ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
B.TECH. INFORMATION TECHNOLOGY

Vision of the Department

To educate students with conceptual knowledge and technical skills in the field of Information Technology with moral and ethical values to achieve excellence in academic, industry and research centric environments.

Mission of the Department

1. To inculcate in students a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.
2. To provide a conducive environment for all academic, administrative and interdisciplinary research activities using state-of-the-art technologies.
3. To stimulate the growth of graduates and doctorates, who will enter the workforce as productive IT engineers, researchers and entrepreneurs with necessary soft skills, and continue higher professional education with competence in the global market.
4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.
5. To cater to cross-cultural, multinational and demographic diversity of students.
6. To educate the students on the social, ethical, and moral values needed to make significant contributions to society.

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Demonstrate core competence in basic engineering and mathematics to design, formulate, analyze, and solve hardware/software engineering problems.
II. Develop insights in foundational areas of Information Technology and related engineering to address real-world problems using digital and cognitive technologies.
III. Collaborate with industry, academic and research institutions for state-of-the-art product development and research.
IV. Inculcate a high degree of professionalism, effective communication skills and team spirit to work on multidisciplinary projects in diverse environments.
V. Practice high ethical values and technical standards.

2. PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Information Technology 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	Interact in industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary 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):

I. Ability to apply programming principles and practices for the design of software solutions in an internet-enabled world of business and social activities.

II. Ability to identify the resources to build and manage the IT infrastructure using the current technologies in order to solve real world problems with an understanding of the tradeoffs involved in the design choices.

III. Ability to plan, design and execute projects for the development of intelligent systems with a focus on the future.

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						✓	✓	✓	✓	✓		

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
YEAR 1	Semester 1	Technical English												
		Engineering Mathematics I												
		Engineering Physics												
		Engineering Chemistry												
		Problem Solving and Python Programming	✓	✓	✓	✓	✓			✓	✓			✓
		Basic Sciences Laboratory												
		Problem solving and Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓			✓
	Semester 2	Professional Communication												
		Engineering Mathematics II												
		Information Technology Essentials	✓	✓	✓	✓	✓				✓		✓	✓
		Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	✓							
		Engineering Graphics	✓	✓	✓	✓	✓		✓			✓	✓	✓
		Information Technology Essentials Laboratory	✓	✓	✓	✓	✓				✓		✓	✓
		Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓	✓				✓		✓	
YEAR 2	Semester 3	Discrete Mathematics												
		Digital Logic and Design	✓	✓	✓	✓	✓				✓			✓

		Programming and Data Structures	✓	✓	✓	✓	✓				✓		✓	✓
		Database Management Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Software Engineering	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
		Electives – Humanities I												
		Programming and Data Structures Laboratory	✓	✓	✓	✓	✓				✓		✓	✓
		Database Management Systems Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Semester 4	Electives – Humanities II												
		Environmental Sciences												
		Audit Course I												
		Object Oriented Programming and Advanced Data Structures	✓	✓	✓	✓	✓				✓		✓	✓
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓				✓			✓
		Operating Systems	✓	✓	✓	✓	✓				✓			✓
		Computer Architecture	✓	✓	✓	✓	✓				✓			✓
		Operating Systems Laboratory	✓	✓	✓	✓	✓				✓			✓
		Advanced Data Structures Laboratory	✓	✓	✓	✓	✓				✓		✓	✓
YEAR 1		Audit Course II												
	Semester 5	Compiler Engineering	✓	✓	✓	✓	✓				✓		✓	✓
		Computer Networks	✓	✓	✓	✓	✓				✓			✓
		Web Technologies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		Professional Elective I												
		Electives – Humanities I												
		Computer Networks Laboratory	✓	✓	✓	✓	✓				✓			✓
		Web Technologies Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Summer Internship / Summer Project (Minimum 4 Weeks)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Semester 6	Embedded Systems and Internet of Things	✓	✓	✓	✓	✓		✓		✓		✓	✓
		Data Science and Analytics	✓	✓	✓	✓	✓			✓				✓
		Distributed and Cloud Computing	✓	✓	✓	✓	✓	✓	✓	✓				✓
		Professional Elective II												
		Professional Elective III												
		Open Elective I												
		Embedded Systems and Internet of Things Laboratory	✓	✓	✓	✓	✓		✓		✓		✓	✓
		Data Analytics and Cloud Computing Laboratory	✓	✓	✓	✓	✓				✓			✓
		Socially Relevant Project Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
YEAR 2	**Semester 7**	Artificial Intelligence	✓	✓	✓	✓	✓	✓			✓			✓
		Mobile Computing	✓	✓	✓	✓		✓	✓	✓	✓		✓	
		Cryptography and Security	✓	✓	✓	✓	✓	✓		✓	✓			

		Professional Elective IV											
		Professional Elective V											
		Open Elective											
		Mobile and Security Laboratory	✓	✓	✓	✓	✓	✓		✓	✓			
		Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Semester 8	Professional Elective VI												
		Professional Elective VII												
		Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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CURRICULA AND SYLLABI FOR I - VIII SEMESTER
SEMESTER I

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS5151	Technical English	HSMC	4	0	0	4	4
2	MA5158	Engineering Mathematics I	BSC	3	1	0	4	4
3	PH5151	Engineering Physics	BSC	3	0	0	3	3
4	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
PRACTICALS								
6	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**1**	**8**	**25**	**21**

SEMESTER II

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS5251	Professional Communication	HSMC	4	0	0	4	4
2	MA5252	Engineering Mathematics II	BSC	3	1	0	4	4
3	IT5201	Information Technology Essentials	ESC	3	0	0	3	3
4	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
5	GE5151	Engineering Graphics	ESC	1	0	4	5	3
PRACTICALS								
6	IT5211	Information Technology Essentials Laboratory	ESC	0	0	4	4	2
7	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**14**	**1**	**12**	**27**	**21**

SEMESTER III

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA5302	Discrete Mathematics	BSC	3	1	0	4	4
2	IT5301	Digital Logic and Design	ESC	2	0	2	4	3
3	IT5352	Programming and Data Structures	PCC	3	0	0	3	3
4	IT5351	Database Management Systems	PCC	3	0	0	3	3
5	IT5302	Software Engineering	PCC	3	0	0	3	3
6		Electives – Humanities I	HSMC	3	0	0	3	3
PRACTICALS								
7	IT5311	Programming and Data Structures Laboratory	PCC	0	0	4	4	2
8	IT5312	Database Management Systems Laboratory	PCC	0	0	4	4	2
			TOTAL	**17**	**1**	**10**	**28**	**23**

SEMESTER IV

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
2.	IT5401	Object Oriented Programming and Advanced Data Structures	PCC	3	0	0	3	3
3.	IT5402	Design and Analysis of Algorithms	PCC	3	0	0	3	3
4.	IT5403	Operating Systems	PCC	3	0	0	3	3
5.	IT5451	Computer Architecture	PCC	3	0	0	3	3
6.		Audit Course – I *	AC	3	0	0	3	0
7.		Electives – Humanities II	HSMC	3	0	0	3	3
PRACTICALS								
8.	IT5411	Operating Systems Laboratory	PCC	0	0	4	4	2
9.	IT5412	Advanced Data Structures Laboratory	PCC	0	0	4	4	2
			TOTAL	**21**	**0**	**8**	**29**	**22**

*Audit Course is optional

SEMESTER V

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	IT5502	Compiler Engineering	PCC	3	0	0	3	3
2.	IT5551	Computer Networks	PCC	3	0	0	3	3
3.	IT5501	Web Technologies	PCC	3	0	0	3	3
4.		Electives – Humanities I	HSMC	3	0	0	3	3
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Audit Course II *	AC	3	0	0	3	0
PRACTICALS								
7.	IT5511	Computer Networks Laboratory	PCC	0	0	4	4	2
8.	IT5512	Web Technologies Laboratory	PCC	0	0	4	4	2
9.	IT5513	Summer Internship / Summer Project (Minimum 4 Weeks)	EEC	0	0	0	0	2
			TOTAL	**18**	**0**	**8**	**26**	**21**

*Audit Course is optional

SEMESTER VI

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	IT5601	Embedded Systems and Internet of Things	PCC	3	0	0	3	3
2	IT5602	Data Science and Analytics	PCC	3	0	0	3	3
3	IT5603	Distributed and Cloud Computing	PCC	3	0	0	3	3
4		Professional Elective II	PEC	3	0	0	3	3
5		Professional Elective III	PEC	3	0	0	3	3
6		Open Elective I	OEC	3	0	0	3	3
PRACTICALS								
7	IT5611	Embedded Systems and Internet of Things Laboratory	PCC	0	0	4	4	2
8	IT5612	Data Analytics and Cloud Computing Laboratory	PCC	0	0	4	4	2
9	IT5613	Socially Relevant Project Laboratory	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER VII

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	IT5701	Artificial Intelligence	PCC	3	0	0	3	3
2	IT5702	Mobile Computing	PCC	3	0	0	3	3
3	IT5703	Cryptography and Security	PCC	3	0	0	3	3
4		Professional Elective IV	PEC	3	0	0	3	3
5		Professional Elective V	PEC	3	0	0	3	3
6		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
7	IT5711	Mobile and Security Laboratory	PCC	0	0	4	4	2
8	IT5712	Project I	EEC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER VIII

S. NO.	CODE NO.	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Professional Elective VI	PEC	3	0	0	3	3
2		Professional Elective VII	PEC	3	0	0	3	3
PRACTICALS								
3	IT5811	Project II	EEC	0	0	16	16	8
			TOTAL	**6**	**0**	**16**	**22**	**14**

TOTAL NO. OF CREDITS: 167

SUMMARY

B.TECH. INFORMATION TECHNOLOGY									
S.No.	Subject Area	Credits per Semester							Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	4	3	3	3				**17**
2	BSC	12	4	4	3					**23**
3	ESC	5	13	3						**21**
4	PCC			13	16	13	13	11		**66**
5	PEC					3	6	6	6	**21**
6	OEC						3	3		**6**
7	EEC					2	1	2	8	**13**
	Total									**167**
8	Non-Credit /(Audit Course)				*	*				

DOMAIN WISE GROUPING OF ELECTIVES:

- The electives have been grouped into 5 domains. The students should take electives from a minimum of four domains (to obtain breadth-wise knowledge), and a minimum of three electives from a single domain (to obtain depth-wise knowledge). The semesters in which the electives can be taken is mentioned.

Sl. No.	Systems and Computational Theory	Data, Analytics and web	Media Processing	Software development	Networks and security
	Domain A	**Domain B**	**Domain C**	**Domain D**	**Domain E**
1	Virtualization Sem: V	Advances in Databases Sem: V, VI, VII, VIII	Computer Graphics Sem: V, VI, VII, VIII	C# and .NET Programming Sem: V, VI, VII, VIII	Advanced Networks Sem: VI, VII, VIII
2	Unix Internals Sem: V, VI, VII, VIII	Soft Computing Sem: VI, VII, VIII	Multimedia Technologies Sem: V, VI, VII, VIII	Software Testing Sem: V, VI, VII, VIII	Network Programming and Management Sem: VI, VII, VIII
3	Heterogeneous Computing Sem: V, VI, VII, VIII	Social Network Analysis Sem: VI, VII, VIII	Digital Signal Processing Sem: V, VI, VII, VIII	E-Learning Techniques Sem: V, VI, VII, VIII	TCP/IP Design and Implementation Sem: VI, VII, VIII

4	Graph Theory Sem: V,VI, VII, VIII	Semantic Web Sem: VI, VII, VIII	Multimedia Coding Techniques Sem: V,VI, VII, VIII	Intellectual Property Rights Sem: VI, VII, VIII	Wireless Sensor and Mesh Networks Sem: VII, VIII
5	Human Computer Interaction Sem: V,VI, VII, VIII	Information Retrieval Sem: VI, VII, VIII	Pattern Recognition Sem: V,VI, VII, VIII	Software Project Management Sem: VI, VII, VIII (after Software Testing)	Ethical Hacking Sem: VII, VIII
6	Logic and Applications in Computer Science Sem: V,VI, VII, VIII	IoT Based Smart Systems Sem: VII, VIII	Visualization Techniques Sem: V,VI, VII, VIII	Service Oriented Architecture and Microservices Sem: VI, VII, VIII	Next Generation Networks Sem: VII. VIII
7	Infrastructure Management Sem VI, VII, VIII	Machine Learning Sem: VII, VIII	Fundamentals of Digital Image Processing Sem: VI, VII, VIII	Software Quality Assurance Sem: VI, VII, VIII	Computer Forensics Sem:VII, VIII
8	Quantum Computing Sem VI, VII, VIII	Cognitive Computing Sem: VII, VIII	Mixed Reality Sem: VI, VII, VIII (after Computer Graphics)	Autonomous Ground Vehicle Systems Sem: VI, VII, VIII	
9	Blockchain Technologies Sem: VII, VIII	Computational Linguistics Sem: VII, VIII	Game Programming Sem: VI, VII, VIII (after Computer Graphics)	Full Stack Software Development with Python Sem VII, VIII	
10		Deep Learning Sem: VII, VIII	Video Processing and Analytics Sem: VII, VIII (after Fundamentals of Digital Image Processing)		
11		Probability and Random Processes Sem: VII, VIII			
		Linear Algebra and Numerical Methods Sem: VII, VIII			

LIST OF PROFESSIONAL ELECTIVES

Sl. No	COURSE CODE	COURSE TITLE	ELECTIVE DOMAIN	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	IT5001	Virtualization (**SEMESTER V**)	A	PEC	3	0	0	3	3
SEMESTER V ONWARDS									
2.	IT5002	Unix Internals	A	PEC	3	0	0	3	3
3.	IT5003	Heterogeneous Computing	A	PEC	3	0	0	3	3
4.	IT5004	Graph Theory	A	PEC	3	0	0	3	3
5.	IT5005	Human Computer Interaction	A	PEC	3	0	0	3	3
6.	IT5006	Logic and Applications in Computer Science	A	PEC	3	0	0	3	3
7.	IT5007	Advances in Databases	B	PEC	3	0	0	3	3
8.	IT5008	Computer Graphics	C	PEC	3	0	0	3	3
9.	IT5009	Multimedia Technologies	C	PEC	3	0	0	3	3
10.	IT5010	Fundamentals Digital Signal Processing	C	PEC	3	0	0	3	3
11.	IT5011	Multimedia Coding Techniques	C	PEC	3	0	0	3	3
12.	IT5012	Pattern Recognition	C	PEC	3	0	0	3	3
13.	IT5013	Visualization Techniques	C	PEC	3	0	0	3	3
14.	IT5014	C# and .NET Programming	D	PEC	3	0	0	3	3
15.	IT5015	Software Testing	D	PEC	3	0	0	3	3
16.	IT5016	E-Learning Techniques	D	PEC	3	0	0	3	3

