods
- To provide Integer Programming Algorithms
- To give exposure to Non-Linear programming with applications
- To explain the significance of Decision and Game Theory
- To provide Dynamic Programming with applications

UNIT I LINEAR PROGRAMMING 12

Introduction of OR - Formulation of linear programming models - assumptions of linear programming problems - Graphical solution – Solutions to LPP using simplex algorithm – Two phase method – Big M method - Transportation and Assignment problems.

UNIT II INTEGER PROGRAMMING 12

Introduction – Cutting plane Algorithm – Branch and Bound Algorithm – Zero-one Programming- Goal programming.

UNIT III NON-LINEAR PROGRAMMING 12

Lagrange multipliers – Equality constraints – Inequality constraints – Kuhn-Tucker conditions – Quadratic programming - Replacement models - Inventory Problems.

UNIT IV DECISION AND GAME THEORY 12

Decision making under certainty – Decision making under risk – Decision making under uncertainty – Decision tree analysis - Game Theory – Two person zero sum games, pure and mixed strategies – Theory of dominance - Graphical Solution – Solving by LP

UNIT V DYNAMIC PROGRAMMING 12

Dynamic programming technique – stage coach problem – reliability problem- capital budgeting problem- manpower planning problem – inventory problem - linear programming – integer programming problem.

TOTAL: 60 PERIODS

OUTCOMES:

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

- develop the skills to consider real-world problems and determine whether or not linear programming is an appropriate modeling framework
- understand of the role of algorithmic thinking in the solution of operations research problems
- able to build and solve Transportation Models and Assignment Models
- understand Operations Research models and apply them to real-life problems
- interpret the solutions and infer solutions to the real-world problems.

REFERENCES:

1. F.S. Hillier and G.J. Lieberman, “Introduction to Operations Research”, Tata McGraw Hill, 8th Edition, New Delhi, 2005.
2. H.A. Taha, “Operations Research : An Introduction”, Pearson Education,10th Edition, New Delhi, 2019.
3. J.K. Sharma, “Operations Research: Theory and Applications”, Macmillan India Ltd., 5th Edition, New Delhi, 2012.
4. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, “Linear Programming and Network Flows”, 2nd Edition, Wiley India Pvt ltd, New Delhi, 2008.
5. Philips, Ravindran and Solberg, “Operations Research : Principles and Procatice”, Wiley India Pvt ltd, 2nd Edition, 2007
6. Pradeep Prabhakar Pai: Operations Research and Practice, Oxford University Press, New Delhi, 2012.
7. Richard Bronson and Govindasami Naadimuthu, “Operations Research, (Schaum’s Outlines – TMH edition), Tata McGraw Hill Publishing Company Ltd., 2nd Edition, New Delhi, 2004.

XC5601 PRINCIPLES OF COMPILER DESIGN L T P C

3 0 0 3

OBJECTIVES:

- To know about the steps involved in any language processing system
- To understand the phases of the compiler and its implementation issues
- To learn the memory management during run time environment
- To provide a practical exposure to aspects of theoretical computer science including Languages, Grammars, and Machines
- To exercise and reinforce prior programming knowledge with a non-trivial programming project to construct a compiler.

UNIT I INTRODUCTION AND LEXICAL ANALYSIS 7

Introduction of the Compiler – The Structure of a Compiler – Lexical Analysis: The role of lexical analyzer – Input Buffering – Specification of tokens – Recognition of Tokens - Tools to Generate Lexical Analyzer.

UNIT II SYNTAX ANALYSIS AND INTERMEDIATE CODE GENERATION 11

Role of Parser – Top –down Parsing – Bottom – up Parsing – LR parser – Parser generators Yacc, Intermediate code generation: Variants of syntax trees – Three address code – Types and definitions – Translation of Expressions – Type checking – Control flow – Back Patching.

UNIT III RUN – TIME ENVIRONMENT 9

Storage Organization – Stack Allocation of Space – Access to Non local Data on the Stack – Heap Management – Introduction to Garbage Collection.

UNIT IV CODE GENERATION 9

Issues in the Design of a Code Generator – The Target Language - Addresses in the Target Code – Basic Blocks and Flow Graphs – Optimization of Basic Blocks – A simple Code Generator – Peephole Optimization.

UNIT V MACHINE-INDEPENDENT OPTIMIZATIONS 9

The Principle Sources of Optimization – Introduction to Data-Flow Analysis – Foundations of Data-Flow Analysis – Constant Propagation – Partial-Redundancy Elimination – Loops in Flow Graphs.

TOTAL: 45 PERIODS

OUTCOMES:

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

- implement all phases of the compiler
- design and implement techniques used for optimization of a compiler.
- modify the existing data structures of an open source optimizing compiler.
- design and implement new data structures and algorithms for code optimisation.
- write programmes in LEX and YACC tools.

REFERENCES:

1. Alfred Aho, Monica S. Lam, V. Ravi Sethi and Jeffery Ullman, “Compiler Principles, Techniques and Tools”, Pearson Education, 2nd Edition, Uttar Pradesh, 2013.
2. Allen Holub, “Compiler design in C”, Prentice Hall of India, New Delhi, 1990.
3. Parag H. Dave, Himanshu B. Dave ”Compilers Principles and Practice”, Pearson, New Delhi, 2012.
4. Steven S. Muchnick, “Advanced compiler design implementation”, Morgan Koffman, , Harcourt, 1997.

XT5651 WEB TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages
- To learn server side programming using servlets and JSP
- To develop web pages using XML/XSLT
- To understand Ajax technology and web services

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I WEB SITE BASICS AND HTML 9

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT II SERVER SIDE SCRIPTING 9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT III SERVER SIDE SCRIPTING 9

Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event Handling-Accommodating Noncompliant Browsers Properties of window. Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

UNIT IV JSP AND XML 9

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT V AJAX AND WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design simple web pages using markup languages like HTML and XHTML.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.
- Understand various web services and how these web services interact.

REFERENCES:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Sixth Edition,Pearson Education, Boston, 2007 .
3. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fifth Edition, Pearson Education, Boston, 2012.
4. Marty Hall and Larry Brown,ll Core Web Programmingll Second Edition, Volume I and II, Pearson Education, California, 2001.
5. Bates, —Developing Web Applicationsll, Wiley, Chichester, West Sussex, England, 2006.

XC5652 **ARTIFICIAL INTELLIGENCE** **L T P C**
4 0 0 4

OBJECTIVES

- To know about the basics of Artificial Intelligence
- To know about the various applications of AI
- To learn about the different search strategies in AI
- To learn about intelligent computing algorithms
- To learn to represent knowledge in solving AI problems

UNIT I BASICS OF ARTIFICIAL INTELLIGENCE **9**

Introduction– Definition - Foundations of Artificial Intelligence – AI Applications - Rule-based Expert Systems - Fuzzy Expert Systems - Frame-based Expert Systems – Case Studies

UNIT II SEARCHING STRATEGIES **9**

Classes of search – General State Space Search – Trees, Graphs and Representation – Uninformed Search – Improvements – Algorithm Advantages – Best- First Search – A* Search – Hill Climbing Search – Simulated Annealing – Tabu Search – Constraint Satisfaction Problems

UNIT III KNOWLEDGE REPRESENTATION **9**

Types of Knowledge – Role of Knowledge – Semantic Nets – Frames – Propositional Logic – Predicate Logic – Semantic Web – Computational Knowledge Discovery – Ontology – Communication of Knowledge – Common Sense

UNIT IV INTELLIGENT COMPUTING **9**

Machine Learning Algorithms – Supervised Learning – Unsupervised Learning - Evolutionary Computing – Genetic Algorithms – Genetic Programming – Evolutionary Strategies – Differential Evolution - Fuzzy Logic

UNIT V INTELLIGENT AGENTS **9**

Taxonomy of Robotics – Natural Sensing and Control – Perception with Sensors – Simple Control Architectures – Movement Planning – Robot Programming Languages – Robot Simulators - Anatomy of an agent – Agent Properties and AI – Agent Environments – Agent Taxonomy – Agent Architectures – Agent Languages – Agent Communication

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand the different AI systems
- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the appropriate agent strategy to solve a given problem
- Design software agents to solve a problem

REFERENCES:

1. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents , Cambridge University Press, New York, 2010.
2. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents , Cambridge University Press, Second Edition, 2017.
3. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science) , Jones and Bartlett Publishers, Inc.; First Edition, Burlington, 2008.
4. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Third Edition, Pearson Education , Canada, 2011.

5. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Paperback, Pearson Education limited, United Kingom, 2017.
6. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach , Prentice Hall, Third Edition, New Delhi, 2015.

XC5611 COMPILER DESIGN LABORATORY **L T P C**
0 0 4 2

Implementation of the following using compiler construction tools and C programming

1. Tokenizer with LEX for declarations in C language
2. Tokenizer with LEX for assignment statement
3. Parser with LEX and YACC to validate “for” statement
4. Evaluation of arithmetic expression with LEX and YACC.
5. Symbol table creation from a list of declarations.
6. Syntax tree creation for “if” statement
7. Three address code generation for simple statements using LEX and YACC
8. Three address code generation for array assignments and while statements using LEX and YACC
9. Translation of three address code to assembly language with fixed number of registers
10. Implement a prototype compiler for a subset of an existing language, as a mini-project.

TOTAL: 60 PERIODS

MA5851 ADVANCED STATISTICAL METHODS FOR COMPUTING **L T P C**
4 0 0 4

OBJECTIVES:

- This course provides a sound and rigorous treatment of the basic principles for a proper understanding of the subject matter and for confidence in applying these principles to practical problem solving
- This course provides a solid undergraduate foundation in Time series Analysis and provides an indication of the relevance and importance of the theory in solving real world problems
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis
- To provide information about Estimation theory and regression lines
- To enable the students to use the concepts of design of experiments and factorial design

UNIT I NONPARAMETRIC TESTS **12**

The Sign Test – The Signed-Rank Test – Rank-Sum Tests: The U Test - Rank-Sum Tests: The H Test – Tests Based on Runs – The Rank Correlation Coefficient

UNIT II DESIGN OF EXPERIMENTS **12**

Analysis of Variance - One-way and two-way Classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design – 2^2 Factorial Design – Taguchi’s Robust Design

UNIT III STATISTICAL QUALITY CONTROL **12**

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) Tolerance limits – Acceptance sampling

UNIT IV TIME SERIES **12**

Components of Time Series – Analysis of Time series – Measurement of Trend – Measurement of Seasonal Fluctuations

UNIT V MULTIVARIATE ANALYSIS **12**

Random vectors and Matrices - Mean Vector and Covariance Matrices - Partitioning of Covariance Matrices - Combination of Random Variables for Mean Vector and Covariance Matrix - Multivariate, Normal Density and its Properties - Principal Components: Population principal components - Principal components from standardized variables.

TOTAL: 60 PERIODS

OUTCOMES:

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

- The ability to use the appropriate and relevant, fundamental and applied mathematical and statistics knowledge and methodologies in solving practical problem
- The ability to bring together and flexibly apply knowledge to characterise, analyse and solve a wide range of problems
- An understanding of the balance between the complexity/accuracy of the mathematical/statistical models used and the timeliness of the delivery of the solution.
- The ability to steeped in research methods and rigor
- Critical thinking based on empirical evidence and the scientific approach to knowledge development
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistic

REFERENCES:

1. Dallas E Johnson et al., “Applied multivariate methods for data analysis”, Thomson and Duxbury press, Singapore, 1998.
2. Gupta S.C. and Kapoor V.K.”Fundamentals of Mathematical Statistics”, Sultan and Sons, New Delhi, 2001.
3. Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, Thomson and Duxbury, Singapore, 2002.
4. Johnson, R.A. and Gupta, C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 8th Edition, 2011.
5. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Fifth Edition, New Jersey, 2002.
6. Miller I. and Miller M., “John E. Freund’s Mathematical Statistics with Applications”, Pearson, 8th Edition, New York City, 2019.
7. Krishnaiah, K. and Shahabudeen, P. “Applied Design of Experiments and Taguchi Methods”, Prentice Hall of India, New Delhi, 2012.

XT5851 BIG DATA ANALYTICS **L T P C**
3 0 2 4

OBJECTIVES:

- Introduce big data analytics concepts, its life cycle, challenges, application areas, tools and platforms.
- To study classification and clustering techniques for analyzing big data
- To introduce analytical theory and methods and recommendation system
- To study in detail about Hadoop and data management for big data
- To know about graphical analysis for big data using case studies

UNIT I INTRODUCTION TO BIG DATA ANALYTICS 9

Big Data Overview - State of the Practice in Analytics - Key Roles for the New Big Data Ecosystem - Data Analytics Lifecycle Overview – Phases of life cycle – GINA – Big data Challenges – Application area – Application Tools and Platforms.

UNIT II ADVANCED ANALYTICAL THEORY AND METHODS 9

Clustering: Overview of Clustering - K-means - Classification: Decision Trees - Naïve Bayes - Diagnostics of Classifiers - Additional Classification Methods – Regression : Linear Regression - Logistic Regression - Reasons to Choose and Cautions - Additional Regression Models.

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules- Validation and Testing - Diagnostics - Finding Association& finding similarity. Recommendation System: Collaborative Recommendation- Content Based Recommendation -Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT IV HADOOP AND NoSQL DATA MANAGEMENT FOR BIG DATA 9

Distributed processing and data storage – Hadoop framework – HDFS and data managements using HDFS – Map reduce framework and programming. NoSQL Databases : Schema-less Modelsll: Increasing Flexibility for Data Manipulation - Key_Value Stores- Document Stores - Tabular Stores - Object Data Stores.