SEMESTER VI ONWARDS									
17.	IT5017	Infrastructure Management	A	PEC	3	0	0	3	3
18.	IT5018	Quantum Computing	A	PEC	3	0	0	3	3
19.	IT5019	Soft Computing	B	PEC	3	0	0	3	3
20.	IT5020	Social Network Analysis	B	PEC	3	0	0	3	3
21.	IT5021	Semantic Web	B	PEC	3	0	0	3	3
22.	IT5022	Information Retrieval	B	PEC	3	0	0	3	3
23.	IT5023	Fundamentals of Digital Image Processing	C	PEC	3	0	0	3	3
24.	IT5024	Mixed Reality	C	PEC	3	0	0	3	3
25.	IT5025	Game Programming	C	PEC	3	0	0	3	3
26.	IT5026	Intellectual Property Rights	D	PEC	3	0	0	3	3
27.	IT5027	Software Project Management	D	PEC	3	0	0	3	3
28.	IT5028	Service Oriented Architecture and Microservices	D	PEC	3	0	0	3	3
29.	IT5029	Software Quality Assurance	D	PEC	3	0	0	3	3
30.	IT5030	Autonomous Ground Vehicle Systems	D	PEC	3	0	0	3	3
31.	IT5031	Advanced Networks	E	PEC	3	0	0	3	3
32.	IT5032	Network Programming and Management	E	PEC	3	0	0	3	3
33.	IT5033	TCP/IP Design and Implementation	E	PEC	3	0	0	3	3

SEMESTER VII ONWARDS									
34.	IT5034	Blockchain Technologies	A	PEC	3	0	0	3	3
35.	IT5035	IoT Based Smart Systems	B	PEC	3	0	0	3	3
36.	IT5036	Machine Learning	B	PEC	3	0	0	3	3
37.	IT5037	Cognitive Computing	B	PEC	3	0	0	3	3
38.	IT5038	Computational Linguistics	B	PEC	3	0	0	3	3
39.	IT5039	Deep Learning	B	PEC	3	0	0	3	3
40.	MA5002	Probability and Random Processes	B	PEC	3	1	0	4	4
41.	MA5356	Linear Algebra and Numerical Methods	B	PEC	3	1	0	4	4
42.	IT5040	Video Processing and Analytics	C	PEC	3	0	0	3	3
43.	IT5041	Full Stack Software Development	D	PEC	3	0	0	3	3
44.	IT5042	Wireless Sensor and Mesh Networks	E	PEC	3	0	0	3	3
45.	IT5043	Ethical Hacking	E	PEC	3	0	0	3	3
46.	IT5044	Next Generation Networks	E	PEC	3	0	0	3	3
47.	IT5045	Computer Forensics	E	PEC	3	0	0	3	3

HSMC COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	HS5251	Professional Communication	HSMC	4	0	0	4	4

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Processes	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5271	Gender, Culture and Development	3	0	0	3
2.	HU5272	Ethics and Holistic Life	3	0	0	3
3.	HU5273	Law and Engineering	3	0	0	3
4.	HU5274	Film Appreciation	3	0	0	3
5.	HU5275	Fundamentals of Language and Linguistics	3	0	0	3
6.	HU5276	Understanding Society and Culture through Literature	3	0	0	3

BASIC SCIENCE COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	MA5158	Engineering Mathematics I	BSC	3	1	0	4	4
2.	PH5151	Engineering Physics	BSC	3	0	0	3	3

3.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
4.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
5.	MA5252	Engineering Mathematics II	BSC	0	0	4	4	2
6.	MA5302	Discrete Mathematics	BSC	3	1	0	4	4
7.	GE5251	Environmental Sciences	BSC	3	0	0	3	3

ENGINEERING SCIENCE COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
2.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
3.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
4.	EE5251	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
5.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
6.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2

PROFESSIONAL CORE COURSES

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	IT5352	Programming and Data Structures	PCC	3	0	0	3	3
2.	IT5351	Database Management Systems	PCC	3	0	0	3	3
3.	IT5302	Software Engineering	PCC	3	0	0	3	3
4.	IT5311	Programming and Data Structures Laboratory	PCC	0	0	4	4	2
5.	IT5312	Database Management Systems Laboratory	PCC	0	0	4	4	2
6.	IT5401	Object Oriented Programming and Advanced Data Structures	PCC	3	0	0	3	3

7.	IT5402	Design and Analysis of Algorithms	PCC	3	0	0	3	3
8.	IT5403	Operating Systems	PCC	3	0	0	3	3
9.	IT5451	Computer Architecture	PCC	3	0	0	3	3
10.	IT5411	Operating Systems Laboratory	PCC	0	0	4	4	2
11.	IT5412	Advanced Data Structures Laboratory	PCC	0	0	4	4	2
12.	IT5502	Compiler Engineering	PCC	3	0	0	3	3
13.	IT5551	Computer Networks	PCC	3	0	0	3	3
14.	IT5501	Web Technologies	PCC	3	0	0	3	3
15.	IT5511	Computer Networks Laboratory	PCC	0	0	4	4	2
16.	IT5512	Web Technologies Laboratory	PCC	0	0	4	4	2
17.	IT5611	Embedded Systems and Internet of Things	PCC	3	0	0	3	3
18.	IT5612	Data Analytics and Cloud Computing Laboratory	PCC	3	0	0	3	3
19.	IT5603	Distributed and Cloud Computing	PCC	3	0	0	3	3
20.	IT5611	Embedded Systems and Internet of Things Laboratory	PCC	0	0	4	4	2
21.	IT5612	Data Analytics and Cloud Computing Laboratory	PCC	0	0	4	4	2
22.	IT5701	Artificial Intelligence	PCC	3	0	0	3	3
23.	IT5702	Mobile Computing	PCC	3	0	0	3	3
24.	IT5703	Cryptography and Security	PCC	3	0	0	3	3

EEC COURSES

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.	IT5513	Summer Internship / Summer Project (Minimum 4 Weeks)	EEC	0	0	0	0	2
2.	IT5613	Socially Relevant Project Laboratory	EEC	0	0	2	2	1
3.	IT5712	Project I	EEC	0	0	6	6	3
4.	IT5811	Project II	EEC	0	0	16	16	8

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No	Course Code	Course Title	Periods per week			Total Contact Periods	Credits
			Lecture	Tutorial	Practical		
1.	AD5091	Constitution of India	3	0	0	3	0
2.	AD5092	Value Education	3	0	0	3	0
3.	AD5093	Pedagogy Studies	3	0	0	3	0
4.	AD5094	Stress Management by Yoga	3	0	0	3	0
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	3	0
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	3	0
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	3	0
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	3	0
Total Credits:						**24**	**0**

HS5151 **TECHNICAL ENGLISH** **L T P C**

4 0 0 4

OBJECTIVES:

- To familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- To develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- To enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF 12

Listening: Listening and Filling a Form, Listening to Speeches by Specialists From Various Branches of Engineering and Completing Activities such as Answering Questions, Identifying the Main Ideas of the Listening Text, Style of the Speaker (Tone and Tenor) – **Speaking**: Introducing Oneself – Introducing Friend/ Family – **Reading:** Descriptive Passages (From Newspapers / Magazines) – **Writing**: Writing a Paragraph (Native Place, School Life) – **Grammar:** Simple Present, Present Continuous – **Vocabulary Development**: One Word Substitution.

UNIT II DIALOGUE WRITING 12

Listening: Listening to Conversations (Asking for and Giving Directions) – **Speaking:** Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays-Dialogues – **Reading:** Reading a Print Interview and Answering Comprehension Questions-**Writing**: Writing a Checklist, Dialogue Writing – **Grammar**: Simple Past – Question Formation (Wh-Questions, Yes or No Questions, Tag Questions) – **Vocabulary Development**: Stress Shift, Lexical Items Related to the Theme of the Given Unit.

UNIT III FORMAL LETTER WRITING 12

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech – Answering Multiple-Choice Questions) – **Speaking:** Giving Short Talks on a Given Topic- **Reading:** Reading Motivational Essays on Famous Engineers and Technologists (Answering Open – Ended and Closed Questions) – **Writing:** Writing Formal Letters/ Emails (Complaint Letters) – **Grammar**: Future Tense Forms of Verbs, Subject and Verb Agreement-**Vocabulary Development**: Collocations – Fixed Expressions.

UNIT IV WRITING COMPLAINT LETTERS 12

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making – **Speaking:** Small Group Discussion, Giving Recommendations – **Reading:** Reading Problem – Solution Articles/Essays Drawn From Various Sources – **Writing:** Making Recommendations – Writing a Letter/ Sending an Email to the Editor – Note Making – **Grammar:** Modals – Phrasal Verbs – Cause and Effect Sentences – **Vocabulary Development**: Connectives, Use Of Cohesive Devices In Writing, Technical Vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

Listening: Listening to a Product Description (Labeling and Gap Filling) Exercises – **Speaking:** Describing a Product and Comparing and Contrasting it with Other Products – **Reading**: Reading Graphical Material for Comparison (Advertisements) – **Writing:** Writing Definitions (Short and Long) – Compare and Contrast Paragraphs- **Grammar:** Adjectives – Degrees of Comparison – Compound Nouns – **Vocabulary Development**: Use of Discourse Markers – Suffixes (Adjectival Endings).

TOTAL : 60 PERIODS

LEARNING OUTCOMES

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

1. Exposure to basic aspects of technical English.
2. Gain confidence to communicate effectively I various academic situations.
3. Learn the use of basic features of Technical English.

TEXTBOOKS:

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

Assessment Pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158 ENGINEERING MATHEMATI CS – I L T P C

(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

OBJECTIVES:

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

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a Real Matrix – Characteristic Equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem – Diagonalization of Matrices – Reduction of a Quadratic Form to Canonical Form by Orthogonal Transformation – Nature of Quadratic Forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of Function – One Sided Limit – Limit Laws – Continuity – Left and Right Continuity – Types of Discontinuities – Intermediate Value Theorem – Derivatives of a Function – Differentiation Rules – Chain Rule – Implicit Differentiation – Logarithmic Differentiation – Maxima and Minima – Mean Value Theorem – (Optional: Polar Coordinate System – Differentiation in Polar Coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES 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.

UNIT V MULTIPLE INTEGRALS 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:

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

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

TEXTBOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, Forty Fourth Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, Sixth Edition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas' Calculus", Pearson, Fourteenth Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Bali N., Goyal M., Watkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), Seventh Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, New Delhi, 2015.
3. Greenberg M.D., “Advanced Engineering Mathematics”, Pearson Education, Second Edition, Fifth Reprint, Delhi, 2009.
4. Jain R.K., Iyengar S.R.K., “Advanced Engineering Mathematics”,Narosa Publications, Fifth Edition, New Delhi, 2017.
5. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, Seventh Edition, New Delhi , 2012.
6. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., Eleventh Reprint, New Delhi, 2010.

PH5151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS 9

Moment of Inertia (M.I) - Radius of Gyration - Theorems of M .I – M.I of Circular Disc, Solid Cylinder , Hollow Cylinder , Solid Sphere and Hollow Sphere – K.E of a Rotating Body – M.I of a Diatomic Molecule – Rotational Energy State of a Rigid Diatomic Molecule – Centre of Mass – Conservation of Linear Momentum – Relation Between Torque and Angular momentum – Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES 9

Gauss's Law – Faraday's Law – Ampere's Law – The Maxwell's Equations – Wave Equation; Plane Electromagnetic Waves in Vacuum, Conditions on the Wave Field – Properties of Electromagnetic Waves: Speed, Amplitude, Phase, Orientation and Waves in Matter – Polarization – Producing Electromagnetic Waves – Energy and Momentum in EM Waves: Intensity, Waves From Localized Sources, Momentum and Radiation Pressure – Cell-Phone Reception. Reflection and Transmission of Electromagnetic Waves from a Non-Conducting Medium – Vacuum Interface for Normal Incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple Harmonic Motion – Resonance – Waves on a String – Standing Waves – Traveling Waves – Energy Transfer of a Wave – Sound Waves – Doppler Effect – Reflection and Refraction of Light Waves – Total Internal Reflection – Interference – Interferometers – Air Wedge Experiment. Theory of Laser – Characteristics – Spontaneous and Stimulated Emission – Einstein's Coefficients – Population Inversion – Nd-YAG Laser, CO_2 Laser, Semiconductor Laser – Applications.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and Light Waves – Electrons And Matter Waves – The Schrodinger Equation (Time Dependent and Time Independent Forms) – Meaning of Wave Function – Normalization - Particle in a Infinite Potential Well – Normalization, Probabilities and the Correspondence Principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The Harmonic Oscillator – Barrier Penetration and Quantum Tunneling – Tunneling Microscope – Resonant Diode – Finite Potential Wells – Particle in a Three Dimensional Box – Bloch's Theorem for Particles in a Periodic Potential, Kronig-Penney Model and Origin of Energy Bands.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understanding the importance of mechanics.
2. Express the knowledge of electromagnetic waves.
3. Know the basics of oscillations, optics and lasers.
4. Understanding the importance of quantum physics.
5. Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

1. D.Kleppner, R.Kolenkow., "An Introduction to Mechanics", McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick, J.Walker, "Principles of Physics". John Wiley & Sons, 2015.
3. N.Garcia, A.Damask, S.Schwarz, "Physics for Computer Science Students", Springer- Verlag, 2012.

REFERENCES:

1. R.Wolfson, "Essential University Physics", Volume 1 & 2, Pearson, 2016.
2. D.J.Griffiths, "Introduction to Electrodynamics. Pearson Education", 2015.
3. K.Thyagarajan, A.Ghatak, "Lasers: Fundamentals and Applications", Springer, 2012.

CY5151 ENGINEERING CHEMISTRY L T P C
(COMMON TO ALL BRANCHES) 3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality – Degree of Polymerization. Classification of Polymers- Natural and Synthetic, Thermoplastic and Thermosetting. Types and Mechanism of Polymerization: Addition (Free Radical, Cationic, Anionic And Living); Condensation and Copolymerization. Properties of Polymers: Tg, Tacticity, Molecular Weight – Weight Average, Number Average and Polydispersity Index. Techniques of Polymerization: Bulk, Emulsion, Solution and Suspension. Structure, Properties and Uses Of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting Polymers – Polyaniline and Polypyrrole.

UNIT II NANOCHEMISTRY 9

Basics – Distinction Between Molecules, Nanomaterials and Bulk Materials; Size-Dependent Properties. Types – Nanoparticle, Nanocluster, Nanorod, Nanowire and Nanotube. Preparation of Nanomaterials: Sol-Gel, Solvothermal, Laser Ablation, Chemical Vapour Deposition, Electrochemical Deposition and Electro Spinning. Characterization – Scanning Electron Microscope and Transmission Electron Microscope – Principle and Instrumentation (Block Diagram). Properties (Optical, Electrical, Mechanical and Magnetic) and Applications of Nanomaterials – Medicine, Agriculture, Electronics and Catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of Photochemistry – Grotthuss-Draper Law, Stark-Einstein Law and Lambert-Beer Law (Derivation and Problems). Photo Physical Processes – Jablonski Diagram. Chemiluminescence, Photo-Sensitization and Photoquenching – Mechanism and Examples. Spectroscopy: Electromagnetic Spectrum – Absorption of Radiation – Electronic, Vibrational and Rotational Transitions. Width and Intensities of Spectral Lines. Atomic Absorption Spectroscopy, UV-Vis and IR Spectroscopy – Principles, Instrumentation (Block Diagram) and Applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

Nuclear Fission – Controlled Nuclear Fission – Nuclear Fusion – Differences Between Nuclear Fission and Fusion – Nuclear Chain Reactions – Nuclear Energy – Light Water Nuclear Power Plant – Fast Breeder Reactor. Solar Energy Conversion – Solar Cells. Wind Energy. Batteries – Types of Batteries – Primary Battery (Dry Cell), Secondary Battery (Lead Acid, Nickel-Cadmium and Lithium-Ion-Battery). Fuel Cells – H_2-O_2 and Microbial Fuel Cell. Explosives – Classification, Examples: TNT, RDX, Dynamite; Rocket Fuels and Propellants – Definition and Uses.

UNIT V WATER TECHNOLOGY 9

Water – Sources And Impurities – Water Quality Parameters: Colour, Odour, pH, Hardness, Alkalinity, TDS, COD and BOD. Boiler Feed Water – Requirement – Troubles (Scale & Sludge, Caustic Embrittlement, Boiler Corrosion and Priming & Foaming. Internal

Conditioning – Phosphate, Calgon and Carbonate Treatment. External Conditioning – Zeolite (Permutit) And Ion Exchange Demineralization. Municipal Water Treatment Process – Primary (Screening, Sedimentation and Coagulation), Secondary (Activated Sludge Process And Trickling Filter Process) And Tertiary (Ozonolysis, UV Treatment, Chlorination, Reverse Osmosis).

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Rrecognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
2. Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. Identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
4. Recognize different forms of energy resources and apply them for suitable applications in energy sectors.
5. Demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C., Monica Jain., “Engineering Chemistry”, Sixteenth Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, “A text book of Engineering Chemistry”, Chand Publications, 2014.

REFERENCES:

1. Schdeva M V, “Basics of Nano Chemistry”, Anmol Publications Pvt Ltd
2. B.Sivasankar, “Instrumental Methods of Analysis”, Oxford University Press. 2012.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International Ltd.
4. V RGowariker, N V Viswanathan, Jayadev Sreedhar, “Polymer Science”, New AGE International Publishers, 2009.

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodes and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.

- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods:
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

Suggested Activities:
- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

Suggested Evaluation Methods:
- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

Suggested Activities:
- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods:
- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

Suggested Activities:
- Implementing Python program by importing Time module, Math package etc.

- Creation of any package (student's choice) and importing into the application.

Suggested Evaluation Methods:

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓

CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

BS5161 **BASIC SCIENCES LABORATORY** **L T P C**
(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS:

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc.
2. Non-uniform bending – Determination of young's modulus.
3. Uniform bending – Determination of young's modulus.
4. Lee's disc Determination of thermal conductivity of a bad conductor.
5. Potentiometer – Determination of thermo e.m.f of a thermocouple.
6. Laser- Determination of the wave length of the laser using grating.
7. Air wedge – Determination of thickness of a thin sheet/wire.
8. Optical fibre – Determination of Numerical Aperture and acceptance angle.
9. Compact disc – Determination of width of the groove using laser..
10. Acoustic grating – Determination of velocity of ultrasonic waves in liquids.
11. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
12. Post office box – Determination of Band gap of a semiconductor.
13. Spectrometer – Determination of wavelength using gating.
14. Photoelectric effect.
15. Michelson Interferometer.
16. Estimation of laser parameters.
17. Melde's string experiment.

TOTAL: 30 PERIODS

OUTCOMES:

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

1. Determine various moduli of elasticity and also various thermal and optical properties of materials.
2. Determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

BASIC SCIENCE LABORATORY

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.

- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler‟s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

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

1. Analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
2. Determine the amount of metal ions through volumetric and spectroscopic techniques.
3. Determine the molecular weight of polymers by viscometric method.
4. Quantitatively analyse the impurities in solution by electroanalytical techniques.
5. Design and analyse the kinetics of reactions and corrosion of metals.

TEXT BOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel‟s Textbook of Quantitative Chemical Analysis (Eighth Edition, 2014).

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.

2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

HS5251 PROFESSIONAL COMMUNICATION

L	T	P	C
4	0	0	4

OBJECTIVES

- To improve the relevant language skills necessary for professional communication.
- To develop linguistic and strategic competence in workplace context.
- To enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION **12**

Listening: Listening to Telephone Conversations (Intent of the Speaker and Note Taking Exercises) – Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself – Reading: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting) – Writing: Writing a Short Biography of an Achiever

Based on Given Hints – Grammar: Asking and Answering Questions, Punctuation in Writing, Prepositional Phrases – Vocabulary Development: Use of Adjectives.

UNIT II SUMMARY WRITING 12

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points – Speaking: Participating in Debates – Reading: Reading Technical Essays/ Articles and Answering Comprehension Questions – Writing: Summary Writing – Grammar: Participle Forms, Relative Clauses – Vocabulary Development: Use of Compound Words, Abbreviations and Acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening: Listening to a Process Description and Drawing a Flowchart – Speaking: Participating in Group Discussions, Giving Instructions – Reading: Reading Instruction Manuals – Writing: Writing Process Descriptions – Writing Instructions – Grammar: Use of Imperatives, Active and Passive Voice, Sequence Words – Vocabulary Development: Technical Jargon.

UNIT IV REPORT WRITING 12

Listening: Listening to a Presentation and Completing Gap-Filling Exercises – Speaking: Making Formal Presentations – Reading: Reading and Interpreting Charts/Tables and Diagrams – Writing: Interpreting Charts/Tables and Diagrams, Writing a Report – Grammar: Direct into Indirect Speech, Use of Phrases – Vocabulary Development: Reporting Words.

UNIT V WRITING JOB APPLICATIONS 12

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises – Speaking: Mock Interview, Telephone Interviews – Reading: Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises – Writing: Job Applications and Resumes And Sops-Grammar: Present Perfect and Continuous Tenses- Vocabulary Development: Technical Vocabulary.

TOTAL : 60 PERIODS

LEARNING OUTCOMES

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

1. Read and comprehend technical texts effortlessly.
2. Write reports of a technical kind.
3. Speak with confidence in interviews and thereby gain employability

TEXTBOOK

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

ASSESSMENT PATTERN

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5252	**ENGINEERING MATHEMATICS – II**	**L**	**T**	**P**	**C**
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)		**3**	**1**	**0**	**4**

OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.

- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 12

Gradient and Directional Derivative – Divergence and Curl – Irrotational and Solenoidal Vector Fields – Line Integral Over A Plane Curve – Surface Integral – Area of a Curved Surface – Volume Integral – Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem – Verification and Application In Evaluating Line, Surface and Volume Integrals.

UNIT II ANALYTIC FUNCTION 12

Analytic Functions – Necessary and Sufficient Conditions for Analyticity – Properties – Harmonic Conjugates – Construction of Analytic Function - Conformal Mapping – Mapping by Functions – Bilinear Transformation $w = c + z,\ az,\ 1/z,\ z^2$.

UNIT III COMPLEX INTEGRATION 12

Line Integral - Cauchy's Integral Theorem – Cauchy's Integral Formula – Taylor's and Laurent's Series – Singularities – Residues – Residue Theorem – Application of Residue Theorem for Evaluation of Real Integrals – Use of Circular Contour and Semicircular Contour With No Pole on Real Axis.

UNIT IV DIFFERENTIAL EQUATIONS 12

Method of Variation of Parameters – Method of Undetermined Coefficients – Homogenous Equations of Euler's and Legendre's Type – System of Simultaneous Linear Differential Equations with Constant Coefficients.

UNIT V 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.

TOTAL : 60 PERIODS

OUTCOMES:

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

1. Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
2. Construct analytic functions and use their conformal mapping property in application problems.
3. Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
4. Apply various methods of solving differential equation which arise in many application problems.
5. Apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Forty fourth Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M., Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), Seventh Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, Fourth Edition, New Delhi, 2011.
3. Jain R.K., Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, Fifth Edition, New Delhi, 2017.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, Seventh Edition, New Delhi, 2012.
5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., Eleventh Reprint, New Delhi, 2010.

IT5201 INFORMATION TECHNOLOGY ESSENTIALS L T P C
3 0 0 3

OBJECTIVES:

- To design and develop web pages using HTML and CSS.
- To understand the general concepts of PHP scripting language and MySQL functionalities for the development of simple data-centric applications.
- To provide a basic knowledge of computer hardware and software.
- To familiarize with the basic taxonomy and terminology of computer networking and mobile communications.
- To understand various types of information systems and their complexities.

UNIT I WEB AND SCRIPTING ESSENTIALS 9

Internet Basics – Browser Fundamentals – Authoring Tools – Introduction to HTML5 – HTML5 Tags – HTML5 Forms – Cascading Style Sheets (CSS3) Fundamentals – Need for Scripting Languages – Introduction to JavaScript/ Angular JS.

Suggested Activities:

- Browse the internet on special topics given by instructor.
- Learn HTML basic tags for web page design.
- Identify different types of form validations in the websites that are commonly used.
- Practical - Design of a small simple website, interlinking set of web pages created using the HTML tags and CSS.

Suggested Evaluation Methods:

- Quizzes on all the topics of the unit.
- Discussion on form validation.
- Peer evaluation of the simple web-sites created.

UNIT II SERVER-SIDE ESSENTIALS (PHP) 11

Introduction to PHP – PHP Variables – Constants – Operators – Flow Control and Looping – Arrays – Strings – Functions – File Handling – Exception Handling – PHP and HTML – Database Management – Introduction to MySQL – MySQL Commands – MySQL Database Creation – Connecting MySQL and PHP – Querying MySQL Database with PHP – Session and Cookies.

Suggested Activities:

- Practical - Simple programs using PHP.

- Design of a dynamic web pages using PHP.
- Practical - Database creation using MySQL and PHP scripts.
- Practical - Creation of session and cookies.

Suggested Evaluation Methods:
- Quizzes on different topics of the unit.
- Demonstration of the implementations.
- Group discussions design of web page.

UNIT III HARDWARE ESSENTIALS 7

Motherboard – Networking Cards – Graphics Card – Processors – Hard Drive – USB Port – Monitor Ports – Servers – Types of Servers – Web Server – Database Server – Data Center and Cloud Servers – Server Management.

Suggested Activities:
- Understanding Personal Computer and various components.
- Case studies on different types of servers.
- Survey on data centre, cloud server and high-end server.

Suggested Evaluation Methods:
- Quizzes on hardware components.
- Presentations of case studies and survey.

UNIT IV NETWORK ESSENTIALS 9

Basics of Computer System – Data Transmission Fundamentals – Communication Medium –Fundamentals of Computer Networking – Types of Computer Networks – Network Topologies – Network Standards: OSI Model, TCP/IP Model – Network Protocols: TCP, UDP, IP – Network Components – Introduction to Mobile Communication – Generations of Cellular Networks – GSM.

Suggested Activities:
- Flipped classroom on generations of cellular networks.
- Explore the web to know more about the networking concepts and recent technologies. Students may present their findings orally or by a written report or through discussion forums.
- Explore the networking devices used in laboratories and homes, and their configurations.

Suggested Evaluation Methods:
- Quizzes on network transmission and communication.
- Report evaluation by peers.
- Discussion on network devices.

UNIT V APPLICATION ESSENTIALS 9

Creation of Simple Interactive Applications – Simple Database Applications – Introduction to Information Systems – Personal Information System – Information Retrieval System – Social Networking Applications.

Suggested Activities:
- Flipped classroom on social networking applications.
- Explore the web to know more about the concepts and technologies used for the design of Information Systems. Students may present their findings orally or by a written report.
- Design a simple web or mobile application.

- Explore and analyze some of the visual analytics software.

Suggested Evaluation Methods:

- Quizzes on features of social networking applications.
- Presentations on various information systems.
- Demonstration of application.
- Discussions through forums.

TOTAL :45 PERIODS

OUTCOMES:

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

CO1: Create dynamic website/web based applications using HTML, PHP, and MYSQL database.

CO2: Design websites that meet specified needs and interests using basic elements to control layout and style.

CO3: Debug the programs by applying concepts and error handling techniques of HTML, JavaScript, PHP and MYSQL.