UNIT V GRAPH ANALYTICS AND CASE STUDY 9

The Simplicity of the Graph Model- Representation as Triples – Graphs and Network Organization – Choosing Graph Analytics – Graph Analytics Use Cases – Graph Analytics Algorithms and Solution Approaches – Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform – Big data application and case study – Big data in scientific applications – Big data in Health care.

TOTAL: (45+30) 75 PERIODS

OUTCOMES:

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

- Work with big data tools and its analysis techniques
- Design efficient algorithms for mining the data from large volumes
- Design an efficient recommendation system
- Design the tools for visualization
- Learn NoSQL databases and management

REFERENCES:

1. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing Limited, Navi Mumbai, 2013
2. David Dietrich "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, Wiley publishers, Indianapolis, 2015.
3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Burlington, 2013.
4. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction”, Cambridge University Press, Cambridge, 2012.
5. Nitin Sawant and Himanshu shah, “ Big data application Architecture Q & A : A problem solution approach”, Dordrecht : Springer, 2014.
6. Wen – Chen Hu and Naima Kaabouch (eds), “Big data management, technology, and Applications”, IGI Global, Hershey.

XT5852 DISTRIBUTED AND CLOUD COMPUTING L T P C
3 0 2 4

OBJECTIVES:

- To introduce the working structure of distributed computing
- To understand the process of virtualization
- To understand virtualization management with respect to storage and networks
- To familiarize the cloud platform architecture
- To have an overview on cloud storage providers

UNIT I BASICS OF DISTRIBUTED COMPUTING 9

Introduction to Distributed computing – Models of distributed computation - Message Ordering and Group Communication; Termination Detection Reasoning with Knowledge; Distributed Mutual Exclusion - Deadlock Detection- Global Predicate Detection; Distributed Shared Memory

UNIT II VIRTUALIZATION 9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization – Hardware Maximization – Architecture

UNIT III VIRTUALIZATION MANAGEMENT 9

Storage Virtualization – Network Virtualization Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads - Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data centre automation.

UNIT IV CLOUD PLATFORM ARCHITECTURE 9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery – Architectural Design Challenges - Public Cloud Platforms : GAE,AWS – Inter-cloud Resource Management

UNIT V CLOUD STORAGE & SECURITY 9

Overview of cloud storage - Cloud storage providers - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus - Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management

TOTAL: (45+30) 75 PERIODS

OUTCOMES:

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

- Understand the basics of distributed computing
- Gain knowledge on virtualization
- Understand and apply storage and network virtualization
- Develop new cloud platform architectures
- Work with cloud storage providers using real time scenarios

REFERENCES:

1. Ajay D. Kshemkalyani and Mukesh Singhal, “Distributed Computing: Principles, Algorithms, and Systems”, Cambridge, 2008.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Elsevier, Burlington, 2013.

3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, Elsevier Science, Amsterdam, 2013.
4. Sunita Mahajan and Seema Shah, “Distributed Computing”, 2nd edition, Oxford Univ. Press, New Delhi, 2013

GE5851 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation
- To identify the causes and effects on environmental pollution and natural disasters
- To impart knowledge on renewable and non-renewable resources by employing sustainable measures for their preservation
- To have a sound knowledge on the long and short term environmental issues
- To familiarize the students on human value education, consumerism and role of technology in environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids, ecotone, ecological niche – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution- oil pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, Tsunami, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Human population growth and environmental constrains, Environmental ethic in population growth-variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- õ Will be exposed to the functions of environment, ecosystems and biodiversity and their conservation
- õ Will be acquitted with the causes and effects of environmental pollution and natural disasters
- õ Will be familiar on renewable and non-renewable resources by employing sustainable measures for their preservation
- õ Will recognize the different forms of energy and apply them for societal development
- õ Will have a sound knowledge on the long and short term environmental issues
- õ Will be familiarized on human value education, consumerism and role of technology in environmental issues

REFERENCES:

1. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2006.
2. Cunningham, W.P. Cooper, T.H. Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, “Environmental law”, Prentice Hall of India PVT LTD, New Delhi, 2007.
4. Gilbert M. Masters Wendell P Ela, “Introduction to Environmental Engineering and Science”, 3rd edition, Pearson Education, Harlow, 2014.
5. R.K. Trivedi, “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media, Karad. 1996.
6. Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press New Delhi, 2005.

MA5951 NUMERICAL METHODS L T P C
4 0 0 4

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving Eigen value problems and linear system of equations.
- To apply the techniques of interpolation for equal and unequal intervals for the given data.
- To understand and to apply the techniques of numerical integration and differentiation for solving and ODE in applying day today life.
- To familiar in solving initial value problems and ODE for given initial and boundary conditions.
- To demonstrate to utility of Numerical techniques of solving Partial Differential Equations in Heat and Fluid problems.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Iterative method and Newton - Raphson method for Algebraic and Transcendental Equations. Solutions of linear system by Gaussian, Gauss-Jordan, Jacobi and Gauss-Seidel methods. Inverse of a matrix by Gauss-Jordan method. Eigenvalue of a matrix by Power methods

UNIT II INTERPOLATION 12

Newton's divided difference formula, Lagrange's formula. Newton's forward and backward difference formulae, Natural Cubic Spline

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Numerical differentiation with interpolating polynomials, Numerical integration by Trapezoidal and Simpson's 1/3rd rule. Double integrals using Trapezoidal and Simpson's rules

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single Step Methods-Taylor Series, Euler and Modified Euler, methods for first order differential equations, Runge-Kutta method of order four for first and second order differential equations. Multistep Methods-Milne and Adam's-Bashforth predictor and corrector methods for first order differential equations

UNIT V BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (explicit scheme), one dimensional wave equation and two dimensional Laplace and Poisson equations

TOTAL: 60 PERIODS

OUTCOMES:

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

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to the algebraic and transcendental equations.
- Apply numerical methods to obtain approximate solutions to mathematical problems using interpolation.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods in solving ODE of First and Second order equations.
- Understand various numerical techniques for solving PDE, for given conditions in Heat and Fluid flow problems.

REFERENCES:

1. Grewal, B.S, and Grewal J.S., "Numerical Methods in Engineering and Science", 39th Edition, Khanna Publishers, New Delhi, 2005.
2. John H. Mathews, "Numerical Methods for Mathematics, Science and Engineering", 2rd Edition, Prentice-Hall of India, New Delhi, 2005.
3. Sankara Rao, K., "Numerical methods for scientists and Engineers", 3rd Edition, Prentice-Hall of India, New Delhi, 2008.
4. Sastry, S. S., "Introductory Methods of Numerical Analysis", 3rd Edition, Prentice-Hall of India, New Delhi, 2004.
5. Veerarajan, T. and Ramachandran, T., "Numerical Methods with Programming in C", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5951 **INTERNET OF THINGS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To build IoT using Rasberry Pi
- To build IoT with Galileo and Arduino
- To apply the concept of Internet of Things in the real world scenario

UNIT I FUNDAMENTALS OF IoT **9**

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M

UNIT II IoT DESIGN METHODOLOGY **9**

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development

UNIT III BUILDING IOT WITH RASPBERRY PI **9**

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services

UNIT IV BUILDING IOT WITH GALILEO/ARDUINO **9**

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks

UNIT V CASE STUDIES AND ADVANCED TOPICS **9**

Various Real time applications of IOT- Connecting IOT to cloud – Cloud Storage for IOT – Data Analytics for IOT – Software & Management Tools for IOT

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of the course the student should be able to:

- Have a broad understanding of designs, protocols and IoT levels
- Design a portable IOT using Arduino/ equivalent boards and relevant protocols
- Develop web services to access/control IOT devices
- Deploy an IOT application and connect to the cloud
- Analyze applications of IOT in real time scenario

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, Hyderabad, 2015.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, Berkeley(CA) , 2014.
3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, Birmingham, 2014.
4. Nasreddine Bouhai, Iman Saleh, “Internet of Things: Evolutions and Innovations”, John Wiley & Sons, Hoboken(NJ), 2017
5. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, “Internet of Things: Architectures, Protocols and Standards”, John Wiley & Sons, Hoboken(NJ), 2019.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5951 ADVANCED MACHINE LEARNING TECHNIQUES L T P C
3 0 2 4

OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability based learning techniques
- To understand graphical models of machine learning algorithms
- To work on real life case studies and process datasets to extract knowledge

UNIT I BASICS OF MACHINE LEARNING 9

Machine Learning - Machine Learning Foundations – Types of machine learning - Basic concepts in machine learning – Polynomial Curve Fitting - Curse of Dimensionality - Probability Distributions

UNIT II LEARNING MODELS 9

Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison - Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression.

UNIT III ARTIFICIAL NEURAL NETWORKS 9

Feed-Forward Network Functions – Network Training – Error Back propagation – Hessian Matrix – Regularization – Mixture Density Networks – Bayesian Neural Networks

UNIT IV DEEP LEARNING 9

Common Architectural Principles – Building Blocks - Unsupervised Pretrained Networks – Convolutional Neural Networks – Recurrent Neural Networks – Recursive Neural Networks

UNIT V APPLICATIONS AND CASE STUDIES 9

Machine Learning applications in Computer Vision, Network Security, Healthcare, Education, Space Research, Artificial Intelligence – Case Studies in machine learning techniques

TOTAL: (45+30) 75 PERIODS

OUTCOMES:

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

- set up a well-defined learning problem for a given task
- select and define a representation for data to be used as input to a machine learning algorithm
- compare different algorithms according to the properties of their inputs and outputs
- compare different algorithms in terms of similarities and differences in the computational methods used
- develop and describe algorithms to solve a learning problem in terms of the inputs, outputs and computational methods used.

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer,reprint of the 1st edition, New York, 2006.
2. Danish Haroon, “Python Machine Learning Case Studies”, Apress, Berkeley (CA), 2017.
3. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, New Delhi, 2005.
4. Josh Patterson and Adam Gibson, “Deep Learning : A Practitioner’s Approach”, OReilly, 1st edition, Sebastopol (CA) ,2017.
5. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, Cambridge ,2012.
6. Tom Mitchell, "Machine Learning", McGraw-Hill, Singapore, 1997.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

MA5961 **NUMERICAL METHODS LABORATORY** **L T P C**
0 0 4 2

Implement the following algorithms:

1. Gaussian Elimination method
2. Gauss - Jacobi and Gauss - Seidal methods
3. Power methods
4. Lagrange's interpolation
5. Newton – cotes Formulae
6. Gaussian Quadrature
7. Spline Appriximation
8. 4^{th} order Runge – kutta method
9. Milne Thomson and Adams BAshforth Methods
10. Finite Difference methods for : Boundary value problemsin ODE, Ellipticn Equations, Parabolic Equations and Hyperbolic Equations.

TOTAL: 60 PERIODS

XT5961 **INTERNET OF THINGS LABORATORY** **L T P C**
0 0 4 2

Working with Arduino – configuring basic sensors – getting data from sensors – processing the data – Working with Raspberry Pi – Activating lights/actuators/motors based on the sensor data Suggested list of applications

1. Automatic Street Lighting system
2. Smart Water Monitoring system
3. Automatic Smart Parking system
4. Multi Room Music Player using IoT
5. Smart Home Monitoring system

TOTAL: 60 PERIODS

XT5071 **.NET PROGRAMMINING** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn basic concepts in in C#.
- To Know the object oriented aspects of C#.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP.NET.
- To introduce advanced topics namely data connectivity, WPF, WWF and WPF with C# and .NET 4.5.
- To implement mobile applications using .NET compact framework.

UNIT I C# LANGUAGE BASICS **9**

.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts - Indexers

UNIT II C# ADVANCED FEATURES **9**

Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions - Reflection

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9

Diagnostics -Tasks, Threads and Synchronization - .Net Security - Localization - Manipulating XML- SAX and DOM - Manipulating files and the Registry- Transactions - ADO.NET- Peer-to-Peer Networking - PNRP - Building P2P Applications - Windows Presentation Foundation (WPF)

UNIT IV WINDOW BASED APPLICATIONS, WCF AND WWF 9

Window based applications - Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services - .Net Remoting - Windows Service - Windows Workflow Foundation (WWF) - Activities -Workflows

UNIT V .NET FRAMEWORK AND COMPACT FRAMEWORK 9

Assemblies - Shared assemblies - Custom Hosting with CLR Objects - Appdomains - Core XAML - Bubbling and Tunneling Events- Reading and Writing XAML - .Net Compact Framework - Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

TOTAL: 45 PERIODS

OUTCOMES:

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

- List the major elements of the .NET Frame work
- Analyze the basic structure of a C# application
- Write various applications using C# Language in the .NET Framework
- Develop distributed application using .NETFramework
- Create Mobile Application using .NET compactFramework

REFERENCES:

1. Andrew Troelsen, Philip Japiske, “C# 6.0 and the .NET 5 Framework”, 7th edition, Apress Publisher, New York, 2015.
2. Andy Wigley, Daniel Moth, Peter Foot, ”Mobile Development Handbook”, Microsoft Press, Sebastopol, 2011.
3. H.M. Deitel and P.J. Deitel,“ C# How to Program“,Pearson Education, 10th Edition, Boston, 2017.
4. Harsh Bhasin, “Programming in C#”, Oxford University Press, New Delhi, 2014
5. Herbert Schildt, “The Complete Reference : C# 4.0”, Tata McGraw Hill, Fourth Edition, New York, 2017.
6. Ian Gariffiths, Mathew Adams, Jesse Liberty, “Programming C# 4.0”,O‘Reilly, Fourth Edition, Sebastopol, 2010.