CO4: Understand the basic concepts of data communications and networking.

CO5: Describe the basic principles of mobile communication systems.

CO6: Identify the fundamental concepts and key issues in the design of commonly used applications.

TEXT BOOKS:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites", O'Reilly Media, Inc, 2014.
2. James Kurose and Keith Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, 2017.

REFERENCES:

1. Steven Holzner, "PHP: The Complete Reference", Fifth Edition, Mc Graw Hill, 2017.
2. Niederst Robbins, Jennifer, "Learning Web Design: A Beginner's Guide to HTML, CSS, Javascript, and Web Graphics", Fifth Edition, O'Reilly Media, 2018.
3. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, "Mastering HTML, CSS & JavaScript Web Publishing", BPB Publications, 2016.
4. Douglas E. Comer, "Computer Networks and Internets", Sixth Edition, Prentice Hall, 2015.
5. Jochen Schiller, "Mobile Communications", Pearson Education, 2012.
6. R. Kelly Rainer, Casey G. Cegielski, Brad Prince, "Introduction to Information Systems", Fifth Edition, Wiley Publication, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	-				-		✓	✓
CO2	✓	✓	✓	✓	-				-		✓	✓
CO3	✓	-	✓	-	✓				✓		✓	✓
CO4	✓	-	✓	-	✓				✓		-	-
CO5	✓	-	✓	-	✓				✓		-	-
CO6	✓	-	✓	-	✓				-		✓	✓

EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical Circuit Elements (R, L and C)-Dependent And Independent Sources – Ohm's Law-Kirchhoff's Laws – Mesh Current and Node Voltage Methods (Analysis with only Independent Source) – Phasors – RMS-Average Values – Sinusoidal Steady State Response of Simple RLC Circuits. Types of Wiring – Domestic Wiring – Specification of Wires – Earthing-Methods – Protective Devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three Phase Supply – Star Connection – Delta Connection – Balanced and Unbalanced Loads- Power in Three-Phase Systems – Comparison of Star and Delta Connections – Advantages-Magnetic Circuits-Definitions – MMF, Flux, Reluctance, Magnetic Field Intensity, Flux Density, Fringing, Self and Mutual Inductances-Simple Problems.

UNIT III ELECTRICAL MACHINES 9

Working Principle of DC Generator, Motor-EMF And Torque Equation-Types – Shunt, Series and Compound-Applications. Working Principle of Transformer-EMF Equation – Operating Principles of Three Phase and Single Phase Induction Motor – Applications. Working Principles of Alternator – EMF Equation – Operating Principles of Synchronous Motor, Stepper Motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic Semiconductors, Extrinsic Semiconductors – P-type and N-type, P-N Junction, VI Characteristics of PN Junction diode, Zener Effect, Zener Diode, Zener Diode Characteristics-Rectifier Circuits – Wave Shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working Principle and Characteristics – BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: To be able to understand the concepts related with electrical circuits and wiring.
CO2: To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3: Capable of understanding the operating principle of AC and DC machines.
CO4: To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5: To be able to understand the characteristics and working of current controlled and voltage controlled devices.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014
2. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi,1989.
3. John Bird, "Electrical Circuit theory and technology", Routledge, Fifth edition, 2013.

REFERENCES:

1. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
3. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill, 2010.
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th ed., Cengage India,2019.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							
CO2	✓	✓	✓	✓	✓						✓	
CO3	✓	✓	✓	✓	✓						✓	✓
CO4	✓	✓	✓	✓	✓						✓	✓
CO5	✓		✓	✓	✓						✓	✓

GE5151 ENGINEERING GRAPHICS L T P C
1 0 4 3

COURSE OBJECTIVES:

- To draw free hand sketches of basic geometrical shapes and multiple views of objects.
- To draw orthographic projections of lines and planes.
- To draw orthographic projections of solids.
- To draw the development of surfaces of objects.
- To draw isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning.

UNIT I PLANE CURVES AND FREE HANDSKETCHING 14

Basic Geometrical Constructions, Curves Used in Engineering Practices – Conics – Construction of Ellipse, Parabola and Hyperbola by Different Methods – Construction of Cycloid – Construction of Involutes of Square and Circle – Drawing of Tangents and Normal to the Above Curves. Visualization Concepts and Free Hand Sketching: Visualization Principles – Representation of Three – Dimensional Objects – Layout of Views- Free Hand Sketching of Multiple Views From Pictorial Views of Objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

Orthographic Projection – Principles – Principle Planes – First Angle Projection – Projection of Points. Projection of Straight Lines (Only First Angle Projections) Inclined to Both the Principal Planes – Determination of True Lengths and True Inclinations by Rotating Line Method and Trapezoidal Method and Traces Projection of Planes (Polygonal and Circular Surfaces) Inclined to Both the Principal Planes by Rotating Object Method.

UNIT III PROJECTION OF SOLIDS 15

Projection of Simple Solids like Prisms, Pyramids, Cylinder, Cone and Truncated Solids When the Axis is Inclined to Both the Principal Planes by Rotating Object Method and Auxiliary Plane Method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of Solids in Simple Vertical Position When the Cutting Plane is Inclined to the One of the Principal Planes and Perpendicular to the other – Obtaining True Shape of Section. Development of Lateral Surfaces of Simple and Sectioned Solids – Prisms, Pyramids Cylinders and Cones. Development of Lateral Surfaces Of Solids With Cut-Outs and Holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of Isometric Projection – Isometric Scale – Isometric Projections of Simple Solids And Truncated Solids – Prisms, Pyramids, Cylinders, Cones – Combination of Two Solid Objects in Simple Vertical Positions and Miscellaneous Problems. Perspective Projection of Simple Solids – Prisms Pyramids and Cylinders by Visual Ray Method And Vanishing Point Method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to Drafting Packages and Demonstration of Their Use.

TOTAL (L: 15 + P: 60):75 PERIODS

COURSE OUTCOMES:

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

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt, N. D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., “Engineering Drawing”, Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., “A text book of Engineering Graphics”, 28thEd., Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., “Engineering Drawing”, Pearson, 2ndEd., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special Points Applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size. The examination will be conducted in appropriate sessions on the same day.

IT5211 INFORMATION TECHNOLOGY ESSENTIALS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

1. To design and develop static web pages using HTML5.
2. To create attractive web pages using CSS (internal & external style sheets).
3. To introduce the JavaScript/Angular JS for client-side validation of the web forms.
4. To understand the concepts of PHP programming.
5. To introduce PHP scripting language and MySQL functionalities for the development of simple data-centric applications.

LABORATORY EXERCISES:

1. Design of static webpage primarily with text and CSS.
2. Apply the inline and block level elements to identify the difference in the layout.
3. Design the HTML forms (text boxes, text areas, radio buttons, check boxes and other elements by understanding the input types and specified needs).
4. Include image/audio and video elements in the web pages.
5. Format and position the text using CSS borders, background and color by understanding the box model.
6. Validate the HTML form elements by creating small client-side validation scripts using JavaScript/Angular JS.
7. Create small PHP scripts to manipulate data using various operators and PHP functions and display the results.
8. Write two different PHP scripts to demonstrate passing variables to a URL.
9. Create Website Registration Form using text box, check box, radio button, select, submit button, and display user inserted value in new PHP page.
10. Write two different PHP scripts to demonstrate passing variables with sessions and cookies.
11. Write PHP script to connect MySQL server from the website incorporating error-handling using exceptions.
12. Create a dynamic web site using PHP and MySQL.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Design and develop static web pages by using the markup languages that meet the specified needs and interests.
CO2: Validate HTML forms developed using the JavaScript/Angular JS.
CO3: Create dynamic websites/web based applications using HTML, PHP, and MYSQL database.
CO4: Debug the programs by applying concepts and error handling techniques of HTML, JavaScript, PHP and MYSQL.
CO5: Address/solve the real-time issues by developing data centric applications.
CO6: Develop responsive websites using the programming languages and techniques associated with the World Wide Web.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓					✓		✓	✓
CO2	✓	✓	✓	✓	✓				✓		✓	✓
CO3	✓	✓	✓	✓	✓				✓		✓	✓
CO4	✓	✓	✓		✓				✓			
CO5	✓	✓	✓	✓					✓			
CO6	✓	✓	✓	✓	✓						✓	✓

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVES

- To impart hands on experience in verification of circuit laws and measurement of circuit parameters
- To train the students in performing various tests on electrical motors.
- To give practical exposure to the usage of CRO, power sources & function generators

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
4. Measurement power in three phase circuits by two-watt meter method.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode.
9. Characteristics of Zener diode.
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.
2. Perform speed characteristic of different electrical machines.
3. Use logic gates and Flip flops.

MA5302 DISCRETE MATHEMATICS L T P C
3 1 0 4

OBJECTIVES:

- To introduce Mathematical Logic, Inference Theory and proof methods.
- To provide fundamental principles of combinatorial counting techniques.

- To introduce graph models, their representation, connectivity and traversability.
- To explain the fundamental algebraic structures, groups and their algebraic properties.
- To provide exposure to the development of the algebraic structures, lattices and Boolean algebra and to demonstrate the utility of Boolean laws.

UNIT I LOGIC AND PROOFS 12

Propositional Logic – Propositional Equivalences – Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

UNIT II COMBINATORICS 12

Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations - Solving Linear Recurrence Relations Using Generating Functions – Inclusion – Exclusion – Principle and Its Applications.

UNIT III GRAPHS 12

Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT IV ALGEBRAIC STRUCTURES 12

Groups – Subgroups – Homomorphisms – Normal Subgroup and Coset – Lagrange'S Theorem – Definitions and Examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial Ordering – Posets – Lattices as Posets – Properties of Lattices – Lattices as Algebraic Systems – Sub Lattices – Direct Product And Homomorphism – Some Special Lattices – Boolean Algebra**.**

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Understand the validity of the logical arguments**,** mathematical proofs and correctness of the algorithm.
2. Apply combinatorial counting techniques in solving combinatorial related problems.
3. Use graph models and their connectivity, traversability in solving real world problems.
4. Understand the significance of algebraic structural ideas used in coding theory and cryptography.
5. Apply Boolean laws and Boolean functions in combinatorial circuit designs.

TEXTBOOKS:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", Tata Mc Graw Hill Pub. Co.Ltd., Seventh Edition, Special Indian Edition, New Delhi, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.

REFERENCES:

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, Fifth Edition, New Delhi, 2014.
2. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3. Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, Boston, 2004.

IT5301 **DIGITAL LOGIC AND DESIGN** **L T P C**
2 0 2 3

OBJECTIVES:

- To learn Boolean algebra and simplification of Boolean functions.
- To learn to design and analyze different combinational circuits.
- To study the basics of synchronous sequential logic, analyze and design sequential circuits.
- To learn about basic memory devices and programmable logic devices to build simple digital systems.
- To learn to write code in Hardware Definition Language for designing larger digital systems.

UNIT I BOOLEAN ALGEBRA AND GATES 6

Number Systems: Binary, Octal, Hexadecimal – Representation of Negative Numbers – 1's and 2's Complements – Arithmetic Operations – Binary Codes – Boolean Algebra – Theorems and Postulates – Functions – Truth Table – Logic Gates – Universal gates– Canonical and Standard Forms – Minterms and Maxterms – Sum of Products and Product of Sums.

Suggested Activities:

- In-class activity - Number systems, problems in number conversion and complements.
- Flipped classroom and activity on various binary codes.
- Proofs and simplification of basic theorems and properties of Boolean algebra in class.
- External learning - Exclusive OR function.

Suggested Evaluation Methods:

- Verifying the correctness of the activity.
- Checking the understanding of the equivalence among various binary codes for decimal digits.
- Quiz on logic gates.

UNIT II KARNAUGH MAP AND COMBINATIONAL LOGIC 6

Simplification of Boolean Functions –Karnaugh Map – 2, 3, 4 variables – NAND/NOR Implementations – Combinational Circuits – Arithmetic Circuits – Half and Full Adders – Subtractors – Introduction to HDL.

Suggested Activities:

- Assignments on simplification of Boolean functions using 3 and 4 variable K-map.
- External learning - HDL for simple circuits.

Suggested Evaluation Methods:

- Verifying the correctness and alternate ways of solving the assignment problems.
- Quiz on HDL for simple circuits.

UNIT III COMBINATIONAL LOGIC 6

Binary Parallel Adder – Carry Look-ahead Adder – BCD Adder – Binary Multiplier – Magnitude Comparator – Code Converters – Decoder – Encoder – Priority Encoder – Mux/Demux – Applications.

Suggested Activities:

- pplications of combinational circuits - activity in class. For example: Identifying the role of the combinational circuits in designing circuits like digital boards.
- External learning - HDL for the combinational circuits.
- Assignments on applications of MUX/DeMUX circuits.

Suggested Evaluation Methods:

- Verifying HDL code for combinational circuits.
- Peer evaluation to check circuits for correctness.
- Verifying the alternate ways used, if any, for solving the assignment problems.

UNIT IV SEQUENTIAL LOGIC 6

RS Latch – D Latch – Flip Flops – JK, T, D – Master/Slave Flip Flop – Flip flop excitation tables – Analysis of clocked sequential circuits – Moore /Mealy models – Registers: Shift Registers, Universal Shift Register – Counters – Asynchronous Ripple Counters, Synchronous Counters.

Suggested Activities:

- Assignments on analysis of different sequential circuits.
- External learning - Up-down, ring, decade, modulus and cascaded counters.
- External learning - HDL for sequential circuits.

Suggested Evaluation Methods:

- Verifying the correctness of the analysis of the given circuits.
- Quiz on counters.

UNIT V SYSTEM DESIGN 6

Memory Systems – RAM – ROM – Memory Decoding – Digital System Design using PLA, PAL and FPGA.

Suggested Activities:

- Assignments on memory decoding, PAL/PLA design.
- Flipped classroom on basic memory types.

Suggested Evaluation Methods:

- Verifying the design for various inputs.
- Quiz on memory types.