MA5071 LINEAR ALGEBRA L T P C

3 0 0 3

OBJECTIVES:

- To acquire the thorough knowledge in vector space, sub spaces, basis and dimensions
- To impart the basic idea of linear transformations, their representation by matrices, geometry of linear operators and change of basis
- To build a base in the analysis of a single linear transformation on a finite dimensional vector space; the analysis of characteristics, values and diagonalizable transformations
- To set a base in the study of finite dimensional inner product spaces in detail, orthogonality, orthogonal projections and the diagonalization
- To follow the required vector space in real time applications such as networks, linear programming, statistics and probability

UNIT I VECTOR SPACES 9

Vector spaces and subspaces – Linear combinations and Linear system of equations, Span, Linear independence and dependence - Null space, Column space, and Row space – Basis and dimension of a vector space.

UNIT II LINEAR TRANSFORMATION 9

Introduction to linear transformations – General Linear Transformations – Rank and nullity - Kernel and range – Matrices of general linear transformation- Geometry linear operators- Change of basis.

UNIT III INNER PRODUCT SAPCES 9

Inner product, Length, angle and orthogonality – Orthogonal sets – Orthogonal projections – Inner product spaces – Orthonormal basis: Gram-Schmidt process – QR Decomposition- Best Approximation, Least-squares.

UNIT IV EIGEN VALUES AND EIGEN VECTORS 9

Introduction to Eigen values- Diagonalizing a matrix- Orthogonal diagonalization-, Applications to differential equations- Positive definite matrices- Similar matrices –Quadratic forms-Quadratic surfaces Singular value decomposition.

UNIT V APPLICATIONS 9

Matrices in Engineering – Graphs and Networks – Markov Matrices, Populations and Economics – Linear Programming – Fourier Series: Linear Algebra for functions – Linear Algebra for statistics and probability.

TOTAL: 45 PERIOD

OUTCOMES:

- The student can set up the base in the basic concepts of vector spaces and dimensions
- Able to study completely about linear transformations and matrices
- Will be familiarized with the techniques of diagonalization by inner product spaces
- Made the objectives clear to get the Eigen values and Eigen vectors required for diagonalization
- Be ready to apply the linear algebra concepts of solving real time problems in various fields

REFERENCES:

1. David C. Lay, “Linear Algebra and its Applications", Pearson Education, third edition, Delhi, 2011.
2. Gilbert Strang, “Linear Algebra and its Applications”, Thomson Learning, fourth edition, Belmont, 2006.
3. Howard Anton and Chris Rorres, “Elementary Linear Algebra”, Wiley, New York, 2011.
4. Kenneth Hoffman & Ray Kunze, “Linear Algebra”, Pearson India education services, second Edition, Noida, 2015.
5. Steven J. Leon, “Linear Algebra with Applications”, Pearson Education UK, Linear Algebra with Applications, 2006.

XT5072 INFORMATION CODING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of these codes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9

Uncertainty – Information and entropy – Source coding theorem – Kraft's Inequality - Huffman coding – Shannon Fano coding – Lempel-Ziv Algorithm – Run Length Encoding.

UNIT II CHANNEL CAPACITY AND CODING 9

Channel Models - Discrete memory less channels – Channel capacity – Channel coding theorem - Information capacity theorem.

UNIT II ERROR CONTROL CODING 9

Linear block codes – Matrix Description - Equivalent codes – Parity Check Matrix – Decoding of Linear Block Code – Syndrome decoding –Cyclic codes – Generator polynomial – Encoder for cyclic codes – Cyclic Redundancy Check (CRC) codes - Convolutional codes – Tree codes – Trellis codes – Viterbi Decoding of Convolutional codes.

UNIT IV TEXT AND IMAGE COMPRESSION 9

Compression Principles – Text compression – Static Huffman coding – Dynamic Huffman coding – Arithmetic coding – Image compression – Graphics interchange format – Tagged image file format – Digitized documents - JPEG

UNIT V AUDIO AND VIDEO CODING 9

Audio compression – Differential pulse code modulation – adaptive differential PCM – adaptive predictive coding - Linearpredictive coding – video compression principles- H.261- H.263 – MPEG – MPEG-1 – MPEG-2 – MPEG-4

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the subject, students would have learnt about:

- Design an application with error-control
- The basic notions of information and channel capacity.
- Convolutional and block codes, decoding techniques
- How error control coding techniques are applied in communication systems.
- Compression techniques for text, image, audio and video

REFERENCES:

1. Amitabha Bhattacharya," Digital Communication", Tata McGraw-Hill, New Delhi,2015.
2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Asia, Delhi, 2001.
3. K. Sayood, "Introduction to Data Compression", Third Edition, Elsevier, San Francisco, 2006.
4. R. Bose, "Information Theory, Coding and Cryptography", Tata McGraw-Hill, New Delhi, 2008.
5. S. Gravano, "Introduction to Error Control Codes", Oxford University Press, Oxford, 2007.

XT5073 HUMAN COMPUTER INTERFACE L T P C
3 0 0 3

OBJECTIVES:

- To learn the principles and fundamentals of Human computer interaction (HCI)
- To analyze HCI theories, as they relate to collaborative or social software.
- To establish target users, functional requirements, and interface requirements for a given computer application.
- To understand user interface design principles, and apply them to designing an interface.
- To know the applications of multimedia on HCI.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I DESIGN PROCESS 9

Humans – Information process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive systems – Usability – Paradigm shift – Interaction design basics – Design Process – Scenarios – Users need –Complexity of design

UNIT II DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS 9

Software Process – Usability engineering – Issue based Information systems – Iterative design practices – Design rules – maximum usability – Principles – Standards and guidelines – design patterns – Programming Tools – Windowing systems – Interaction tool kit – User Interface management system – Evaluation techniques – evaluation design – Evaluating implementations – Observational Methods

UNIT III MODELS 9

Universal design principles – Multimodal systems – User Support – Presentation and Implementation Issues – types – requirements – approaches – Cognitive model – Hierarchical model – Linguistic model – physical and device models – Sociotechnical models – Communication and Collaboration models – Task models – Task analysis and design

UNIT IV EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI 9

Basic Design structure – Single independent variable – multiple independent variable – factorial design – split-plot design – random errors – experimental procedure – Statistical analysis – T tests– Analysis of Variance test – Regression – Chi-Square test – Survey – Probabilistic sampling – Non-probabilistic sampling – developing survey questions

UNIT V THEORIES 9

Dialogue notations and design – Dialogue need – dialogue design notations – Graphical – Textualrepresenting dialogue – formal descriptions – Dialogue analysis – System models – Interaction models – relationship with dialogue – Formalisms – Formal notations – Interstitial behavior – Virtual reality – Modeling rich interaction – Status Event analysis – Properties – Rich contexts – Sensor-based systems – Groupware – Applications – Ubiquitous computing – Virtual reality

TOTAL: 45 PERIODS

OUTCOMES:

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

- interpret the contributions of human factors and technical constraints on human– computer interaction.
- evaluate the role of current HCI theories in the design of software.
- apply HCI techniques and methods to the design of software.
- categorize and carefully differentiate various aspects of multimedia interfaces.
- design and develop issues related to HCI for real application.

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Prentice Hall, Human Computer Interaction, 3rd Edition, New Jersey, 2004.
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs and Niklas Elmqvist, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Pearson, sixth edition, Boston, 2018.
3. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser,Research Methods in Human-Computer Interaction , Wiley, New Delhi, 2010.

XT5074 **OPEN SOURCE SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To expose the context and operation of open source software.
- To understand open source operating system and database.
- To learn programming language like: PHP – Python.
- To learn configuration of web servers.
- To learn some important OSS tools.

UNIT I PRINCIPLES OF OPEN SOURCE SOFTWARE 9

Introduction to Open Source - The Philosophy of OSS - The Cathedral and Bazaar Model - Commercial Software and OSS - Free Software and Freeware - Open Source Licenses - Copyrights and Copyleft – Patents - Economics of FOSS:Zero Marginal Cost - Income - Generation Opportunities - Problems with Traditional Commercial Software - Internationalization.

UNIT II OPEN SOURCE OPERATING SYSTEMS AND DATABASE 9

Kernel Types - Architectures - Supported File Systems -Security Issues - Case Study: Flavors Of Linux - SQL Standard Compliance - Supported Platforms - Programming Interfaces. Case Study: Mysql - Internals and Portability - Data Types - Security - Scalability - Connectivity - Localization - Postgresql - Couchdb - Hbase.

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES 9

Introduction to Open Source Programming and Scripting Languages- Execution Environment - Programming in Web Environment - File Handling and Data Storage - Working with Forms - Case Study: PHP - Python.

UNIT IV OPEN SOURCE WEB SERVER 9

Web Server - Feature – Architectures - **Case Study:** Apache Web Server - Configuring and Using Web Server - Comparison of Apache Web Server with Commercial Web Servers.

UNIT V TOOLS AND TECHNOLOGIES 9

Integrated Development Environment for Development and Testing - Text Processing Tools - E-Learning Tools - Version Control and Content Management Tools - Parallel and System Programming Tools - Virtualization and Cloud Computing - Social Network Engine.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

- install and run open-source operating systems.
- apply the security concept in open source database.
- contribute software to and interact with Free and Open Source Software development projects.
- build and modifyone or more Free and Open Source web server's configuration.
- use a version control system.

REFERENCES:

1. Brian D Foy, "Mastering Perl", O'Reilly Media, Second Edition, California, 2014.
2. Christopher Negus and Christine Bresnahan, "Linux Bible", Wiley, 8th Edition, Washington, 2015.
3. Julie Meloni, "Teach Yourself PHP, MySQL and Apache All in One", Sams Publishers, Fifth Edition, Indiana, 2012.
4. KailashVadera and Bhavyesh Gandhi, "Open Source Technology", University Science Press, First Edition, New Delhi, 2009.
5. SandeepKoranne, "Handbook of Open Source Tools", Springer Science & Business Media, Heidelberg, 2010.

XC5071 **HIGH SPEED NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES:

- To facilitate the students on the basis of ATM and Frame relay concepts and explain the various types of LAN's and to know about their applications.
- To provide an overview of high-speed networking technologies.
- To learn the enhanced set of functionalities for high-speed networking.
- To understand the underlying concept involved for high performance
- To Enable the students to know techniques involved to support real-time traffic and congestion control

UNIT I HIGH SPEED NETWORKS 9

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet – Gigabit Ethernet– Fibre Channel – Wireless LAN's: applications, requirements – Architecture of 802.11.

UNIT II CONGESTION AND TRAFFIC MANAGEMENT 8

Queuing Analysis – Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III TCP AND ATM CONGESTION CONTROL 12

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats – ABR Capacity allocations – GFR traffic management.

UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES 8

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services - RSVP - RTCP.

UNIT V MPLS NETWORKS 8

Multiprotocol Label Switching – Operations - Label Stacking - Protocol Details – Congestion Control and Routing in MPLS networks – MPLS Virtual Private Networks - MPLS Traffic Engineering.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the subject, students would be able to:

- Understand the building blocks and operation of high speed networking technology including the hardware and software components.
- Understand the concepts of frame relay and ATM.
- Understand the concepts of traffic management in Single server queues.
- Understand the congestion control mechanisms in TCP.
- Understand the integrated and differentiated services and MPLS networks.

REFERENCES:

1. Irvan Pepelnjk, Jim Guichard, and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
2. Sumit Kasera, "ATM Networks: Concepts and Protocols", McGraw-Hill Professional, New York, 2006.
3. Walrand, Pravin Varaiya, "High performance communication networks", 2nd Edition , Jean Harcourt Asia Pvt. Ltd., San Francisco, 2000.
4. William Stallings, "High speed networks and internet", 2nd Edition, Pearson Education, Noida, 2010.

XC5072 **UNIX INTERNALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the design of the UNIX operating system
- To become familiar with the various data structures used
- To learn the various low-level algorithms used in UNIX
- To learn about different file systems
- To learn I/O and memory management policies

UNIT I OVERVIEW **9**

General Overview of the System - History – System structure – User perspective –Operating system services – Assumptions about hardware - Introduction to the Kernel - Architecture of the UNIX operating system – Introduction to system concepts - The Buffer Cache - Buffer headers – Structure of the buffer pool – Scenarios for retrieval of a buffer– Reading and writing disk blocks– Advantages and disadvantages of the buffer cache

UNIT II FILE SUBSYSTEM **9**

Internal representation of files - Inodes – Structure of a regular file – Directories –Conversion of a path name to an Inode – Super block – Inode assignment to a new file – Allocation of disk blocks.