PRACTICAL EXERCISES 30

1. Verification of Boolean theorems using logic gates. (2 hrs)
2. Design and implementation of combinational circuits using gates for arbitrary functions. (2 hrs)
3. Implementation of 4-bit binary adder/subtractor circuits and getting started with HDL. (2 hrs)
4. Implementation of combinational circuits using code converters. (2 hrs)
5. Implementation of BCD adder, encoder and decoder circuits. (4 hrs)
6. Implementation of any one of the synchronous counters. (2 hrs)
7. Implementation of a Universal Shift register. (2 hrs)
8. HDL coding for any of the combinational and sequential circuits. (4 hrs)

9. Mini project on design of a digital circuit for solving practical problems.

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Simplify complex Boolean functions.
CO2: Implement digital circuits using combinational logic ICs and PLDs.
CO3: Understand the characteristics of various Flip-Flops.
CO4: Design digital circuits with combinational and sequential components.
CO5: Use HDL to build digital systems.
CO6: Analyze digital system designs.

TOTAL: 60 PERIODS

TEXT BOOK:
1. M. Morris Mano, Michael D. Ciletti, "Digital Design", Fifth Edition, Pearson Education, 2013.

REFERENCES:
1. Charles H. Roth Jr., "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House, 2003.
2. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007.
3. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, 2003.
4. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	-	✓		✓	✓			✓	✓
CO2	✓	✓	✓	✓	✓			✓			✓	✓
CO3	✓	✓	✓	-	✓			✓			✓	✓
CO4	✓	✓	✓	✓	✓			✓			✓	✓
CO5	✓	✓	✓	✓	✓			-			✓	✓
CO6	✓	✓	✓	✓	✓			✓			✓	✓

IT5352 PROGRAMMING AND DATA STRUCTURES L T P C
3 0 0 3

OBJECTIVES:
- To introduce the basics of C programming language.
- To learn the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

UNIT I C PROGRAMMING FUNDAMENTALS 9
Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

Suggested Activities:

- Implementing programs using data types, arithmetic operators and basic input/output operations.
- Developing programs using if-else, do-while, while, for, switch, break, continue, enum.
- Write an application to perform operations like finding the maximum, minimum, average values using single dimensional integer and float arrays.
- Develop an application to perform matrix operations using multi-dimensional arrays.
- Create an application that performs operations like concatenation, finding a substring from a given string, etc. using character arrays.
- Develop any application (student's choice) using User-defined functions and Recursive functions.

Suggested Evaluation Methods:

- Tutorials on conditionals and loops.
- Evaluation of the programs implemented.

UNIT II C PROGRAMMING - ADVANCED FEATURES 9

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.

Suggested Activities:

- Implementing applications using Structures, Unions, Enumerations.
- Demonstration of C programs using pointers to variables, arrays, functions and using address arithmetic.
- Demonstration of programs using dynamic memory.
- Demonstration of real world applications using file operations.

Suggested Evaluation Methods:

- Tutorials on file handling.
- Checking output of programs implemented.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly-Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.

Suggested Activities:

- Converting an algorithm from recursive to non-recursive using stack.
- Demonstrating stack for Towers of Hanoi application.
- Developing any application (student's choice) using all the linear data structures.

Suggested Evaluation Methods:

- Tutorials on applications of linear data structures.
- Checking output of programs implemented.

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

Suggested Activities:

- Implementing binary tree and tree traversals.

- Solving expressions using expression trees by determining infix, prefix and postfix expressions.
- Implementation of phone directory using hash tables.
- Developing any application using trees.

Suggested Evaluation Methods:

- Tutorials on hashing.
- Check output of programs implemented.
- Quiz on various topics of the unit.

UNIT V SORTING AND SEARCHING TECHNIQUES 9

Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

Suggested Activities:

- External learning - External sorting implementation.
- Implementation of all sorting techniques in C language.
- Demonstration of searching techniques under best and worst case inputs.

Suggested Evaluation Methods:

- Tutorials on external sorting.
- Checking output of programs implemented.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Develop C programs for any real world/technical application.
Co2: Apply advanced features of C in solving problems.
CO3: Write functions to implement linear and non–linear data structure operations.
CO4: Suggest and use appropriate linear/non–linear data structure operations for solving a given problem.
CO5: Appropriately use sort and search algorithms for a given application.
CO6: Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 1997.
2. Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.

REFERENCES:

1. Brian W. Kernighan, Rob Pike, “The Practice of Programming”, Pearson Education, 1999.
2. Paul J. Deitel, Harvey Deitel, “C How to Program”, Seventh Edition, Pearson Education, 2013.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson, “Fundamentals of Data Structures”, Galgotia, 2008.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓						✓
CO2	✓	✓	✓	✓	✓	✓			✓			✓

CO3	✓	✓	✓	✓	✓	✓			✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5351 DATABASE MANAGEMENT SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of Data – Data Models – Database System Architecture – Introduction to Relational Databases – Relational Model – Keys – Relational Algebra – Relational Calculus – SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL.

Suggested Activities:

- Creating tables with key constraints, adding and removing constraints with referential integrity using DDL commands.
- Flipped classroom on relational algebra operations (selection, projection, joins etc.).
- Write SQL queries for demonstrating CRUD operations, aggregate functions and various join operations using DML commands.
- Create stored procedures for executing complex SQL transactions.
- Create triggers for alerting user/system while manipulating data.

Suggested Evaluation Methods:

- Tutorials on DDL, DML and DCL queries.
- Quizzes on relational algebra operations.
- Demonstration of created stored procedures and triggers.

UNIT II DATABASE DESIGN 9

Entity-Relationship Model – ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

Suggested Activities:

- Simple database application design using ER diagram.

- Practical - ER modeling using open source tools and realizing database.
- Study of various anomalies and normalizing table (1NF, 2NF, 3NF, BCNF).
- Flipped classroom on topics of database design and normalization.

Suggested Evaluation Methods:

- Tutorials on application specific ER Diagram.
- Tutorials on normalization and database design.

UNIT III TRANSACTION MANAGEMENT 9

Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling – Recovery System – Failure Classification – Recovery Algorithm.

Suggested Activities:

- Checking serializability among transactions.
- Flipped classroom on concurrency control protocols.
- Study of crash recovery algorithm (ARIES).

Suggested Evaluation Methods:

- Tutorials on serializability and crash recovery algorithm
- Quizzes on concurrency control protocols.

UNIT IV IMPLEMENTATION TECHNIQUES 9

Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation – Query Optimization.

Suggested Student Activities:

- Study of different RAID levels and its uses in different applications.
- Practical - Creation of B+ tree with insertion and deletion operations.
- Assignments on cost estimation of different types of queries.

Suggested Evaluation Methods:

- Report on applications of RAID levels.
- Tutorials on B+ Tree manipulation.
- Quizzes on hashing mechanisms.
- Exercise on cost estimation for various SQL queries.
- Evaluation of the practical assignments.

UNIT V ADVANCED TOPICS 9

Overview of Distributed Databases – Data Fragmentation – Replication – XML Databases – XML Schema – NOSQL Database: Characteristics – CAP theorem – Types of NoSQL Datastores: Column Oriented, Document, Key-Value and Graph Types – Applications – Current Trends.

Suggested Student Activities:

- Design of distributed database using fragmentation.
- Creation of XML document based on XML schema.
- Creation of document and column oriented databases and simple manipulation.

Suggested Evaluation Methods:

- Tutorials on fragmenting database tables and writing simple SQL queries.
- Assignments on creation of XML schema and validating XML documents.

- Demonstration of created document and column-oriented databases.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Model an application's data requirements using conceptual modeling and design database schemas based on the conceptual model.
CO2: Formulate solutions to a broad range of query problems using relational algebra/SQL.
CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4: Run transactions and estimate the procedures for controlling the consequences of concurrent data access.
CO5: Explain basic database storage structures, access techniques and query processing.
CO6: Describe distributed, semi-structured and unstructured database systems.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2014.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.

REFERENCES:

1. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
3. G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
4. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation and Management", Ninth Edition, Cengage Learning, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5302 **SOFTWARE ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To gain knowledge about various software development lifecycle (SDLC) models.
- To learn how to elicit and formulate requirements.

- To be aware of designing a software considering the various perspectives of end user.
- To learn to develop a software component using coding standards and facilitate code reuse.
- To analyze the software using metrics and measurement and predict the complexity and the risk associated.

UNIT I PRODUCT AND PROCESS 9

The Nature of Software – The changing nature of Software – The Software Process – Process models – Prescriptive Process Models – Specialized Process Models – Agile Development – Extreme Programming (XP) – Other Agile Process Models.

Suggested Activities:

- In-class activity - Application specific product and process view.
- External learning - Impact of unified process models on quality software development methods and JIT software.

Suggested Evaluation Methods:

- Assignments on selection of suitable software process models for a given software specification.
- Tutorials on identification of sample application for each process model and justify the same stating reasons.
- Assignments on selection of appropriate standards for each phase in software development.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Requirements Analysis – Software Requirements – Requirements Engineering – Eliciting Requirements – Developing Use Cases – Building the Requirements Model – Negotiating and Validating Requirements.

Suggested Activities:

- External learning - Using open source tools for requirement engineering to understand the requirements traceability and interdependency among the functionalities provided by the software project.
- External learning - Using open source tools for conceptual data modeling of a sample application, scenario based modeling of a problem statement and class based modeling for given software requirements.

Suggested Evaluation Methods:

- Quiz on requirements elicitation mechanisms and selection of an appropriate strategy.
- Assignments on requirement categorization (considering contradicting, omission, commission of requirements) in a software project; Data Modeling of Sample application; Designing use case diagram and activity diagram to analyze the requirements obtained from the customer and segregate them as use cases and determine the possible set of activities from the end user; Determining the flow of data/events among the processes in the application under consideration.

UNIT III ANALYSIS AND DESIGN 9

Requirements Modeling: Scenarios, Information, Analysis Classes – Scenario Based Modeling – Data Modeling – Class-Based Modeling – Flow Oriented Models – Behavioral Models.

Design Process and Concepts – Design Model: Data Design Elements – Architectural Design – Component Level Design – Deployment Level Design – User Interface Design – Pattern-Based Design.

Suggested Activities:

- External learning - Use open source tools to perform different modeling approaches.
- Model the object classes that might be used in the system implementation to represent a mailbox and an e-mail message.
- Develop a software design for any socially relevant project.

Suggested Evaluation Methods:

- Quizzes on different modeling approaches and design methodologies
- Identification of the data and flow of the software design.
- Creation of UML diagrams using a tool such as StarUML.

UNIT IV SOFTWARE TESTING 9

Software Testing Strategies – System Testing – Debugging – White Box Testing – Black Box Testing – Model Based Testing – Testing for Specialized Environments, Architectures and Applications – Testing Object-Oriented and Web Based Applications – User Interface Testing – Configuration Testing – Security Testing – Performance Testing.

Suggested Activities:

- External learning - Understanding the requirements (SRS) and designing a suitable test suite; Determining valid interfaces for integration testing and designing necessary stub and driver modules; Software test documentation.
- External learning - Testing a simple online application on selected test cases.
- Tutorials on automation software for testing.
- In-class activity - Equivalence class partitioning, boundary value analysis.

Suggested Evaluation Methods:

- Quiz and discussion on testing strategies, types of testing and their methods.
- Assignments on testing of sample application using any OSS on software test automation.
- Assignments on testing sample application using Black Box approaches and understanding the differences in selecting of test cases from the test suite.

UNIT V SOFTWARE PROJECT MANAGAMENT 9

Software Project Management Concepts – Process and Project Metrics – Estimation for Software Projects – Project Scheduling – Risk Management – Software Configuration Management – Software Process Improvements (SPI) – The SPI Process – Capability Machine Model Integration (CMMI) – Other SPI Frameworks.

Suggested Activities:

- External learning - Tools for estimating software cost.
- Flipped classroom on software project management, risk management & mitigation, configuration management, software documentation standards

Suggested Evaluation Methods:

- Tutorials on identification of potential risks for a software project during development/ maintenance and tabulate.
- Assignments on using a software configuration management template for a software project.
- Quizzes on various metrics of project management.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Obtain an insight into the concepts of software engineering.

CO2: Analyze and resolve information technology problems through the application of systematic approaches and diagnostic tools for end to end solutions.

CO3: Elicit the requirements for real-time problems.

CO4: Estimate the cost of software, risks of handling, do software planning and configuration management.

CO5: Have knowledge about the role of software tester and be aware of testing methodologies and tools.

CO6: Maintain documentation for software engineering process.

TEXT BOOK:

1. Roger S. Pressman, “Software Engineering: A Practitioner‘s Approach” , McGraw Hill International Edition, Seventh Edition, 2009.

REFERENCES:

1. Ian Sommerville, “Software Engineering”, Ninth Edition, Pearson Education, 2008.
2. Watts S. Humphrey, “A Discipline For Software Engineering” , Pearson Education, 2007.
3. Shari Lawrence Pfleeger, Joanne M. Atlee, “Software Engineering: Theory and Practice”, Fourth Edition, Pearson Education, 2010.
4. ISO STANDARDS https://www.iso.org/home.html.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓	✓	✓	-	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5311 PROGRAMMING AND DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To introduce the concepts of structured programming language and writing ADTs.
- To familiarize with the advanced features of C language.
- To introduce the concepts of primitive data structures.
- To introduce the concepts of hashing and sorting.
- To understand the searching process in linear and non-linear data structures.

LIST OF EXERCISES:

1. Practice of C Programming on real world/technical applications using statements, expressions, decision making constructs.

2. Practice of C Programming on real world/technical applications using Iterative and branching constructs, Structures, arrays, functions, pointers and File handling.
3. Implementation of Linked List.
4. Implementation of Stack using Arrays and Linked List.
5. Implementation of Queue using Arrays and Linked List.
6. Implementation of Stack and Queue applications.
7. Implementation of Binary Search Tree.
8. Implementation of Priority Queue.
9. Implementation of Insertion Sort, Heap Sort.
10. Implementation of Quick Sort, Merge Sort.
11. Implementation any application using Linear Search.
12. Implementation any application using Binary Search.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:
CO1: Develop C programs for any real world/technical situations.
CO2: Apply advanced features of C in solving problems.
CO3: Implement data structures using C language.
CO4: Write code using linear and non-linear data structure operations.
CO5: Implement various sorting and searching techniques.
CO6: Analyze and implement hashing techniques that solve in linear time.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓						✓
CO2	✓	✓	✓	✓	✓	✓			✓			✓
CO3	✓	✓	✓	✓	✓	✓			✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5312 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

LABORATORY EXERCISES:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in database table.
9. Create View and index for database tables with large number of records.
10. Create a XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Create databases with different types of key constraints.
CO2: Write simple and complex SQL queries using DML and DCL commands.
CO3: Realize database design using 3NF and BCNF.
CO4: Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO5: Create XML database and validate with meta-data (XML schema).
CO6: Create and manipulate data using NOSQL database.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

GE5251 ENVIRONMENTAL SCIENCES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.

- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and 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 – 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 – Bio Geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – 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 (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, 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 47 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 Protection 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

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:

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

1. Recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
2. Identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
3. Identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4. Recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
5. Demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
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. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd., 2013.

IT5401 OBJECT ORIENTED PROGRAMMING AND ADVANCED DATA STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce basic concepts and advanced features of Object Oriented Programming.
- To learn and implement different data structures using object oriented concepts.
- To learn about non-linear data structures.

- To familiarize with graph and graph-related algorithms.
- To learn about the applications of graphs for real world problem solving.

UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 9

Data Abstraction – Encapsulation – Class – Object – Constructors – Static members – Constant members – Member functions – Pointers – References – Role of 'this' Pointer – String Handling – Copy Constructor – Polymorphism – Function Overloading – Operators Overloading – Dynamic Memory Allocation.

Suggested Activities:

- Flipped Classroom - Features of OOP, Pointers.
- External learning - Dynamic memory allocation operators and its usage.
- Exploration of examples on static functions and usage of 'this' pointer.
- Exploration of the usage of reference variables, pointer to reference and reference to a pointer.
- Application development using Friend functions and function overloading.

Suggested Evaluation Methods:

- Assignments on the usage of dynamic memory allocation operators, Friend functions and reference variables.
- Quizzes on pointers and usage of pointers.
- Demonstration of the application development.

UNIT II OBJECT ORIENTED PROGRAMMING - ADVANCED FEATURES 9

Generic Programming – Templates – Class template – Function template – Inheritance – Virtual Functions – Abstract class – Exception Handling – STL: Containers, Algorithms, Iterators.

Suggested Activities:

- Flipped Classroom on basics of exception handling.
- External learning - STL Containers and Iterators.
- Practical - Solve a given problem (such as Vector Manipulation, List Updation) by choosing appropriate functions from STL.
- Exploration on the usage of Virtual Functions and Abstract Classes.
- Application development using exception handling.

Suggested Evaluation Methods:

- Assignments on problem solving using STL.
- Quizzes on exception handling, abstract classes.
- Demonstration for application development.

UNIT III ADVANCED NON-LINEAR DATA STRUCTURES 9

AVL Trees – Splay Trees – B-Trees – Red Black Trees – Leftist Heaps – Binomial Heap.

Suggested Activities:

- Flipped classroom on binary search trees and binary heap concepts.
- External learning - Fibonacci Heap, Tries.
- Exploration of application of trees where trees can be applied for real time problems.
- Practical - Design and Implementation of a suitable tree/heap structure for solving a given real time problem such as implementation of syntax trees in compilers/ implementation of Binary Space Partition in video games/order statistics problem.

Suggested Evaluation Methods:

- Assignments on Fibonacci Heaps, Tries, Real time problem solving using Trees/Heaps.
- Quizzes on BST, Binary Heap.
- Demonstration of practical learning component.

UNIT IV ELEMENTARY GRAPH ALGORITHMS 9

Graphs – Definitions – Representation of Graphs – Graph Traversals – Topological Sort – Shortest Path Algorithms – Unweighted Shortest Path – Dijkstra's Algorithm – Single source Shortest Paths – Bellman-Ford algorithm – Minimum Spanning Tree – Prim's Algorithm – Kruskal's Algorithm.

Suggested Activities:

- Flipped Classroom on basics of graphs.
- External learning - Applications of graphs.
- Exploration of other single source shortest path problems.
- Practical - To choose and apply a suitable graph algorithm for solving a real time problem/scenario such as Network Routing/Finding relations in Networks/Finding shortest path in Maps.

Suggested Evaluation Methods:

- Assignments on representation of graphs for a given problem and solving real time problems by applying suitable graph structures.
- Quizzes on basics of graphs.

UNIT V ADVANCED GRAPH ALGORITHMS 9

Applications of Depth First Search – Undirected Graphs – Biconnectivity – Directed Graph – Finding Strong Components – All Pair Shortest paths – Floyd Warshall algorithm – Network Flow Problem – A Simple Maximum Flow Algorithm.

Suggested Activities:

- Flipped Classroom on BFS and its applications.
- External learning - Inline memory data structures.
- Exploration of more applications of DFS and its usage in real time scenario.
- Simulation of All Pair Shortest Path with various graphs.

Suggested Evaluation Methods:

- Assignments on inline memory data structures and application of a DFS algorithm to solve a real time problem.
- Quizzes on BFS and few more applications of DFS.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the problem specifications as per the requirements.
CO2: Design practical applications using OOP concepts.
CO3: Solve the given problem using object oriented programming concepts.
CO4: Implement advanced data structures through ADTs using OOP.
CO5: Apply graph data structures for a real world problem.
CO6: Understand and apply the advanced data structures for solving real world applications.

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++” , Fourth Edition, Pearson Education, 2013.

2. Herbert Schildt, “C++ The Complete Reference”, Fourth Edition, McGraw Hill Education, 2003.

REFERENCES:

1. Paul Deitel, Harvey Deitel, “C++ How to Program”, Tenth Edition, Pearson Education, 2017.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms” , Third Edition, McGraw Hill, 2009.
3. Robert Sedgewick, “Algorithms in C++”, Third Edition, Pearson Education , 1998.
4. Bjarne Stroustrup, “The C++ Programming Language”, Fourth Edition, Pearson Education, 2014.
5. Michael T, Goodrich, Roberto Tamassia, David Mount, ““Data Structures and Algorithms in C++”, Seventh Edition, Wiley Publishers, 2004.

Course outcomes	Programme outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓		✓		✓		✓	✓
CO4	✓	✓		✓	✓				✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓		✓		✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓

IT5402 DESIGN AND ANALYSIS OF ALGORITHMS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the process of problem solving.
- To be conversant with algorithms for common problems.
- To analyse the algorithms for time/space complexity.
- To learn to write algorithms for a given problem using different design paradigms.
- To understand computational complexity of problems.

UNIT I FUNDAMENTALS 9

The Role of Algorithms in Computing – Algorithms – Designing Algorithms – Analysing Algorithms – Iterative Algorithms – Step Count – Operation Count – Recursive Algorithms – Recurrence Equations – Substitution Method – Recursion Tree Method – Master Theorem – Proof – Asymptotic Notations – Growth of Functions.

Suggested Activities:

- Discussion on role of algorithms in computer science.
- External learning - Design of simple problems, sample problems in Hackerrank, like, diagonal difference in matrices, staircase construction.
- Computation of step count and operation count for merge sort and Quicksort.
- Design of induction proofs for algorithm verification for recursive algorithms.

- Practical - Implementation of time complexity in Python.

Suggested Evaluation Methods:

- Tutorials on operation count and step count for iterative algorithms such as linear search and array sum.
- Assignments on recursive algorithm analysis and Master Theorem.
- Quizzes on algorithm writing.

UNIT II DESIGN TECHNIQUES 9

Divide-and-Conquer – Merge Sort – Quicksort – Dynamic Programming – Matrix Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence – Basics of String – String Edit Problem.

Suggested Activities:

- External learning - Divide and conquer based algorithms, Hackerrank divide and conquer algorithms.
- External learning - Dynamic programming based algorithms like coin change.
- Computation of step count and operation count.
- Design of Induction Proofs for algorithm verification.
- Practical - Implementation of Merge sort and Longest Common Sequence like Spell Checker, Hackerrank problems like coin change.

Suggested Evaluation Methods:

- Tutorials on matrix chain multiplication and longest common sequence.
- Assignments on string edit and string basics.
- Quizzes on algorithm design.

UNIT III GREEDY APPROACH AND MATRIX OPERATIONS 9

Elements of The Greedy Strategy – Huffman Code – Task Scheduling Problem – Activity Selection – Set Cover and Vertex Cover – Transform and Conquer Approach – Matrix Operations – Solving Systems of Linear Equations – LUP Decomposition – Matrix Inverse and Determinant of a Matrix.

Suggested Activities:

- Flipped classroom on algorithm design.
- External learning - Greedy approach based algorithms like set cover and vertex. cover – Hackerrank problems like Password cracker.
- Computation of step count and operation count of Huffman code.
- Design of greedy based proofs for set cover problems.
- Practical - Implementation of matrix inverse using Gaussian Elimination problem.

Suggested Evaluation Methods:

- Tutorial on Huffman code and task scheduling.
- Assignments on LUP Decomposition and Matrix Inverse using matrix decomposition.
- Quizzes on greedy approach.

UNIT IV LINEAR PROGRAMMING 9

Linear Programming – Problem Formulation – Diet Problem – Voting Problem – Standard And Slack Forms of Linear Programming Problems – Initial Basic Feasible Solution – Simplex Algorithm – Duality.

Suggested Activities:

- Flipped classroom on Linear Algebra, Linear Programming basics
- External learning - Problems like Diet Problem in Hackerrank.

- Formulation of Duality for simple Linear Programming problems like Diet Problem.
- Practical - Implementation of Simplex algorithm.

Suggested Evaluation Methods:

- Tutorials on linear programming.
- Assignments in duality and linear programming problem formulations.
- Quizzes on linear programming.

UNIT V COMPUTATIONAL COMPLEXITY 9

Understanding of Computational Complexity – NP-Hard – NP-Completeness – Reducibility – Cook's Theorem – NP-Completeness Proofs – Probabilistic Analysis and Randomized Algorithms – Quicksort – Approximation Algorithms – Set Cover and Vertex Cover.

Suggested Activities:

- Flipped classroom on computational complexity.
- External learning - NP complexity, Turing machines.
- Computation and derivation of exponential complexity for set cover and vertex cover problems.
- Design of approximation bounds for randomized quicksort.
- Practical - Implementation of approximation algorithm for set cover problem.

Suggested Evaluation Methods:

- Tutorials on NP-complete proofs such as SAT problem.
- Assignments on set cover and vertex cover approximation problems.
- Quizzes on computational complexity.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Articulate the process of problem solving and writing algorithms.
CO2: Understand different algorithmic design strategies.
CO3: Design and implement any problem using design techniques.
CO4: Critically analyse the complexity of the given algorithm.
CO5: Solve a problem in polynomial time or prove that to be an NP-Complete problem.
CO6:Obtain knowledge of advanced topics such as approximation algorithms, linear programming and randomized algorithms.

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, McGraw Hill, 2009.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015.

REFERENCES:

1. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2010.
2. Robert Sedgewick, Kevin Wayne, "Algorithms", Fourth Edition, Pearson Education, 2011.
3. Donald E. Knuth, "Art of Computer Programming, Volume I - Fundamental Algorithms", Third Edition, Addison Wesley, 1997.

COURSE OUTCOMES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✓	✓	✓	✓	✓				✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓			✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓			✓	✓		✓	✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓			✓					✓	✓

IT5403 OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the basic concepts and functions of operating systems (OS).
- To learn the mechanisms of OS to handle processes and threads and their communication.
- To study the basic components of scheduling mechanism.
- To learn memory management strategies in contemporary OS.
- To appreciate the emerging trends in operating systems.

UNIT I INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES 9

Introduction to OS – Operating System Operations – Virtualization – Operating System Services – User and Operating System Interface – System Calls – Operating System Structures – Process Concept – Process Scheduling – Context Switch – Operations on Processes – Interprocess Communication – IPC in Shared-Memory Systems – IPC in Message-Passing Systems – Examples of IPC Systems.

Suggested Activities:

- Introduction to Linux and shell programming.
- External learning - Introduction to xv6: download, build, boot (in virtual machine if needed).
- Implement a user program in xv6 to print “Hello World!!”.
- Study and use of system calls in xv6: getpid, fork, clone, exit, wait.
- Study of the following files in xv6:
    - main.c[Bootstrap processor running, other CPU setup, starting running processes], syscall.h[system call numbers], syscall.c[system call handler] sysproc.c[system call definitions], proc.c[set up first user process, create new process, allocating process, exit of process, process states and scheduling], swtch.S[context switch], proc.h [per-CPU state and per-process state], vectors.S[trap handler], trapasm.S[build trap frame], trap.c[Interrupt Descriptor Table], traps.h[Interrupt constants]

- Exercises on Virtualization like the following may be given:
  Given two C code snippets that compile and execute without any errors, queries like the following may be asked: If the given code snippets are run on

a machine with a single CPU and a main memory of size 1 GB, what are the hardware resources that are being virtualized - Only CPU OR only memory OR both?

- Writing a user program to check and print the state of a process (current/all/specified) in xv6.
- Give two C code snippets (assuming that these compile successfully and APIs like fork(), exec(), and wait() never fails) and questions like the following may be given:
  (a) After program 1 is executed, how many processes are created?
  (b) After program 2 is executed, how many processes are created?
- External learning - Mobile OS structure.

Suggested Evaluation Methods:

- Quiz on understanding of Linux and shell programming.
- Implementation evaluation of "Hello World!" user program.
- Quizzes on xv6 system calls, study files and other topics of the unit.
- Assignments to be appropriately evaluated.
- Assignments and implementation evaluation.

UNIT II PROCESS SYNCHRONIZATION AND SCHEDULING 12

Multicore Programming – Multithreading Models – Thread Libraries – Threading Issues – The Critical-Section Problem – Peterson's Solution – Hardware Support for Synchronization – Mutex Locks – Semaphores – Monitors – Liveness – Basic Concepts of CPU Scheduling– Scheduling Criteria – Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Multilevel Feedback Queue – Thread Scheduling –Real-Time CPU Scheduling.

Suggested Activities:

- Add a new system call with parameters in xv6 and invoke it in user program.
- Create thread and implement multi threading using pthread library in any language.
- Implement at least one form of producer consumer problem in any language.
- Implement process synchronization using lock variable method in any language.
- Implement Dekker's algorithms using thread in any language.
- Implement semaphores in any language.
- Computation of the response time and turnaround time when running three jobs of length 200 with the SJF, FIFO and RR (time–slice of 1) schedulers.
- Study of the following files in xv6: main.c [Starting running processes], vm.c [allocating space for scheduler processes], proc.h [process context and state], proc.c [scheduling], swtch.S [context switch]
- Study of the scheduling algorithm in xv6 and making appropriate changes in the Round Robin scheduler in xv6 to print the process id and process name during scheduling.
- Assignments on scheduling mechanisms.

Suggested Evaluation Methods:

- Implementation evaluation of system call in xv6 using the implemented user program.
- Implementation evaluation o f multi-threading.
- Quiz on xv6 study files and other topics of the unit.
- Quiz to check the understanding of the scheduling concepts in xv6.
- Assignments to be appropriately evaluated.

UNIT III FILE SYSTEM 6

File Concept – Access Methods – Directory Structure – Protection – File-System Structure – File-System Operations – Directory Implementation – Allocation Methods – Free-Space Management – Recovery.

Suggested Activities:

- Demonstration of various combined actions using system calls and file such as the followings: Is it possible to use file names only without using file descriptor (fd) or, given an fd, is it possible to get the corresponding file name or can multiple directories “contain” the same file?
- Create a file in xv6 and perform read and write operations.
- Study the following files in xv6: file.c, sysfile.c [file creation, reading and writing].
- Change the existing xv6 file system to add high-performance support for small files. The basic idea is as follows: If one has a small file that can be indexed with only 13 direct data pointers, we use the 13th pointer as reserved for indirect data block as a direct data pointer, thus speeding up access to the small file, as well as saving some disk space.

Suggested Evaluation Methods:

- Checking the understanding of the file concepts in xv6.
- Quiz on xv6 study files and other topics of the unit.
- Assignment on xv6 to be appropriately evaluated.
- Implementation evaluation of small file problem in xv6.

UNIT IV MEMORY MANAGEMENT 9

Contiguous Memory Allocation – Paging – Structure of the Page Table – Swapping – Demand Paging – Copy-on-Write – Page Replacement – Allocation of Frames – Thrashing – Memory Mapped Files – Allocating Kernel Memory.

Suggested Activities:

- Study files in xv6: umalloc.c and kalloc.c (kvalloc() [allocating space for kernel process], allocuvm() [allocating page tables and physical memory], deallocuvm() [deallocating physical memory], freevm() [free physical memory page table].
- Practical - Implementation and use of functions malloc() and free() in xv6.
- Practical - Implementation of at least one of the page replacement policies.
- Assignments on computing page faults for LRU, FIFO and Optimal Page Replacement algorithms.
- Practical - Implementation of the program in any programming language to select free holes from given memory partitions using first-fit, best-fit, and worst-fit dynamic storage allocation strategies.

Suggested Evaluation Methods:

- Quiz on xv6 study files and other topics of the unit.
- Implementation evaluation of assignment in xv6 and other programs.

UNIT V I/O SYSTEMS AND STORAGE MANAGEMENT 9

I/O Hardware – Application I/O Interface – Kernel I/O Subsystem – Transforming I/O Requests to Hardware Operations – STREAMS – I/O Performance – DISK Scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK – Disk Management: Disk formatting, Boot block, Bad Blocks.

Suggested Activities:

- Use I/O (open, read, write, ioctl) system calls in xv6.
- External learning - Learn the differences between solid state drives and hard disk drive.
- External learning - Understand the concepts of blocking and non-blocking I/O.
- Practical - Write a chat program using blocking I/O (read/write) and non-blocking I/O using any language.

- Practical - Write a program to perform contiguous, linked and indexed allocation strategies using any language.

Suggested Evaluation Methods:

- Quizzes on I/O and other concepts in xv6 and other topics of the unit.
- Implementation evaluation of the practical assignments.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Articulate the main concepts, key ideas, strengths and limitations of operating systems.
CO2: Analyze the structure and basic architectural components of OS.
CO3: Design various scheduling algorithms.
CO4: Understand various file management systems.
CO5: Design and implement memory management schemes.
Acquire a detailed understanding of various aspects of I/O management.

TEXT BOOK:

1. Silberschatz Abraham, Greg Gagne, Peter B. Galvin. "Operating System Concepts", Ninth Edition, Wiley, 2014.

WEBLINKS:

1. https://pdos.csail.mit.edu/6.828/2014/xv6/book–rev8.pdf
2. The xv6 source code: *git clone git://pdos.csail.mit.edu/xv6/xv6.git*

REFERENCES:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Adison Wesley, 2009.
2. D. M. Dhamdhere, "Operating Systems: A Concept–based Approach", Second Edition. Tata McGraw–Hill, 2006.
3. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition. Prentice Hall, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	-	✓	✓		✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓				-		✓	✓
CO4	✓	✓	✓	✓	✓				✓		✓	✓
CO5	✓	✓	✓	✓	✓				✓		✓	✓
CO6	✓	✓	✓	✓	✓				✓		✓	✓

IT5451 **COMPUTER ARCHITECTURE** **L T P C**
3 0 0 3

OBJECTIVES:

- To identify the functional units in a digital computer system.
- To distinguish between the various ISA styles.

- To trace the execution sequence of an instruction through the processor.
- To evaluate different computer systems based on performance metrics.
- To understand the fundamentals of memory and I/O systems and their interface with the processor.

UNIT I FUNDAMENTALS OF COMPUTER SYSTEMS 9

Functional Units of a Digital Computer – Operation and Operands of Computer Hardware – Software Interface – Translation from a High Level Language to Machine Language – Instruction Set Architecture – RISC and CISC Architectures – Addressing Modes – Performance Metrics – Power Law – Amdahl's Law.

Suggested Activities:

- In-class activity on performance evaluation.
- Flipped classroom – Evolution and types of computer systems, identification of benchmarks.
- Use a Simulator for RISC and CISC. Analyze the ISA supported by the architectural simulator by running simple programs on the simulator.
- Mapping and correlating a C code with its machine code.
- Practical – Opening up a computer system and studying the components.

Suggested Evaluation Methods:

- Mock test on problems for computer performance.
- Group discussion on activity four with assembly instruction, identifying the instruction type and encoding used in machine code.
- Quizzes on ISA.

UNIT II ARITHMETIC FOR COMPUTERS 9

Addition and Subtraction – Fast Adders – Multiplication: Booths Algorithm, Bit Pair Recoding – Division: Restoring and Non-Restoring – Floating Point Numbers: Single and Double Precision – Arithmetic Operations – ALU Design.

Suggested Activities:

- Flipped classroom – Unsigned binary operations(+,–,*,/).
- Simulation of the floating point operations.
- External learning – Arithmetic algorithms for faster multiplication and division.
- Tutorials on multiplication and division (Booths algorithm, restoring and non-restoring).

Suggested Evaluation Methods:

- Mock test on multiplication and division.
- Quizzes on floating point single precision and double precision representation.

UNIT III PROCESSOR 9

Design Convention of a Processor – Building a Datapath and designing a Control Unit – Execution of a Complete Instruction – Hardwired and Micro programmed Control –Instruction Level Parallelism – Basic Concepts of Pipelining – Pipelined Implementation of Datapath and Control Unit – Hazards – Structural, Data and Control Hazards.

Suggested Activities:

- Flipped Classroom for analyzing data path in Intel and ARM core.
- Practical – Analyzing the data path on the standard simulator.
- Practical – Study of the pipelined implementation and analysis of various hazards on a standard simulator.

Suggested Evaluation Methods:

- Assignment on data path design.
- Group discussion on pipeline depth and stages.
- Quiz on class or automatic quizzes on the flipped classroom content.

UNIT IV MEMORY AND I/O 9

Types of Memories – Need for a hierarchical memory system – Cache memories– Memory Mapping – Improving Cache Performance – Virtual Memory – Memory Management Techniques – Accessing I/O devices – Programmed Input/output – Interrupts – Direct Memory Access.

Suggested Activities:

- Flipped classroom on memory hierarchy in Intel i7 and ARM Cortex.
- Practical – Implement a simple functional model for memory mapping in cache using C/C++.
- Study hit/miss rates for various access patterns. Experiment with different replacement policies.

Suggested Evaluation Methods:

- Mock test for problems on memory mapping.
- Quizzes on memory management in ARM and Intel processor.

UNIT V PARALLEL PROCESSING 9

Exploitation of more ILP – Dynamic Scheduling: Tomasulo's Algorithm – Introduction to Multicore – Graphics Processing Units – Overview of Next Generation Processors.

Suggested Activities:

- Flipped classroom on evolution of GPU.
- External learning – Speculative dynamic scheduling.
- Survey on multicore and draw a mind map on trends of multicore processors.

Suggested Evaluation Methods:

- Quizzes on dynamic scheduling.
- Group discussion on how to reduce CPI to less than one clock cycle.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Interpret assembly language instructions.
CO2: Design and analyze ALU circuits.
CO3: Implement a control unit as per the functional specification.
CO4: Design and analyze memory, I/O devices and cache structures for processor.
CO5: Evaluate the performance of computer systems.
CO6: Point out the hazards present in a pipeline and suggest remedies.

TEXT BOOKS:

1. David A. Patterson, John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann/Elsevier, 2013.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.

2. John L. Hennessey, David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier Publishers, Fourth Edition, 2007.
3. V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education, 2004. 6. Behrooz Parhami, “Computer Architecture”, Oxford University Press, 2007.
4. Douglas E. Comer, “Essentials of Computer Architecture”, Sixth Edition, Pearson Education, 2012.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓	✓	✓						✓	✓
CO3	✓	✓	✓	✓	✓						✓	✓
CO4	✓	✓	✓	✓	✓						✓	✓
CO5	✓	✓	✓	✓	✓						✓	✓
CO6	✓	✓	✓	✓	✓						✓	✓

IT5411 **OPERATING SYSTEMS LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES:

- To learn about the basic commands of operating systems.
- To implement process synchronization mechanisms in operating systems.
- To learn various process management schemes in operating systems.
- To practice with the important memory management mechanisms.
- To implement the file allocation techniques.

LIST OF EXERCISES:

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
2. Shell script.
3. Process control system calls - demonstration of fork, exec and wait
4. Thread management.
5. Thread synchronization.
6. Deadlock avoidance using semaphores.
7. Program to simulate preemptive and non-preemptive process scheduling algorithms.
8. Program to simulate file allocation strategies.
9. Interprocess communication using pipes.
10. Interprocess communication using FIFOs.
11. Interprocess communication using signals.
12. Implementation of CPU scheduling policy in Linux.
13. Implementation of memory management policy in Linux.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Understand and implement basic services and functionalities of the operating system using system calls.
CO2: Use modern OS system calls and synchronization libraries in software/hardware interfaces.
CO3: Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4: Analyze various IPC techniques in the operating system
CO5: Implement memory management schemes and page replacement schemes.
CO6: Simulate file allocation and organization techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓	✓		✓	✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓

IT5412 ADVANCED DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To understand the concepts of Object Oriented Programming.
- To use standard template library in the implementation of standard data structures.
- To learn advanced data structures using Object Oriented Programming (OOP) language.
- To explore graph structures and traversals using OOP concepts.
- To understand various graph algorithms using OOP concepts.

LIST OF EXPERIMENTS:

Implement the following exercises using C++:

1. Implementation of an Application (such as Library Management System) using Classes, Objects, Constructors, Destructors and String Handling.
2. Implementation of Programs using Function Overloading and Operator Overloading.
3. Implementation of an Application such as Student Information System using Inheritance, Virtual Functions and Abstract Classes.
4. Implementation of Programs using Function Templates and Class Templates.
5. Implementation of Stack, Queue and List Data Structures using STL Concepts.
6. Implementation of AVL tree using Templates.
7. Implementation of Splay Tree using Templates.
8. Implementation of a Heap tree using Templates.
9. Implementation of Graphs and Sorting of vertices using Topological Sort.
10. Implementation of Graph Traversals Algorithms: Breadth-First Search, Depth-First Search.
11. Implementation of Shortest Path Algorithms: Dijkstra's algorithm, Bellman-Ford algorithm, Floyd-Warshall algorithm.
12. Implementation of Minimum Spanning Tree: Kruskal's and Prim's algorithm.

TOTAL:60 PERIODS

OUTCOMES:

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

CO1: Implement the basic and advanced concepts of object-oriented programming.
CO2: Solve the given problem using object oriented concepts.
CO3: Implement basic and advanced data structures through ADTs using OOP.
CO4: Analyze and apply the graph data structures for a real world problem.
CO5: Design and develop real time applications by applying suitable data structures and associated operations.
CO6: Design and develop efficient algorithms with data representations on their own based on the requirements.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓		✓		✓		✓	✓
CO2	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓		✓		✓		✓	✓
CO4	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO6	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓

IT5502 COMPILER ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To learn about automata theory and regular expressions.
- To learn the concepts in the design of compilers.
- To learn about the runtime store organization.
- To know the data structures used to implement symbol tables.
- To be familiar with garbage collection.

UNIT I INTRODUCTION TO AUTOMATA THEORY AND REGULAR EXPRESSIONS 9

Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – NFA to DFA – Finite Automata with Epsilon Transitions – Epsilon-NFA to DFA – Kleene's Theorem – Minimization of Automata – Regular Expressions – Equivalence between Regular Expression and Automata – Properties of Regular Expressions.

Suggested Activities:

- Flipped classroom on Finite Automata and Regular Expressions.
- External learning - Automata, Basics of Finite Automata, NFA, DFA ,Finite state machines - Regular expressions.
- Practical - Study of Lexical analysis tools and lexer generators.

Suggested Evaluation Methods:

- Tutorials on minimization of automata.
- Assignments on regular expressions.

- Quizzes on automata.

UNIT II LEXICAL ANALYSIS 9

Introduction – The Structure of Compiler – Evolution of Programming Languages – Application of Compiler Technology – Programming Languages Basics – Lexical Analysis – Role of Lexical Analyzer – Specification and Recognition of Tokens – Lexical Analyzer Generators.