UNIT III SYSTEM CALLS FOR THE FILE SYSTEM **9**

Open – Read – Write – File and record locking – Adjusting the position of file I/O – Lseek – Close – File creation – Creation of special files – Changing directory – root – owner - mode – stat and fstat – Pipes – Dup – Mounting and unmounting file systems – link – unlink

UNIT IV PROCESSES **9**

Process states and transitions – Layout of system memory – The context of a process –Saving the context of a process – Manipulation of the process address space – Sleep - Process Control - Process creation – Signals – Process termination – Awaiting process termination – Invoking other programs – user id of a process – Changing the size of a process - Shell – System boot and the INIT process– Process Scheduling

UNIT V MEMORY MANAGEMENT AND I/O **9**

Memory Management Policies - Swapping – Demand paging - The I/O Subsystem -Driver Interface – Disk Drivers – Terminal Drivers

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able:

- To analyze the internals of the unix operating system.
- To make use of the various data structures
- To implement various low-level algorithms used in UNIX
- To design memory management schemes

REFERENCES:

1. B. Goodheart, J. Cox, “The Magic Garden Explained”, Prentice Hall of India,New Delhi,1994.
2. Maurice J. Bach, “The Design of the Unix Operating System”, First Edition,Pearson Education, 1999.
3. S. J. Leffler, M. K. Mckusick, M. J. .Karels and J. S. Quarterman., “The Design and Implementation of the 4.3 BSD Unix Operating System”, Addison Wesley, 1998.

XT5075 **DATABASE TUNING** **L T P C**
3 0 0 3

OBJECTIVES:

- To get the feel of basics of database tuning.
- To learn concepts behind database design optimization.
- To write procedures involving query planning.
- To understand how troubleshooting is done
- To formulate new indexing methods

UNIT I FUNDAMENTALS OF TUNING **9**

Review of Relational Databases – Relational Algebra - Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Transaction Chopping – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Recovery Tuning– Operating Systems Considerations – Hardware Tuning.

UNIT II INDEX TUNING **9**

Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Comparison of Indexing and Hashing techniques – Hot Table – Storage Structure Optimization through Index Tuning.

UNIT III DESIGN AND QUERY OPTIMIZATION **9**

Tuning Relational Systems – Normalization – Tuning De-normalization – Clustering Two Tables – Aggregate Maintenance – Record Layout –Triggers – Client Server Mechanisms – Types of Queries – Query Tuning.

UNIT IV INTERFACE AND CONNECTIVITY TUNING **9**

Objects, Application Tools and Performance –Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases – ODBC – JDBC Tuning — Case Studies: Tuning E-Commerce Application– Data Warehouse Tuning.

UNIT V TROUBLESHOOTING **9**

Query Plan Explainers – Performance Monitors – Event Monitors – Finding —Suspicious Queries – Understanding Access Plans – Analyzing a Query‘s Access Plan – Profiling a Query Execution – Analyzing DBMS Subsystems and Hardware Resources – SQL performance Analyzer – Time Series Databases – Configuration Parameters: Oracle; SQL Server; DB2UDB.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design databases involving normalization.
- Write optimized code for accessing multiple databases.
- Use tuning tools for different database operations.
- Troubleshoot database issues.
- Use benchmark databases for demonstrating concepts behind database tuning.

REFERENCES:

1. Dennis Shasha and Philippe Bonnet —Database Tuning, Principles, Experiments, and Troubleshooting Techniques, Morgan Kaufmann: An Imprint of Elsevier, SanFrancisco, 2003.
2. Peter Gulutzan and Trudy Pelzer, —SQL Performance Tuning, Addison-Wesley, First Edition, Boston, 2002.
3. Richard Niemiec, —Oracle Database 11g Release 2 Performance Tuning Tips and Techniques, McGraw Hill Osborne, New York, 2012.
4. Thomas Connolly and Carolyn Begg, —Database Systems: A Practical Approach to Design, Implementation and Management, Fifth Edition, Pearson Education, Boston, 2009.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5076 **SOFTWARE PROJECT MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To develop an awareness of the need for project planning and management
- To understand workflows of the software management process
- To study about the stages involved in the system development lifecycle process
- To explain the procedures needed to monitor, control and report on quality
- To explain the ways in which project can be done in cost effective ways

UNIT I OVERVIEW OF SOFTWARE PROJECT MANAGEMENT 9

Conventional software management - Evolution of software economics - Improving software economics - Conventional Vs Modern software project management.

UNIT II SOFTWARE MANAGEMENT PROCESS FRAMEWORK 9

Lifecycle phases - Artifacts of the process - Model based software architectures -Workflows of the process - Checkpoints of the process.

UNIT III SOFTWARE MANAGEMENT DISCIPLINES 9

Iterative process planning - Organization and Responsibilities - Process automation - Process control and process instrumentation - Tailoring the process. Project planning - Scheduling - Tracking and Control - Time and Cost overruns - Project organization - Staffing - Group working - Team dynamics

UNIT IV MANAGED AND OPTIMIZED PROCESSES 9

Quality management and ISO 9000 quality assurance method - Configuration management - Quality reviews - Software standards - Tracking of defects - Process improvements - SCI/CMM models - Other process models - Data gathering and analysis Principles of data gathering - Data gathering process - Software measures - Data analysis - Managing software quality - Defect prevention.

UNIT V CASE STUDIES 9

COCOMO Cost estimation model - Change metrics - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop project that matches the organizational needs to the most effective software development model
- Effectively process project workflow
- Managing people and do effective communications among people and do effective planning to meet changes in software developmental stages.
- Select and employ mechanisms for tracking the software projects and maintaining Quality
- To develop the skills for tracking and controlling software deliverables

REFERENCES:

1. Bob Hughes, Mike Cotterell, “Software Project Management”, 5th edition, Tata McGraw Hill,New Delhi, 2009.
2. Humphrey Watts, “Managing the software process”, Reading, Massachusetts Addison Wesley, 1989.
3. Ramesh Gopalaswamy, “Managing Global Software Projects”, Tata McGraw Hill, New Delhi, 2006.
4. Walker Royce “Software Project Management A Unified Framework”, Pearson Education, 2004.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5077 **PERSONAL SOFTWARE PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

- To study how to manage and track the time for software processes and personal life
- To study how to plan a product and how to measure size of a product
- To learn how to schedule a process and how to be committed in work.
- To learn about software Development process and how to produce defect free product.
- To learn how to estimate the product and process quality.

UNIT I OVERVIEW AND PLANNING PROCESS **9**

Overview of Software Development Life cycle – Overview of PSP – Different levels of PSP – Importance of Statistical data - Why do planning? – Size and Time – Process and sequencing – Tracking – Making the plan – Common planning tools – Software size.

UNIT II SOFTWARE SIZE, PROBE SIZE ESTIMATION AND SCHEDULE ESTIMATION **9**

Estimation Process - Common estimation techniques – Function points – PROBE overview - Time estimation – size estimation – Time in phase - Planning development time – Estimating task time – Schedule estimating -– Software size estimation.

UNIT III DESIGN AND CODE METHODOLOGIES AND REVIEWS **9**

Advantages – Effectiveness data – justifying time investment – setting up a review process – Heuristics for design review – - Design and Coding methodologies - Review metrics – Derived metrics – checklists – Different Review Mechanism – Importance of review – Different types of testing.

UNIT IV SOFTWARE QUALITY MANAGEMENT AND PROCESS DESCRIPTION **9**

Quality Management, Hurdles to Quality – Different Statistical tools - Quality economics – Metrics for cost of quality – Effects of yield variance on schedule – Defect removal process – using casual analysis – Benefits of process definition – process components – Defining phases.

UNIT V DATA SUMMARY AND CAUSAL ANALYSIS AND DEVELOPING PSP PROCESS SCRIPTS **9**

Defect removal – Basic resource – Causal Analysis Techniques –– Tracking – Overall defect rates – Reduce compile and test defects –Refining time estimation – Developing PSP Process scripts Tailoring PSP Process Scripts to the needs.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain software development life cycle
- Analyze, prioritize, and manage requirements and do scheduling the jobs based on estimation plan
- Design checklist which is used in reducing defect injection in coding and planning
- Identify and prioritize risks in producing quality product
- Do analyze the root cause for defect and will be committed towards quality

REFERENCES:

1. Humphrey, W.S., “Introduction to Personal Software Process”, Pearson Education (Singapore) Pvt., Ltd., Delhi, 2003.
2. Raghav S. Nandyal, “ Making Sense of Software Quality Assurance”, 1st Edition, Tata McGraw Hill, New Delhi, 2007.
3. Steve McConnell,” Code Complete” A Practical Handbook of Software Construction”, 2nd Edition, Microsoft Press, Washington, 2011.

XT5078 **VISUALISATION TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn basics concepts ofdata representation.
- To understand the importance of data visualization.
- To know the different types of visualization techniques.
- To understand the various type of dimensional visualization.
- To create various visualizations

UNIT I INTRODUCTION TO DATA REPRESENTATION 9

Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design.

UNIT II FOUNDATIONS FOR DATA VISUALIZATION 9

Visualization stages – Experimental Semiotics based on Perception Gibson's Affordance theory – Model of Perceptual Processing – power of visual perception-Types of Data-visualization and data objects.

UNIT III COMPUTER VISUALIZATION 9

Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces– Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data - Interacting with visualization

UNIT IV MULTIDIMENSIONAL VISUALIZATION 9

One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces

UNIT V CASE STUDIES 9

Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able

- Understand the fundamentals of data presentation.
- Apply visualization over different types of data.
- To compare various visualization techniques.
- Apply multidimensional visualization techniques for various data analysis tasks.
- Design creative visualizations.

REFERENCES:

1. Colin Ware, "Information Visualization Perception for Design" Margon Kaufmann Publishers, 3rd edition, Waltham, 2013.
2. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, Harlow, 2007
3. Stephen Few, "Information Dashboard Design-The Effective Visual Communication of Data": O'Reilly Media Publisher,1st Edition, Beijing, 2006
4. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers, San Francisco, 2007.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5079	DIGITAL IMAGE PROCESSING	L T P C 3 0 0 3

OBJECTIVES:

- To learn the fundamental concepts and applications of Digital Image Processing.
- To study about various Filters and its types.
- To understand segmentation and feature analysis processes.
- To understand various compression techniques.
- To learn about image processing applications in recent trends.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9

Introduction – Fundamental Steps in Image Processing – components of Image Processing Systems – Image Sensing &Acquisition – Sampling and Quantization – Pixel Relationships.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level Transformations - Histogram Processing – Arithmetic and Logical Operations on images - Spatial Filtering – Smoothing and Sharpening spatial filters. Frequency Domain : Filtering in Frequency Domain – DFT, DCT – Smoothing and Sharpening frequency filters – Homomorphic Filtering.

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS 9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Segmentation by Morphological WaterSheds – Use of Motion in Segmentation.

UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS 9

Multi Resolution Analysis: Image Pyramids – Multiresolution Expansions – Wavelet Transforms.Image Compression: Fundamentals – Compression Models – Elements of Information Theory – Error Free Compression – Lossy Compression – Compression Standards.

UNIT V APPLICATIONS OF IMAGE PROCESSING 9

Image Classification – Image Recognition – Image Understanding – Video Motion Analysis – Image Fusion – Digital Compositing – Mosaics – Color Image Processing.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the subject, students would have learnt about:

- How to apply the knowledge of mathematics, science, and engineering in image processing.
- How to enhance an image using various filters.
- How to segment an image and extract feature in image to interpret data.
- How to apply compression techniques to an image in processing and transmission.
- How to do analysis for video and how to classify, recognize and do image fusion.

REFERENCES :

1. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India, New Delhi, 2006.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Cengage Learning, 4th Edition, Stamford, 2015.
3. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Pearson Education, 4th Edition, New York, 2018.
4. Sridhar. S, “Digital Image Processing”, Oxford University press, 2nd Edition, New Delhi, 2016.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5073 **NETWORK PROGRAMMING** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the basics UNIX OS and IPC.
- To learn the basics of socket programming using TCP and UDP.
- To learn about the Echo Server, Day Time Server and I/O multiplexing.
- To learn about the various socket options.
- To learn to create and implement raw sockets.

UNIT I DISTRIBUTED DATABASES **9**

Introduction – Overview of UNIX OS - Environment of a UNIX process - Process control - Process relationships Signals – Interprocess Communication- Overview of TCP/IP protocols

UNIT II ELEMENTARY TCP SOCKETS **9**

Introduction to Socket Programming –Introduction to Sockets – Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server.

UNIT III APPLICATION DEVELOPMENT **9**

TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown – I/O multiplexing – I/O Models – Select function – Shutdown function – TCP echo Server (with multiplexing) – Poll function – TCP echo Client (with Multiplexing)

UNIT IV SOCKET OPTIONS, ELEMENTARY UDP SOCKETS **9**

Socket options – getsocket and setsocket functions – generic socket options – IP socket options – ICMP socket options – TCP socket options – Elementary UDP sockets – UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function – getservbyname and getservbyport functions.

UNIT V ADVANCED SOCKETS **9**

Ipv4 and Ipv6 interoperability – Threaded servers – Thread creation and termination – TCP echo server using threads – Mutexes – condition variables – Raw sockets – Raw socket creation – Raw socket output – Raw socket input – Ping program – Trace route program.

TOTAL: 45 PERIODS

OUTCOMES:

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

- understand TCP/IP networking
- understand the design considerations in building network applications.
- understand the Signal handling and I/O multiplexing in Server with multiple clients environment
- gain an in-depth knowledge of Berkley sockets and the system calls needed to support network programming.
- achieve a greater understanding of WIN32 and/or UNIX programming. E.g. Multi-threaded coding.

REFERENCES:

1. Richard Stevens. W, Bill Fenner, Andrew M Rudoff, “Unix Network Programming – The Sockets and Networking API Volume 1”, Addison-Wesley, 3rd Edition, Boston, 2012.
2. W. Richard Stevens, “Unix Network Programming – Volume 2 **Inter process communication**”, Prentice Hall International, Upper Saddle River, 2009.
3. W. Richard Stevens, Stephen A. Rago, “Advanced Programming in The UNIX Environment”, Addison Wesley, Third Edition, Upper Saddle River, 2014.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5080 **SOFT COMPUTING** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the key aspects of Soft computing and Neural networks.
- To study the fuzzy logic components.
- To gain insight onto Neuro Fuzzy modeling and control.
- To know about the components and building block hypothesis of Genetic algorithm
- To gain knowledge in machine learning through Support Vector Machines.

UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS 9

Evolution of Computing – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Neural Networks - Adaptive Network - Supervised Learning -Perceptrons - Back propagation Multilayer Perceptrons - Learning from Reinforcement -Temporal Difference - Q-Learning - A Cost Path Problem - Unsupervised learning Networks -Kohonen Self-Organizing Networks - Learning Vector Quantization - Principal Component Networks.

UNIT II FUZZY SETS AND FUZZY LOGIC 9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations - Fuzzy Rules Non – interactive fuzzy sets – Fuzzification – Intuition , inference, Rank ordering – Defuzzification – Max-membership principle, Centroid method, Center of sums, Center of largest area.

UNIT III GENETIC ALGORITHMS 9

Introduction - Traditional vs. Genetic algorithm - Basic genetic operation - Schema Theorem Classification of genetic algorithm - Holland Classifier Systems - Genetic programming, gene encoding, fitness function and reproduction, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Applications of GA.

UNIT IV NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case studies.

UNIT V APPLICATIONS OF SOFT COMPUTING 9

ANFIS Applications - Printed Character Recognition - Nonlinear system identification - Channel Equalization - Fuzzy Filtered Neural Networks - Hand written Numeral Recognition - Soft computing for color recipe Prediction - CANFIS modeling

TOTAL : 45 PERIODS

OUTCOMES:

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

- discuss on machine learning through Neural networks.
- build soft computing models for any given problem
- apply knowledge in developing a Fuzzy expert system
- model Neuro Fuzzy system for clustering and classification.
- discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system.

REFERENCES:

1. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 30th Print, Boston, 2012.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Pearson, New Delhi, 2015.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications and Programming Techniques”, Pearson Education, New Delhi, 2011.

4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI Learning, New Dehli, 2010.
5. Melanie Mitchell, “An Introduction to Genetic Algorithm”, Mass Publications, Cambridge, 2006.
6. S.N.Sivanandam · S.N.Deepa, “ Introduction to Genetic Algorithms”, Springer, Berlin, 2010.
7. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer-Verlag, Berlin, 2007.
8. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley, New Delhi, 2013.

XC5074 NATURAL LANGUAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of natural language processing
- To appreciate the use of CFG and PCFG in NLP
- To understand the role of semantics and pragmatics
- To understand how to model a language
- To understand how NLP is applied in real world problems

UNIT I INTRODUCTION TO AUTOMATA 9

Words - Regular Expressions and Automata - Words and Transducers - N-grams - Part-of-Speech – Tagging - Hidden Markov and Maximum Entropy Models.

UNIT II SPEECH 9

Speech – Phonetics - Speech Synthesis - Automatic Speech Recognition - Speech Recognition: - Advanced Topics - Computational Phonology

UNIT III SYNTAX 9

Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity

UNIT IV SEMANTICS AND PRAGMATICS 9

The Representation of Meaning - Computational Semantics - Lexical Semantics - Computational Lexical Semantics - Computational Discourse

UNIT V APPLICATIONS 9

Information Extraction - Question Answering and Summarization - Dialogue and Conversational Agents - Machine Translation

TOTAL: 45 PERIODS

OUTCOMES:

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

- tag a given text with basic Language features
- design an innovative application using NLP components
- implement a rule based system to tackle morphology/syntax of a language
- design a tag set to be used for statistical processing for real-time applications
- compare and contrast use of different statistical approaches for different types of NLP applications.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES:

1. Breck Baldwin, Krishna Dayanidhi, “Language Processing with Java and LingPipe Cookbook”, Packt Publishing Limited, London, 2014.
2. Daniel Jurafsky, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Dorling Kindersley Pvt, Ltd., 2nd Edition, India, 2016.
3. Nitin Indurkhya and Fred J. Damerau, “Handbook of Natural Language Processing”, Chapman & Hall/CRC, Second Edition, Boca Raton, 2010.
4. Richard M Reese, “Natural Language Processing with Java”, Packt Publishing, 2nd Edition, Birmingham, 2018.
5. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, O‘Reilly Media, First Edition, Beijing , 2009.

XT5081 INFORMATION SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To Understand basic information security principles and approaches.
- To Recognize the major information security threats and countermeasures.
- To understand the importance of information security
- To understand the various security protocols
- To design a secure system model

UNIT I INTRODUCTION TO INFORMSTION SECURITY 9

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

UNIT II SECURITY INVESTIGATION 9

Need for Security - Business Needs – Threats - Attacks – Legal - Ethical and Professional Issues

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk - Assessing and Controlling Risk.

UNIT IV LOGICAL DESIGN 9

Blueprint for Security - Information Security Policy - Standards and Practices - ISO 17799/BS 7799 - NIST Models - VISA International Security Model - Design of Security Architecture - Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology – IDS - Scanning and Analysis Tools – Cryptography - Access Control Devices - Physical Security - Security and Personnel

TOTAL: 45 PERIODS

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

OUTCOMES:

Upon completion of the subject, students would have learnt about:

- How to Identify both external and internal vulnerabilities to enterprise computer infrastructures and sensitive digital assets anddevise a mitigation plan against them.
- Have comprehensive information about security policies, establishing necessary organizational processes /functions for information security and will be able to arrange necessary resources.
- Differentiating among the models, architectures, challenges and global legal constraints of secure electronic commerce technologies used to ensure transmission, processing and storage of sensitive information.
- About cyber law and ethics.
- About recent information security threats and preventive measures

REFERENCES:

1. Matt Bishop, Elisabeth Sullivan; Michelle Ruppel "Computer Security Art and Science", Addison-Wesley, 2nd Edition, Boston, 2019.
2. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Mass. : Cengage Learning, 6th Edition, Boston, 2018.
3. Micki Krause, Harold F. Tipton, "Information Security Management Handbook 3", CRC Press, 6th Edition, Boca Raton,.2009.
4. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 7th Edition, New York, 2012.

XT5082 ADHOC AND SENSOR NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To gain knowledge of mobile ad hoc networks.
- To gain the protocol design issues of the ad hoc and sensor networks.
- To gain knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid.
- To gain knowledge of clustering mechanisms and the different schemes that have been employed, e.g., hierarchical, flat, and leaderless.
- To gain knowledge of the 802.11 Wireless Lan (WiFi) and Bluetooth standards.

UNIT I INTRODUCTION TO MANET AND ROUTING 9

Introduction to MANET – Applications of MANETS – Challenges – Routing – Unicast – Proactive – reactive – Position based and QoS routing – Multicasting and geocasting.

UNIT II ADHOC MAC LAYERS 9

MAC LAYER – IEEE 802.11 (for wireless LANs) – IEEE 802.15 – Bluetooth technology – Wireless Mesh Networks.

UNIT III ADHOC TRANSPORT LAYERS 9

Cognitive Radio and Networks – TCP over ADHOC Networks – Applications of sensor networks – Necessity for mesh networks – Heterogeneous mesh networks – Vehicular mesh networks.

UNIT IV SENSOR NETWORKS 9

Introduction – Sensor networks Design Considerations – Sensor networks in controlled Environment and actuators – Data Dissemination – Data gathering – MAC protocols for sensor networks – Location discover – Quality of sensor networks.

UNIT V ENERGY MANAGEMENT AND SECURITY 9

Need for Energy management – Classification of Energy management schemes – Battery management and Transmission power management schemes – Network layer and Data link layer solutions - System power management schemes - Security in Adhoc and sensor networks – Integrating MANETS WLANS and Cellular networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.
- Have an understanding of the principles and characteristics of wireless sensor networks (WSNs).
- Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.
- Understand how reactive routing protocols function and their implications on data transmission delay and bandwidth consumption.
- Understand how hybrid routing protocols function and their ability to balance speed and bandwidth consumption.

REFERENCES:

1. Carlos de morais cordeiro and Dharma Prakash Agarwal, “Adhoc and Sensor Networks: Theory and Applications”, World Scientific Publications, Second Edition, Chennai, 2011.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati,” Wireless Sensor Networks: Technology, Protocols and Applications”, Wiley, New Jersey, 2010.
3. Sivaram Murthy C. and Manoj B.S., “Adhoc Wireless Networks – Architecture and Protocols”, Pearson Education, Delhi, 2006.

XT5083 INFORMATION RETRIEVAL TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To learn the concepts behind IR
- To understand the operation of web search
- To learn the algorithms related to text classification, indexing and searching
- To understand various IR models
- To understand how IR is applied in real world problems

UNIT I INTRODUCTION TO IR 9

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

UNIT II MODELING AND RETRIEVAL EVALUATION 9

IR models – Classic Information Retrieval – Alternative Set Theoretic Models – Alternative Algebraic Models – Alternative Probabilistic Models – Other Models – Hypertext Models – Web based Models – Retrieval Evaluation – Cranfield Paradigm – Retrieval Metrics – Reference Collections – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback – Clicks – Implicit Feedback Through Local Analysis – Global Analysis – Documents: Languages & Properties – Queries: Languages & Properties.

UNIT III TEXT CLASSIFICATION, INDEXING AND SEARCHING 9

A Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Feature Selection or Dimensionality Reduction – Evaluation metrics – Organizing the classes – Indexing and Searching – Inverted Indexes –Signature Files – Suffix Trees & Suffix Arrays – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Search Engine Ranking – Managing Web Data – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation - Structured Text Retrieval.

UNIT V TYPES OF IR AND APPLICATIONS 9

Parallel and Distributed IR –Data Partitioning – Parallel IR – Cluster-based IR – Distributed IR - Multimedia Information Retrieval – Challenges – Content Based Image Retrieval – Audio and Music Retrieval – Retrieving and Browsing Video – Fusion Models – Segmentation – Compression Enterprise Search –Tasks – Architecture of Enterprise Search Systems – Enterprise Search Evaluation - Library Systems – Digital Libraries

TOTAL: 45 PERIODS

OUTCOMES:

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

- use an open source search engine framework and explore its capabilities
- represent documents in different ways and discuss its effect on similarity calculations and on search
- design and implement an innovative feature in a search engine
- build an IR model
- enhance an existing IR model

REFERENCES:

1. Bruce Croft, Donald Metzler and Trevor Strohman, “Search Engines: Information Retrieval in Practice”, Pearson, Boston, 2010.
2. C. Manning, P. Raghavan and H. Schütze, “Introduction to Information Retrieval”, Cambridge University Press, Cambridge, 2008.
3. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, “Modern Information Retrieval: The Concepts and Technology behind Search”, Addison-Wesley , Second Edition, England, 2011.
4. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval: Implementing and Evaluating Search Engines”, The MIT Press, Cambridge, 2016.

XT5084 SEMANTIC WEB L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of semantic web and to conceptualize and depict Ontology for semantic web.
- To make a study of languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of management of ontology.
- To understand the working of ontology models

UNIT I THE QUEST FOR SEMANTICS 9

Building Models - Calculating with Knowledge - Exchanging Information - Semantic Web Technologies – Layers – Architecture - Components –Types – Ontological Commitments – Ontological Categories – Philosophical Background - Sample Knowledge Representation Ontologies –Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation.

UNIT II LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES 9

Web Documents in XML – RDF - Schema – Web Resource Description using RDF - RDF Properties –Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM - OKBC – OCML - Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL - OWL.

UNIT III ONTOLOGY LEARNING FOR SEMANTIC WEB 9

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning –Importing and Processing Ontologies and Documents – Ontology Learning Algorithms -Evaluation

UNIT IV ONTOLOGY MANAGEMENT AND TOOLS 9

Overview – Need for management – development process – target ontology – ontology mapping – Skills management system – Ontological class – Constraints – Issues. Evolution –Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

UNIT V APPLICATIONS 9

Web Services – Semantic Web Services - Case Study for specific domain – Security issues – Web Data Exchange and Syndication - Semantic Wikis - Semantic Portals - Semantic Metadata in Data Formats - Semantic Web in Life Sciences - Ontologies for Standardizations - RIF Applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

- create Ontology for a given domain.
- develop an application using ontology languages and tools.
- perform ontology management effectively
- evaluate different ontology models
- design and develop web service applications using semantic portals.

REFERENCES:

1. Alexander Maedche, — Ontology Learning for the Semantic Web,Springer; New York 1 edition, 2012.
2. Dean Allemang(Author),James Hendler(Author) —Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL (Paperback), Morgan Kaufmann, Burlington, Massachusetts 2008.
3. Grigoris Antoniou, Frank van Harmelen, —A Semantic Web Primer (Cooperative Information Systems), The MIT Press, Cambridge ,Massachusetts, 2004.
4. John Davies, Dieter Fensel, Frank Van Harmelen, —Towards the Semantic Web: Ontology – Driven Knowledge Management, John Wiley & Sons Ltd. West Sussex, 2003.
5. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, —The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management, Wiley, Indianapolis, 2003.
6. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
7. Steffen Staab (Editor), Rudi Studer, —Handbook on Ontologies (International Handbooks on Information Systems), Springer 1st edition, Berlin Heidelberg 2004.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5085 PERFORMANCE EVALUATION OF SYSTEM AND NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queueing analysis for both simple and complex systems
- To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies

UNIT I QUEUEING MODELS 9

Performance Characteristics – Requirement Analysis: Concepts –User, Application, Device, Network Requirements – Single Queuing systems: M/M/1 Queuing System – Little's Law – Reversibility and Burke's theorem – M/M/1/N – M/M/∞ - M/M/m – M/M/m/m – M/M/1/∞ - M/G/1 Queuing System.

UNIT II QUEUEING NETWORKS 9

Network of Queues: Product form solution – Algebraic Topological interpretation of the product form solution – Recursive solution of Nonproduct form networks – Queuing Networks with negative customers.

UNIT III QUEUES IN COMPUTER SYSTEMS 9

Stochastic Petri Nets: Bus oriented multiprocessor model – Toroidal MPN Lattices – Dining Philosophers problem – Station oriented CSMA/CD protocol model – The Alternating Bit Protocol – SPN's without product form solutions.

UNIT IV DISCRETE TIME QUEUEING MODELS 9

Discrete Time Queuing Systems – Discrete time Arrival Processes – Geom/Geom/m/N – Geom/Geom/1/N – Geom/Geom/1 Queuing Systems.

UNIT V NETWORK PERFORMANCE 9

Network Traffic Modeling: Continuous Time Models – Discrete Time Models – Solution Methods – Burstiness – Self Similar Traffic.

TOTAL: 45 PERIODS

OUTCOMES:

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

- identify the need for performance evaluation and the metrics used for it
- discuss open and closed queueing networks and Define Little'e law and other operational laws
- apply the operational laws to open and closed systems
- use discrete-time and continuous-time Markov chains to model real world systems
- develop analytical techniques for evaluating scheduling policies

REFERENCES:

1. Bertsekas & Gallager, "Data Networks", 2nd Edition, Pearson India, 2015.
2. D. Bertsekas, A. Nedic and A. Ozdaglar, "Convex Analysis and Optimization", Athena Scientific, Cambridge, Massachusetts, 2003.
3. James D.McCabe, "Network Analysis, Architecture and Design", 3rd Edition, Morgan Kaufmann, Massachusetts**,** 2010.
4. Jerry Banks, John S. Carson, Barry L. Nelson and David M. Nicol," Discrete Event Systems Simulation" 5th Edition, Pearson, 2013.
5. Nader F.Mir, "Computer and Communication Networks", Pearson Education, Upper Saddle River, New Jersey, 2007.

6. Paul J.Fortier and Howard E.Michel, "Computer Systems Performance Evaluation and Prediction", Digital Press, Burlington, *Massachusetts,* 2003.
7. Thomas G.Robertazzi, "Computer Networks and Systems – Queuing Theory and Performance Evaluation", 3rd Edition, Springer Verlag, New York Inc, 2009.

XT5086 BIO INFORMATICS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on basic techniques of Bioinformatics working knowledge of biology and its applications
- To increase proficiency in computer languages
- To gain skills in data mining
- To gain skills in data visualization
- Experience with systems biology tools

UNIT I INTRODUCTION 9

Over view and need for Bioinformatics technologies – Role of Structural bioinformatics – Data format and processing – Secondary resources and applications - Biological Data Integration System.

UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS 9

Bioinformatics data – Datawarehousing architecture – Data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture – Applications

UNIT III MODELING FOR BIOINFORMATICS 9

Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – Multiple alignment generation – Comparative modeling – Protein modeling – Genomic modeling - Molecular modeling – Computer programs for molecular modeling

UNIT IV PATTERN MATCHING AND VISUALIZATION 9

Gene regulation – Motif recognition and detection – Strategies for motif detection – Visualization – Fractal analysis – DNA walk models – One dimension –Two dimension - DNA, Protein, Amino acid sequences.

UNIT V MICROARRAY ANALYSIS 9

Microarray technology for genome expression study – Image analysis for data extraction – Preprocessing – Segmentation – Gridding – Spot extraction – Normalization, filtering – Cost Matrix – Evaluation model - Benchmark – Tradeoffs

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the subject, students would have learnt about:

- sequencing alignment and dynamic programming, sequence databases, evolutionary trees and phylogeny
- prepare large-scale expression and sequence data for bioinformatics analyses
- write programs to manipulate files and directories
- extract useful information from text files
- learn genomics resource and how to annotate genes

REFERENCES:

1. Arthur M Lesk, "Introduction to Bioinformatics", 4th Edition, Oxford University Press, New York, 2014.

2. Bryan Bergeron, “Bio Informatics Computing”, Pearson Education, 2nd Edition, New Delhi, 2015.
3. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, Springer Verlag, First Indian Reprint, Berlin, 2007.
4. Zoe lacroix and Terence Critchlow, “BioInformatics – Managing Scientific data”, Morgan Kaufmann, San Francisco, 2009.

XT5087 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To learn the basic concepts of TQM.
- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems.

UNIT I INTRODUCTION TO QUALITY 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen service quality frameworks and gaps – Control charts for variables and attributes.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures - BPR.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of the module students will be able to:

- develop and understanding on quality management philosophies and frameworks
- develop in-depth knowledge on various tools and techniques of quality management
- learn the applications of quality tools and techniques in both manufacturing and service industry.
- develop analytical skills for investigating and analyzing quality management issues in the industry.
- assess exactly where an organization stands on quality management with respect to the ISO 9000 quality management standard and the Baldrige Award criteria.

REFERENCES:

1. Anakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd.,New Delhi, 2006.
2. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education Asia,5th Edition, 2018.
3. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
4. ShridhavaBhat, "Total Quality Management" Himalaya Publishing house, 1st Edition, 2002.
5. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., New Delhi,2006 .

XT5088	3G AND 4G WIRELESS NETWORKS	L T P C 3 0 0 3

OBJECTIVES:

- To learn various generations of wireless and cellular networks.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.
- To study about WiMAX networks, protocol stack and standards.
- To understand about the emerging trends of smart phones and evolution of latest standards like DLNA, NFC and femtocells.

UNIT I BASICS OF CELLULAR SYSTEMS 9

History of Mobile Cellular Systems - First Generation - Second Generation - Generation 2.5 - Overview of 3G & 4G. 3GPP and 3GPP2 standards

UNIT II 3G NETWORKS 9

Evolution from GSM, 3G Services and Applications - UMTS network structure - Core network - UMTS Radio access - HSPA – HSUPA- HSDPA- CDMA 1X – WCDMA

UNIT III 4G LTE 10

LTE: Introduction, Radio interface architecture - Physical layer, Access procedures - System Architecture Evolution (SAE) - Communication protocols – Interfaces- LTE Advanced.

UNIT IV WIMAX NETWORKS 8

Introduction to WiMax Networks– IEEE 802.16 – Frame Format – Protocols - OFDM – MIMO - IEEE 802.20 – Applications

UNIT V DLNA AND NFC REVOLUTION 9

Introduction and Evolution - Applications of DLNA and NFC – DLNA Architecture and Protocol stack - Smart phone and NFC – Mobile Commerce and NFC – NFC tags –Security Issues – Femtocells from the network operators and user's point of view.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of the course the student should be able:

- To appreciate the evolution of cellular networks.
- To deploy 3G Services.
- To explore the developments in 4G Networks.
- To implement WiMAX networks, protocol stack and standards.
- To explore the need for NFC in future.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming , "3G Evolution HSPA and LTE for Mobile Broadband",2nd Edition Academic Press, Oxford, 2008
2. Erik Dahlman, Stefan Parkvall, Johan Skold, "4G, LTE Advanced Pro and the road to 5G", 3rd Edition, Academic Press, San Diego, 2016.
3. Flavio Muratore, "UMTS Mobile Communication for the Future", 3rd Edition, John Wiley & Sons, New York, 2007
4. Juha Korhonen, "Introduction to 3G Mobile Communication", Artech House, London, 2003
5. Martin Sauter, "3G & 4G & Beyond: Bringing Networks, Devices and the Web together", 2nd Edition, Wiley, Chichester, 2013.

XC5075 COMPUTATIONAL LINGUISTICS L T P C
3 0 0 3

OBJECTIVES:

- Learn about the statistical modeling and classification for NLP
- Learn the basic techniques of information retrieval
- Know about the basics of text mining
- Learn the generic issues in speech processing and applications relevant to natural language generation
- To understand the problems associated with storage

UNIT I NATURAL LANGUAGE PROCESSING 9

Linguistic background - spoken language input and output technologies - Written language input - Mathematical methods - Statistical modeling and classification - Finite state methods: Grammar for NLP - Parsing - Semantic interpretation: Semantics and logical form - Ambiguity Resolution - Other strategies for semantic interpretation - Word Sense Disambiguation - Named Entity Recognition

UNIT II INFORMATION RETRIEVAL 9

Information Retrieval architecture - Indexing - Storage - Compression techniques - Retrieval approaches - Evaluation - Search Engines - Commercial search Engine features - comparison - Performance measures - Document processing - NLP based Information Retrieval - Information Extraction - Vector Space Model

UNIT III TEXT MINING 9

Categorization : Extraction based Categorization - Clustering - Hierarchical clustering - Flat Clustering - Document classification and routing - Finding and organizing answers from text search - Categories and clusters for organizing retrieval results - Text Categorization - Efficient summarization using lexical chains - Pattern extraction

UNIT IV GENERIC ISSUES 9

Multilinguality - Multilingual Information Retrieval and Speech Processing - Multimodality- Text and Images - Modality Integration - Transmission and storage - Speech coding - Evaluation of systems - Human factors and user acceptability.

UNIT V APPLICATIONS 9

Machine translation - Transfer metaphor - Interlingua and statistical approaches - Discourse processing - Dialog and conversational agents - Natural language generation - Surface Realization and discourse planning.

TOTAL: 45 PERIODS

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

OUTCOMES:

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

- Develop applications related to speech processing
- Develop applications related to text mining
- Formulate new text mining methods
- Extract patterns in previously existing data
- Solve the issues associated with transmission and storage

REFERENCES:

1. Christopher D.Manning, Hinrich Schutze, "Foundations of Statistical Natural Language Processing", Cambridge, MIT Press, 1999.
2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Pearson Education, Harlow, 2013.
3. Gerald J.Kowalski, Mark. T. Maybury, "Information Storage and Retrieval systems: theory and implementaion", Kluwer Academic Publishers, Boston, 2009.
4. Michael W.Berry, "Survey of Text Mining: Clustering, Classification and Retrieval", Springer Verlag, New York, 2011.
5. Ronald Cole, J.Mariani, et.al, "Survey of the state of the art in human language Technology", Cambridge University Press, Cambridge , 1997.

XT5089 MOBILE AND PERVASIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To learn about the basics of wireless communication
- To learn basic concepts and systems issues in telecommunication and satellite systems
- To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area
- To design successful mobile and pervasive computing applications and services research project
- To evaluate critical design tradeoffs associated with different mobile technologies, architectures, interfaces and business models and how they impact the usability, security, privacy and commercial viability of mobile and pervasive computing services and applications

UNIT I OVERVIEW OF WIRELESS COMMUNICATION 9

History of wireless communication – applications of wireless networks and mobile communications – wireless transmission- frequencies for radio transmission- signals – antennas – signal propagation- multiplexing – modulation – spread spectrum – cellular systems – medium access control.

UNIT II TELECOMMUNICATION AND SATELLITE SYSTEMS 9

GSM – Functional architecture of a GSM system – Handover in GSM – security – DECT – TETRA – UMTS and IMT -2000 – Bluetooth - WiFi, WiMAX, 3G, 4G ,WATM.- Mobile IP protocols -WAP push architecture-WML scripts and applications - Data networks – SMS – GPRS – EDGE – Hybrid Wireless Networks – ATM – Wireless ATM.

UNIT III PERVASIVE COMPUTING 9

Introduction - Principles, Characteristics- interaction transparency, context aware, automated experience capture. Architecture for pervasive computing- Pervasive devices-embedded controls - smart sensors and actuators -Context communication and access services

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT IV PROTOCOLS **9**

Open protocols- Service discovery technologies- SDP, Jini, SLP, UpnP protocols–data synchronization- SyncML framework - Context aware mobile services - Context aware sensor networks, addressing and communications- Context aware security.

UNITV TECHNOLOGIES, PLATFORMS AND RECENT TRENDS **9**

Past, Present and Future-Device Technology-Device Connectivity-Web application Concepts-WAP and Beyond-Voice Technologies-Personal Digital Assistants -Network simulators: NS2 – GLOMOSIM – SENSIM – OPNET – Programming Platforms – J2ME – SYMBIAN OS – Recent advances in Wireless Networks.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student should be able to

- To deploy better strategies for radio and signal transmission.
- To develop suitable scripts and applications for recent networks.
- To use context aware sensor and mesh networks to develop mobile computing environment.
- To develop better protocols and effective communication mechanism for mobile and context aware computing.
- To develop more system model by using different simulators and design an appropriate mechanism to evaluate the system performance.

REFERENCES :

1. Jochen Burkhardt, Stefan Heper, Klaus Rindtorf, Thomas Schaeck, "Pervasive Computing-Technology and Architecture of Mobile Internet Application", Pearson Education, 6th Edition, Boston, 2009.
2. Jochen Schiller, "Mobile Communications", Pearson, London, 2012.
3. Seng Loke, Context-Aware Computing Pervasive Systems, Auerbach Pub., New York, 2007.
4. Uwe Hansman etl ,Pervasive Computing, 2nd Edition,Springer, New York,2003.

XC5076 COMPUTER VISION **L T P C**
3 0 0 3

OBJECTIVES:

- To provide knowledge about computer vision
- To understand the basic concepts of various detection techniques.
- To understand about camera calibration, stereoscopic imaging and higher level image processing operations.
- To familiarize the student with the motion field and estimation techniques to evaluate motions.
- To understand the appearance and shape of high level vision using various algorithms.

UNIT I OVERVIEW OF CAMERA VISION **9**

Image Formation and Representation, Intensity and Range Images – Camera models – Camera parameters – Camera models – Light and colour – Image Noise – Image Filtering (spatial domain) - Mask-based filtering - Image Smoothing , Sharpening.

UNIT II IMAGE FEATURES **9**

Image Features – Point and Line Detection – Hough Transform – Edge Detection – Corner Detection – Harris Detector – Textures - Deformable Contours – Features Reduction – Principal Component analysis – Feature Descriptors – SIFT and SURF.

UNIT III CAMERA CALIBRATION AND STEREO GEOMETRY 9

Camera Parameters – Intrinsic and Extrinsic parameters – Direct Parameter Calibration – Extraction from Projection matrix, Stereopsis – Correspondence Problem –RANSAC and Alignment - Epipolar Geometry

UNIT IV MOTION DETECTION AND SHAPE FROM CUES 9

Motion field of rigid objects – Notation of Optical flow – Estimating motion field – Estimation Motion Field – Horn and Schunck algorithm – Lucas and Kanade Algorithm – Using and Evaluation of Motion field – Shape from Shading and shape from Texture Modelbased Vision, smooth surfaces and their outlines, Aspect graphs and Range data**.**

UNIT V HIGH LEVEL VISION 9

Interpretation trees, Invariants – Appearance and Shape based Classification – 3D object modeling– Matching from Intensity Data – Matching from Range Data – Visual Recognition – AdaBoost and Random Decision Forests.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Apply various filtering techniques in image processing.
- Apply different Detection methods to extract image features.
- Apply calibration parameters to camera for effective vision.
- Use various algorithms to detect motion and shape from cues.
- Use classification techniques to extract appearance and shape of object.

REFERENCES:

1. David Forsyth and Jean Ponce, “Computer Vision: a Modern Approach”, Prentice Hall, Harlow, 2009.
2. E.R.Davies, ” Computer vision: theory, algorithms, practicalities”, Elsevier, 4th Edition, London, 2012
3. ReinhardKlette , “Concise Computer Vision: An Introduction into Theory and Algorithms”, Springer-Verlag, London, 2014.
4. Richard Hartley and Andrew Zisserman, “Multiple View Geometry in Computer Vision”, Cambridge University Press, New York, 2001.
5. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer International, London, 2011.

XC5077 BIOMETRICS L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic ideas and principles in biometrics
- To familiarize the student with scanning mechanism of finger and facial
- To understand the technologies used in iris and voice scan
- To understand the various physiological biometrics used for biometrics application development
- To understand the role of multi-biometrics in industrial applications.

UNIT I OVERVIEW OF BIOMETRICS MECHANISM 9

Introduction – Benefits of biometric security – Verification and identification – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions.

UNIT II FINGER AND FACIAL SCAN 9

Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies – Strength and weakness. Types of algorithms used for interpretation. Facial Scan - Features – Components – Operation (Steps) – Competing facial Scan technologies–Strength-weakness.

UNIT III IRIS AND VOICE 9

Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness. Voice Scan - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness.

UNIT IV PHYSIOLOGICAL BIOMETRICS 9

Other physiological biometrics – Hand scan – Retina scan – AFIS (Automatic Finger Print Identification Systems) – Behavioral Biometrics – Signature scan - keystroke scan. Multimodalities and combining biometrics for improving performance

UNIT V BIOMETRICS APPLICATION DEVELOPMENT 9

Biometrics Application – Biometric Solution Matrix – Bio privacy – Comparison of privacy factor in different biometrics technologies – Designing privacy sympathetic biometric systems. Biometric standards – (BioAPI , BAPI) – Biometric middleware. Biometrics for Network Security. Statistical measures of Biometrics.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Implement customized biometrics mechanism according to end-user needs.
- Analyze finger and facial features and able to use in appropriate applications.
- Analyze iris and voice features and able to use in appropriate applications.
- Analyze other physiological biometrics which can be used for effective security mechanism.
- Analyze and implement different biometrics technologies according to industrial needs or customized individual needs.

REFERENCES:

1. Anil K. Jain, Arun A. Ross and Karthik Nandakumar, “Introduction to Biometrics”, Springer, Boston, 2011
2. James L. Wayman, Anil K. Jain, DavideMaltoni, and Dario Maio, “Biometric Systems: Technology, Design and Performance Evaluation”, London, Springer, 2004.
3. Samir Nanavati, Michael Thieme, Raj Nanavati, “Biometrics – Identity Verification in a Networked World”, John Wiley and Sons, New York, 2002.
4. Stan Z. Li and Anil K. Jain, “Handbook of Face Recognition”, Springer, New York, 2005.

XT5090 MULTIMEDIA INFORMATION STORAGE AND RETRIEVAL L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basics of multimedia information storage technology, techniques for analysis, representation and retrieval that is commonly used in industry.
- To compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Models.
- To outline the structure of queries and media elements.
- To critically evaluate Multimedia retrieval system effectiveness and improvement techniques
- To understand how multimedia storage takes place in real world

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I FUNDAMENTAL MEDIA UNDERSTANDING 9

Introduction – Media Types – Media Understanding – Description of Audio, Visual spectral and Video - Storage networks, storage medium.

UNIT II TEXT RETRIEVAL AND MUSIC 9

Text Information retrieval: Information retrieval system-catalog and indexing – automatic indexing – term clustering – User search Techniques- Information Visualization- Fundamentals - Instantaneous Features - Intensity - Tonal Analysis - Musical Genre, Similarity and Mood

UNIT III IMAGE RETRIEVAL 9

Content-base image retrieval techniques – Feature extraction – Integration – Similarity – Feature in indexing – Interactive Retrieval – MPEG-7 standard

UNIT IV VIDEO RETRIEVAL 9

Content Based Video Retrieval - Video Parsing – Video abstraction and Summarization– Video Content Representation, Indexing and retrieval –Video Browsing Schemes–Example of Video Retrieval Systems

UNIT V RETRIEVAL METRICS AND MODERN IR 9

Average recall and average precision - Harmonic mean - Evaluation of a search engine – Relevance Issue – Kappa Measure – Quality versus Quantity, possible factors which influence outcome of a search – Grandfield Experimental Study. Introduction- parallel IR – Distributed IR – trends and research Issue.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of the course the student can able to

- learn the basics of multimedia information storage technology, techniques for analysis, representation and retrieval that is commonly used in industry.
- compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Models.
- outline the structure of queries and media elements.
- critically evaluate Multimedia retrieval system effectiveness and improvement techniques.
- work on recent trends in multimedia retrieval systems

REFERENCES:

1. Brusilovsky, Peter et.al. The Adaptive Web: Methods and Strategies of Web Personalization, Springer, Berlin, 2007.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, "Introduction to Information Retrieval" , Cambridge University Press, Cambridge, 2008.
3. Ricci, F.; Rokach, L.; Shapira, B.; Kantor, P.B., "Recommender Systems Handbook". 1st Edition., New York, 2011.

XT5091 GAME PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To get subsequent understanding of graphics methods which can be used in game design and development
- To get knowledge in Game design and development
- To get exposure to Rendering tools which is used in hardware and software design
- To learn about recent platforms and frame works used in Gaming
- To learn how develop game for single and Multi player

UNIT I GRAPHICS FOR GAME PROGRAMMING 9

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.

UNIT II GAME DESIGN PRINCIPLES 9

Game Logic, Game AI, Path Finding, Game Theory, Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection.

UNIT III GAMING ENGINE DESIGN 9

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics.

UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio, Unity.

UNIT V GAME DEVELOPMENT 9

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of this subject students should be able to:

- Illustrate an understanding of the concepts behind game programming techniques.
- Implement game programming techniques to solve game development tasks.
- Construct a basic game engine using open-source programming libraries.
- Develop effective mechanism for collision detection.
- Develop game for single and multiple players.

REFERENCES :

1. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” Morgan Kaufmann, 2nd Edition, 2006.
2. Jonathan S. Harbour, “Beginning Game Programming”, Course Technology PTR, 3rd Edition, 2009.
3. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 1st Edition, 2011.
4. Mike McShaffrfy, “Game Coding Complete”, 3rd Edition, Charles River Media, 2009.

XT5092 AUGMENTED REALITY AND VIRTUAL REALITY L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of augmented reality.
- To study about how to create various content in augmented reality.
- To understand the elements, architecture, input and output devices of virtual and augmented reality systems.
- To study about interfaces used in virtual reality systems.
- To understand various rendering systems used in virtual world.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I OVERVIEW OF AUGMENTED REALITY 9

Augmented Reality – Relationship between augmented reality and other technologies–Augmented reality concepts – major hardware components for augmented reality systems – major software components for augmented reality systems

UNIT II AUGMENTED REALITY CONTENT 9

Contents of augmented reality - creating visual content – creating audio content – Interaction in Augmented Reality – Mobile Augmented Reality – Augmented Reality Applications.

UNIT III VIRTUAL REALITY KEY ELEMENTS 9

Virtual Reality – Key elements of virtual reality – communication through medium – common issues of Human Communication Media – Interface to the Virtual World

UNIT IV VIRTUAL REALITY SYSTEMS 9

Interface to virtual world – input – user monitoring – world monitoring – interface to virtual world – output – visual displays

UNIT V RENDERING THE VIRTUAL WORLD 9

Representation of Virtual world – Visual representation in VR – Aural representation in VR – Rendering Systems – Visual Rendering system – Aural rendering system.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Analyze the relationship between augmented reality and other technologies.
- Develop contents for augmented reality applications.
- Develop solutions for human communication media issues.
- Apply monitoring techniques in virtual reality systems.
- Apply rendering techniques in virtual world.

REFERENCES:

1. Alan B. Craig, “Understanding Augmented Reality: Concepts and Applications”. Morgan Kaufhann, Amsterdam, 2013.
2. Burdea, G. C. and P. Coffet. “Virtual Reality Technology”, 2nd Edition. Wiley-IEEE Press, New York, 2006.
3. Fei GAO. “Design and Development of Virtual Reality Application System”, Tsinghua Press, Regina, March 2012.
4. Greg Kipper, Joseph Rampolla, “Augmented Reality: An Emerging Technologies Guide to AR“, Syngress, Elsevier, 2013.
5. Guangran LIU. “Virtual Reality Technology”, Tsinghua Press, Beijing, Jan. 2011.
6. Sherman, William R. and Alan B. Craig. “Understanding Virtual Reality – Interface, Application, and Design”, Morgan Kaufmann, Cambridge, 2018.

XC5078 PATTERN RECOGNITION L T P C
3 0 0 3

OBJECTIVES:

- To learn about Supervised and unsupervised Learning.
- To study about feature extraction and structural pattern recognition.
- To explore different classification models.
- To learn Artificial Intelligence techniques.
- To understand Fuzzy Pattern Classifiers and Perception.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT I OVERVIEW OF PATTERN RECOGNITION 9

Discriminant functions - Supervised learning - Parametric estimation - Maximum Likelihood estimation - Bayesian parameter estimation - Problems with Bayes Approach - Pattern classification by distance functions - minimum distance Pattern classifier

UNIT II UNSUPERVISED CLASSIFICATION 9

Clustering for unsupervised learning and classification, clustering concepts C – means algorithm – hierarchical clustering – Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – feature selection through functional approximation – Binary selection – Elements of formal grammars, syntactic description, stochastic grammars, Structural representation

UNIT IV AI TECHNIQUES 9

Search and control strategies – Uniformed search – Informed search – searching AND/OR graphs - Matching techniques – Knowledge for recognition and Classification process – Visual image understanding - Expert system architectures.

UNIT V RECENT ADVANCES AND IMAGE APPLICATIONS 9

Learning of neural pattern recognition - Fuzzy logic – Fuzzy pattern classifiers – image segmentation – Credit scoring – Applications in Computer vision, Automated Target recognition, Finger print Identification, Industrial Inspection.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the subject, students would have learnt about:

- how to classify data and identifying patterns.
- how to extract feature set and select the features from given data set
- how to apply graph theory approaches to pattern clustering.
- how to apply AI techniques
- how to apply Fuzzy logic and neural pattern rules

REFERENCES :

1. Andrew Webb, Keith D Copsey, “Statistical Pattern Recognition”, John Wiley & Sons, Third Edition, Hoboken, 2011.
2. Dan Patterson, “Introduction to artificial Intelligence and Expert Systems”, Pearson Education, 1st Edition, New Delhi, 2015.
3. Richard O Duda, Peter E Hart, David G Stork, “Pattern Classification and Scene Analysis”, John Wiley, 2nd Edition, New York, 2000.
4. Earl Gose, Richard Johnson baugh, SteneJost, “Pattern Recognition and Image analysis”, Pearson India Education, Indian Edition, Noida, 2015.
5. Elaine Rich, Kevin Knight, “Artificial Intelligence”, Tata Mcgraw Hill Education, 3rd Edition, New Delhi, 2011.
6. Morton Nadier and Eric Smith P., “Pattern Recognition Engineering”, John Wiley and sons, New York, 1993.
7. Robert J. Schalkoff, “Pattern recognition: Statistical Structural and Neural approaches”, John Wiley and Sons, New York, 1992.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XT5093	MULTIMEDIA TOOLS AND TECHNIQUES	L T P C 3 0 0 3

OBJECTIVES:

- To learn about the building blocks of multimedia
- To learn how multimedia is useful in web
- To study about the methods used to authoring and story boarding
- To get exposure in various compression algorithms
- To get familiar with multimedia applications in recent trends.

UNIT I MULTIMEDIA BASICS 9

Creation – Editing – Design – Usage – Tools and Hardware – File Formats for Text, Image /Graphics, Audio, Video, Animation. Color Models, Multimedia Data Structures, KD Trees – RTrees.

UNIT II MULTIMEDIA ON THE WEB 9

Hypertext, Hypermedia, Hypermedia Structures and Formats, Web Graphics, Web DesignGuidelines, HTML5, Plugins, Multimedia Networking.

UNIT III AUTHORING AND TOOLS 9

Authoring – Story Boarding, Metaphors - Card / Page, Icon, Timeline, Tools – Adobe DreamWeaver CC, Flash, Edge Animate CC, Camatasia Studio 8, Claro, E-Learning Authoring Tools –Articulate, Elucidate, Hot Lava.

UNIT IV DATA COMPRESSION 9

Text Compression – RLE, Huffman, Arithmetic, Dictionary Based, Image Compression – JPEG JPEG 2000, JPEG – LS, Audio Compression – PCM, ADPCM, LPC, MPEG Audio, Video Compression – MPEG – 1,2,4.

UNIT V MULTIMEDIA APPLICATIONS 9

Multimedia Databases – Content Based Information Retrieval, Multimedia Communications - Multimedia Information Sharing and Retrieval – Applications – Social Media Sharing, Online Social Networking - Virtual Reality - Multimedia for Portable Devices, Collaborative Multimedia Applications

TOTAL: 45 PERIODS

OUTCOMES:

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

- understand working basic elements of multimedia
- explain the importance of web based multimedia usage
- use and apply authoring tools for web and e-learning
- apply the data compression techniques to multimedia data.
- implement various multimedia applications.

REFERENCES:

1. Nigel Chapman and Jenny Chapman, “Digital Multimedia”, John Wiley & Sons, Third Edition, Chichester, 2013.
2. Parag Havaldar and Gerard Medioni, “Multimedia Systems - Algorithms, Standards and Industry Practices”, Course Technology, Course Technology Cengage Learning, Boston, 2010.
3. Ralf Steinmetz and Klara Nahrstedt, “Multimedia Computing, Communications and Applications”, Dorling Kindersley Pvt Lt, New Delhi, 2013.
4. Ze - Nian Li, Mark S Drew and Jiangchuan Liu, “Fundamentals of Multimedia”, Springer-Verlag, Second Edition, New York, 2016.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

XC5079 SOFTWARE TESTING AND QUALITY ASSURANCE L T P C
3 0 0 3

OBJECTIVES:

- To present the concepts software processes methodologies and quality Standards.
- To understand the models and metrics of software quality and reliability.
- To know the behavior of the testing techniques
- To design test cases to detect the errors in the software
- To enable students to gain a working knowledge of techniques for management of testing projects.

UNIT I INTRODUCTION TO SOFTWARE QUALITY 8

Ethical Basis for Software Quality – Total Quality Management Principles – Software Processes and Methodologies – Quality Standards, Practices & Conventions – Improving Quality with Methodologies – Structured/Information Engineering – Measuring Customer Satisfaction–Software Quality Engineering – Defining Quality Requirements – Management Issues for Software Quality – Data Quality Control – Benchmarking and Certification.

UNIT II SOFTWARE QUALITY METRICS AND RELIABILITY 9

Writing Software Requirements and Design Specifications – Analyzing Software Documents using Inspections and Walkthroughs – Software Metrics – Lines of code, Cyclomatic Complexity, Function Points, Feature Points – Software Cost Estimation– Reliability Models – Reliability Growth Models – OO Metrics

UNIT III TEST CASE DESIGN 11

Testing as an Engineering Activity – Testing Fundamentals – Defects – Strategies and Methods for Black Box Test Case Design – Strategies and Methods for White-Box Test Case design –Test Adequacy Criteria – Evaluating Test Adequacy Criteria – Levels of Testing and different types of testing – OO Testing

UNIT IV TEST MANAGEMENT 9

Testing and Debugging Goals and Policies – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Process and the Engineering Disciplines – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V CONTROLLING AND MONITORING 8

Measurement and Milestones for Controlling and Monitoring – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans – Reporting review results

TOTAL: 45 PERIODS

OUTCOMES:

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

- appreciate the importance of software quality assurance;
- apply quality and reliability metrics to ensure the performance of the software.
- test the software by applying various testing techniques.
- prepare test planning based on the document.
- know the inputs and deliverables of the testing process.

REFERENCES:

1. Edward Kit, Susannah Finzi, “Software Testing in the Real World – Improving the Process”, Addison-Wesley, Reprinted, Harlow , 1999.
2. Elfriede Dustin, “Effective Software Testing”, Addison-Wesley, 5th printing, Boston, 2006.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

3. Ilene Burnstein, “Practical Software Testing - **a process-oriented approach”,** Springer-Verlag, New York, 2010.
4. M G Limaye, “Software Testing – Principles, Techniques and Tools”, Tata McGraw-Hill Education, New Delhi, 2009.
5. Milind Limaye, “Software Quality Assurance”, Tata McGraw Hill Education, New Delhi, 2011.
6. Rajani and Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill, New Delhi, 2007.
7. Stephen Kan, “Metrics and Models in Software Quality”, Addison-Wesley, 2nd Edition, Boston, 2008.
8. Yogesh Singh, “Software Testing” Cambridge University Press, Cambridge, 2013.

OPEN ELECTIVE COURSES (OEC)

MA5891 GRAPH THEORY L T P C
3 0 0 3

OBJECTIVES:

- To introduce graph models and their basic concepts.
- To explain the importance of connectivity and traversability in graphs.
- To provide structural characterization of graphs with matching and perfect matching.
- To give exposure to graph coloring and planar graphs.
- To give a structural understanding of directed graphs.

UNIT I INTRODUCTION 9

Graphs and simple graphs - Graph isomorphism - Incidence and adjacency matrices - subgraphs - Vertex degrees - Paths and connection - Cycles - Trees - Cut edges and bonds - Cut vertices.

UNIT II GRAPH CONNECTIVITIY AND GRAPH TRAVERSIBILITY 9

Connectivity - Whitney’s theorems - Blocks - Applications of connectivity - Euler’s tour - Hamilton Cycles - The Chinese Postman Problem - The Traveling Salesman Problem (only a brief introduction to these problems.)

UNIT III MATCHINGS IN GRAPHS 9

Matching - Matchings and covering in bipartite graphs - Perfect matchings - Independent sets.

UNIT IV GRAPH COLORING AND PLANAR GRAPHS 9

Vertex chromatic number - k – critical graphs - Brook’s theorem - Planar graphs - Euler’s formula - Five color theorem.

UNIT V DIRECTED GRAPHS 9

Directed graphs –Strong directed graphs - Tournaments.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Understand the graph models and their utilities and relevant basic concepts.
- Use graph traversability in solving application problems.
- Apply graph matching ideas in various matching related problems.
- Apply graph coloring and planarity ideas in solving graph partitioning and circuit layout problems.
- Apply directed graph ideas in solving real life application problems.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

REFERENCES

1. Balakrishnan R. and Ranganathan K., "A Text Book of Graph Theory", Springer- Verlag,New York, 2012.
2. Bondy J. A. and Murty U.S. R.,"Graph theory with Applications", Elsevier North-Holland New York,1976.
3. Chartrand G. and Zhang P., "Introduction to Graph Theory", Tata McGraw-Hill, New Delhi, 2006.
4. Douglas B. West, "Introduction to Graph Theory", Pearson, Second Edition,New York,2015.

MA5991 STATISTICAL METHODS L T P C
3 0 0 3

OBJECTIVES

- To organize and describe the data and hence compute the various descriptive measures
- To give an idea of testing the statistical hypothesis claimed based on a set of data points using standard sampling distributions
- To expose to the basic principles of experimental design and hence carry out the analysis of variance
- To use non parametric methods on data sets which are not from normally distributed population
- To prepare the students to implement the various concepts in statistics using R statistical tool

UNIT I DESCRIPTIVE STATISTICS 9

Frequency distribution - Graphs of frequency distribution - Descriptive Measures - Quartiles and Percentiles - Calculation of sample mean and population mean

UNIT II HYPOTHESIS TESTING 9

Sampling Distributions- Central Limit Theorem - Testing a Statistical Hypothesis - Tests Concerning Means and variances - Independence of Attributes - Goodness of Fit

UNIT III ANALYSIS OF VARIANCES 9

One way and two way classification - Completely Randomized Design - Randomized Block Design - Latin Square Design

UNIT IV NONPARAMETRIC METHODS 9

Sign Test - Wilcoxon's Signed Rank Test - Rank Sum Tests - Tests of Randomness - Kolmogrov Smirnov and Anderson Darling Tests

UNIT V CALCULATIONS USING R 9

Classification and tabulation of data - Graphical representation - Calculation of central tendency and dispersion of data - Implementation of skewness, moments and kurtosis - Hypothesis Testing - Implementation of ANOVA, sign test and rank sum test.

TOTAL : 45 PERIODS

OUTCOMES:

- It equips the student to compute mean, variances, quartiles and percentiles for a large set of data points obtained from a series of measurements
- It imparts the knowledge of various test statistics used in hypothesis testing for mean and variances of large and small samples
- It enables the students to compare several means
- It makes the students use sign test and rank test which can be applied to any raw data without the underlying assumptions that the observations are from normal population.
- It equips the students to implement the various concepts learnt using R tool for statistics

REFERENCES :

1. Gupta S. C. and Kapoor V. K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, New Delhi, 2002.
2. John E. Freund ," Mathematical Statistics with Applications", 8th Edition, Pearson Education, New Delhi, 2017.
3. Richard A. Johnson, Irwin Miller and John Freund, "Miller and Freund's Probability and Statistics for Engineers", 8th edition, Pearson Education,New Delhi, 2015.

AUDIT COURSES (AC)

AX5091	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES:

CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										✓		✓
CO2										✓		✓
CO3										✓		✓
CO4										✓		✓
CO5										✓		✓

REFERENCES:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX5092 DISASTER MANAGEMENT L T P C
2 0 0 0

OBJECTIVES:

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 9

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 9

Economic Damage, Loss of Human and Animal Life, Destruction OfEcosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, DroughtsAnd Famines, Landslides And Avalanches, Man-made disaster: Nuclear ReactorMeltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease AndEpidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA 9

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 9

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT **9**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL: 30 PERIODS

OUTCOMES:

CO1: Ability to summarize basics of disaster
CO2: Ability to explaina critical understanding of key concepts in disaster riskreduction and humanitarian response.
CO3: Ability to illustratedisaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describean understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to developthe strengths and weaknesses of disaster management approaches

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3	✓	✓	✓									
CO4	✓	✓	✓									
CO5	✓	✓	✓									

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

AX5093 SANSKRIT FOR TECHNICAL KNOWLEDGE **L T P C 2 0 0 0**

OBJECTIVES:

- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS **6**

Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES **6**

Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS 6

Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE 6

Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES:

- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										✓		✓
CO2										✓		✓
CO3												✓
CO4												✓
CO5												✓

REFERENCES:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

AX5094 VALUE EDUCATION L T P C

2 0 0 0

OBJECTIVES

Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I

Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements

UNIT II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT III

Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV

Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to

- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

SUGGESTED READING

1. Chakroborty, S.K."Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

AX5095 CONSTITUTION OF INDIA L T P C
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION:

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION:

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:

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

UNIT IV ORGANS OF GOVERNANCE:

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

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT V LOCAL ADMINISTRATION:

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

UNIT VI ELECTION COMMISSION:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX5096 PEDAGOGY STUDIES L T P C
2 0 0 0

OBJECTIVES

Students will be able to:

- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY:

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to understand:

- What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

1. Ackers J, HardmanF (2001) Classroom interaction in Kenyan primary schools, Compare, 31(2): 245-261.
2. Agrawal M (2004)Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36(3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1.London:DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33(3): 272–282.
5. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M(2003) Read India: Amass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

AX5097 STRESS MANAGEMENT BY YOGA L T P C
2 0 0 0

OBJECTIVES

- To achieve overall health of body and mind
- To overcome stress

UNIT I

Definitions of Eight parts of yoga.(Ashtanga)

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

UNIT II

Yam and Niyam - Do‘s and Don’t’s in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III

Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING

1. ‘Yogic Asanas for Group Tarining-Part-I”:Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AX5098	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L T P C 2 0 0 0

OBJECTIVES

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I

Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont’s) - Verses- 71,73,75,78 (do’s)

UNIT II

Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 - Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and man kind to peace and prosperity
- Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING

1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.