Suggested Activities:

- Flipped classroom on Compilers and Interpreters, The compilation process and the anatomy of a compiler, Bootstrapping.
- External learning - The role of the lexical analyzer, Finite state machines - Regular expressions.
- Practical - Perform lexical analysis and use lexical analyzer generators, Implementation of lexers using FLEX.

Suggested Evaluation Methods:

- Tutorials on structure of the compiler.
- Assignments on lexical analysis.
- Quizzes on lexical generators.

UNIT III SYNTAX ANALYSIS 9

Introduction – Context Free Grammar – Top Down Parsing – Recursive Descend Parsing – Predictive Parsing – Non-Recursive Predictive Parsing – Error Recovery – Bottom Up Parsing – LR Parsers – Construction of SLR (1) Parsing Table, Canonical LR (1) Parsing Table and LALR (1) Parsing Table – Parser Generators.

Suggested Activities:

- Flipped classroom on languages, writing grammars for programming languages, transformations on grammars.
- External learning - Parser generators.
- Practical - Read and write grammars for programming language constructs, Perform top-down parsing, bottom-up parsing and use parser generators, Implementation of Parsers using YACC in Unix Environment.

Suggested Evaluation Methods:

- Tutorials on context-free grammar.
- Assignments on various parsers.
- Quizzes on parsers.

UNIT IV INTERMEDIATE CODE GENERATION 9

Symbol Table – Construction – Syntax Directed Definitions – Evaluation Orders for Syntax Directed Definitions – Applications of Syntax Directed Translation – Intermediate Code Generation – Three Address Code – Types and Declarations – Expression Translation – Type Checking – Back Patching.

Suggested Activities:

- Flipped classroom on attributes grammars.
- External learning - Type checking, intermediate code and abstract machines.
- Practical - Perform semantic analysis including static checking, intermediate representations and attribute grammars, implementation of semantic analyzers using YACC.

Suggested Evaluation Methods:

- Tutorials on syntax directed definitions.

- Assignments on type checking.
- Quizzes on intermediate code generation.

UNIT V CODE GENERATION AND OPTIMIZATION 9

Issues – Design of Code Generator – Addresses in the Target Code – Basic Blocks in Flow Graph – Simple Code Generator – Peephole Optimization – Machine Independent Optimization – Principal Sources of Optimizations – Bootstrapping a Compiler – Compiling Compilers – Full Bootstrap.

Suggested Activities:

- Flipped classroom on Target machine.
- External learning - Code generation, Elementary optimizations. Basicblocks, Dataflow analysis.
- Practical - Perform code generation.

Suggested Evaluation Methods:

- Tutorials on code generation.
- Assignment problems flow graph.
- Quizzes on code optimization.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand the concept of lexical analysis and construction of deterministic and non-deterministic automata.

CO2: Understand the concept of parsing and construction of parser. Develop an Intermediate Code generator.

CO3: Study programming language design, target machine design and run time environment of compilers.

CO4: Study about the compiler construction tools.

CO5: Obtain knowledge to construct a prototype compiler for a subset of a programming language.

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, “Compilers: Principles, Techniques, and Tools”, Second Edition, Pearson Education, 2009.
2. John Hopcroft, Rajeev Motwani, Jeffrey Ullman, “Introduction To Automata Theory Languages, and Computation”, Third Edition, Pearson Education, 2007.

REFERENCES:

1. Torbengidius Mogensen, “Basics of Compiler Design”, Springer, 2011.
2. Charles N, Ron K Cytron, Richard J LeBlanc Jr., “Crafting a Complier”, Pearson Education, 2010.
3. K. D. Cooper, L. Torczon, “Engineering a Compiler”, Morgan-Kaufmann, Second Edition, 2011.
4. Micheal Sipser, “Introduction to the Theory of Computation”, Third Edition,2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓									
CO2	✓		✓									
CO3	✓											

CO4		✓	✓									
CO5		✓	✓		✓							
CO6		✓	✓		✓							

IT5551 **COMPUTER NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concept of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.
- To understand the components required to build different types of networks.
- To learn concepts related to network addressing and routing.

UNIT I INTRODUCTION AND APPLICATION LAYER 9

Building network – Network Edge and Core – Layered Architecture – OSI Model – Internet Architecture (TCP/IP) Networking Devices: Hubs, Bridges, Switches, Routers, and Gateways – Performance Metrics – Introduction to Sockets – Application Layer protocols – HTTP – FTP Email Protocols – DNS.

Suggested Activities:

- In-class activity - Solving problems on performance metrics.
- In-class activity - HTTP problems.
- Accessing HTTP and SMTP server through Telnet.
- External learning - HTTP/DNS format using a tool like Wireshark.
- External learning - POP3 and IMAP protocols of email application.

Suggested Evaluation Methods:

- Quiz on Wireshark.
- Quiz on POP3 and IMAP.
- Assignment problems different protocols.

UNIT II TRANSPORT LAYER 9

Transport Layer functions – Multiplexing and Demultiplexing – User Datagram Protocol – UDP Applications – Transmission Control Protocol – Flow Control – Retransmission Strategies – Congestion Control.

Suggested Activities:

- Flipped Classroom on UDP Applications.
- External learning - Wireshark for UDP, TCP packet formats.
- External learning - Transport for Real Time Applications.
- External learning - Understanding RFCs.
- Assignments on flow control analysis in class.

Suggested Evaluation Methods:

- Quiz on UDP applications.
- Quiz on real time transport protocols.
- Discussion/assignment on RFC.

- Interpreting Wireshark output.

UNIT III NETWORK LAYER 9

Network Layer: Switching concepts – Internet Protocol – IPV4 Packet Format – IP Addressing – Subnetting – Classless Inter Domain Routing (CIDR) – Variable Length Subnet Mask (VLSM) – DHCP – ARP – Network Address Translation (NAT) – ICMP – Concept of SDN.

Suggested Activities:

- In-class activity - IP addressing.
- External learning - IPV4 Packet Format using Wireshark.
- In-class activity - Subnetting for different scenarios.
- Flipped classroom on CIDR.
- External learning - Ping and trace-route commands.
- Mini-project on the implementation of a protocol based on an RFC.

Suggested Evaluation Methods:

- Quiz on CIDR.
- Check ability to use commands.

UNIT IV ROUTING 7

Routing Principles – Distance Vector Routing – Link State Routing – RIP – OSPF – BGP – IPV6 – Introduction to Quality of Service (QoS).

Suggested Activities:

- In-class activity - Distance Vector Routing, Link State Routing.
- External learning - RIP, OSPF packet formats.
- Assignment on Link state routing for different network graphs.
- In-class activity - Error Detection and Correction.
- Flipped classroom on IPV6.
- External learning - Study on global IP address assignment.

Suggested Evaluation Methods:

- Quizzes on RIP, OSPF packet format.
- Quiz on IPv6.

UNIT V DATA LINK AND PHYSICAL LAYERS 11

Data Link Layer – Framing – Flow control – Error control – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) – Physical layer – Signals – Bandwidth and Data Rate – Encoding – Multiplexing – Shift Keying – Transmission Media.

Suggested Activities:

- In-class activity - Problems on encoding techniques.
- External learning - Virtual LAN , Wireless LAN (802.11) formats.
- Flipped Classroom on recent developments in transmission media.
- Design a protocol for some application.
- Trace the end-to-end flow of packets through the network.

Suggested Evaluation Methods:

- Quizzes on VLAN and 802.11 formats.
- Presentation/Implementation of design.
- Demonstration of RFC implementation project.

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Highlight the significance of the functions of each layer in the network.
CO2: Identify the devices and protocols to design a network and implement it.
CO3: Build network applications using the right set of protocols and estimate their performances.
CO4: Trace packet flows and interpret packet formats.
CO5: Apply addressing principles such as subnetting and VLSM for efficient routing.
CO6: Explain media access and communication techniques.

TEXT BOOKS:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.

REFERENCES:

1. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2014.
2. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓		✓							
CO3	✓	✓	✓	✓	✓				✓			✓
CO4	✓	✓	✓	✓	✓							
CO5	✓	✓	✓	✓	✓							
CO6	✓	✓	✓	✓	✓							

IT5501 WEB TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the basic object oriented concepts using Java language.
- To understand the advanced features of Java language.
- To understand the essential client side technologies for web programming.
- To develop applications using database connectivity and server side programming in Java environment.
- To develop smart device based web application and deploy in different platforms.

UNIT I JAVA BASICS 9

Introduction to Java – Input / Output and Operators – Control Statements – Methods – Arrays – Lists – Classes and Objects – Strings – Inheritance – Polymorphism and Interfaces – Regular Expressions – Exception Handling.

Suggested Activities:

- Simple Java programming using control statements, strings, arrays, ArrayList, passing and returning object with exception handling.
- Exploring class hierarchy using inheritance and implementing Interface based run–time polymorphism.
- String manipulation and regular expression based examples.

Suggested Evaluation Methods:

- Grading system to evaluate simple java exercises.
- Tutorials on program writing skills.
- Simple application development using all the above mentioned features.

UNIT II JAVA GUI, FILE STREAM AND CONCURRENCY 9

GUI Development using SWING – I/O Streams and Object Serialization – Generic Collections – Concurrency – Thread States and Life Cycles – Thread Synchronization – Java Networking.

Suggested Activities:

- Applet and frame based application development using Swing.
- File stream and object serialization on text and binary data.
- Thread priorities and synchronization based application development.
- Simple networking programs like chat application.

Suggested Evaluation Methods:

- Grading system to evaluate simple java exercises.
- Tutorials on various GUI control based applet and frame applications with event handling.
- Application development based on I/O stream and thread manipulation.

UNIT III CLIENT SIDE ESSENTIALS 9

Java Script Objects and Functions – JQuery – Accessing DOM Elements using Java Script and JQuery Objects – Java Script Event Handling – XML DOM – AJAX Enabled Rich Internet Applications with XML and JSON – Dynamic Access and Manipulation of Web Pages using Java Script and JQuery – Web Speech API – Speech Synthesis Markup Language.

Suggested Activities:

- Programming exercises on HTML forms with Java script and JQuery objects.
- XML and JSON based AJAX enabled rich Internet application.
- Tutorials on web speech API.

Suggested Evaluation Methods:

- Case studies on simple web site with HTML, Java script and JQuery objects.
- AJAX enabled web site realization.
- Java script based speech API implementation.

UNIT IV SERVER SIDE ESSENTIALS 9

Overview of Servlet – Life Cycle of Servlet – Servlet Configuration – Running Servlet with Database Connectivity – Servlet Support for Cookies – Session Tracking – Basics of JSP – Java Server Faces – Multitier Application Architecture – MVC Architecture of JSF Apps – JSF Components – Session Tracking – Developing Dynamic Data Driven Websites.

Suggested Student Activities:

- Servlet programming with database connectivity and session tracking.
- JSF applications with database connectivity and session management.

Suggested Evaluation Methods:

- Demonstration of simple web application using Servlet and JSF.
- Session management demos using Servlet and JSF.

UNIT V SERVERLESS AND MOBILE BASED WEB DEVELOPMENT 9

Node Programming Fundamentals – Asynchronous Programming Techniques – Sequencing Asynchronous Logic – Node JS – Global Objects – Event Listeners – J2ME Basics – MIDlet –Mobile Web Application Frameworks – Simple Android Based Development – Cloud Based Applications Deployment.

Suggested Student Activities:

- Asynchronous web application development.
- Android based mobile application development.
- Practical - Application deployment in web servers.

Suggested Evaluation Methods:

- Evaluating asynchronous application development.
- Evaluation of online web hosting.
- Modular design factors like cohesion and coupling used to evaluate proper modules breakup.

OUTCOMES:

On completion of the course, the student will be able to:
CO1: Implement object oriented concepts using Java language.
CO2: Develop GUI application by including I/O streams and threads.
CO3: Create web pages with proper client–side features.
CO4: Design dynamic web pages with server–side and other technologies.
CO5: Develop simple android based mobile application.
CO6: Deploy web applications in a cloud based environment.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for Programmers”, Pearson Education, 2015.
2. “Core and Advanced Java”, Black book, DreamTech Press, 2018.

REFERENCES:

1. Uttam K. Roy, “Web Technologies”, Oxford University Press, 2011.
2. Harvey Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5th Edition, Pearson Publication, 2012.
3. Reto Meier, “Professional Android 4 Application Development”, Wiley India Pvt Ltd, 2012.
4. Mike Cantelon, Marc Harter, TJ Holowaychuk and Nathan Rajlich, “Node.js in Action”, Manning Publications, 2013.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓	✓			✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓		✓		✓			✓

CO3		✓	✓		✓					✓		✓
CO4	✓	✓	✓	✓	✓		✓		✓	✓		✓
CO5		✓	✓	✓	✓		✓		✓	✓		✓
CO6	✓	✓	✓	✓	✓		✓		✓	✓		✓

IT5511 COMPUTER NETWORKS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To explore various network commands in different operating systems.
- To understand and practice the configuration of various network devices.
- To implement functionalities using raw sockets.
- To understand and implement the network programming concepts using APIs.
- To explore the various network simulators for analysing network behaviour.

EXERCISES:

1. Practice different network commands available in Windows and Linux Operating Systems and troubleshoot the network.
2. Configure the network devices such as Router, Switch, Hub, Bridge and Repeater.
3. Write socket programs to simulate the operation of the following application layer protocols:
   a) HTTP
   b) FTP
   c) DNS
   d) SMTP and POP3
4. Simulate ECHO and CHAT applications using the following transport layer protocols:
   e) TCP
   f) UDP
5. Implement the functionality of Ping and traceroute commands using raw sockets.
6. Analysing the Network traffic using Packet Analyser (Wireshark) and understanding the various protocol headers.
7. Configure IPv4 and IPv6 addressing for a network using static and dynamic approaches (SLAAC and DHCP).
8. Configure Dynamic Routing mechanism using RIP and OSPF protocols.
9. Simulate TCP congestion control mechanism using NS2/NS3/OPNET.
10. Performance analysis of Network using NS2/NS3/OPNET (Delay, Bandwidth etc.)

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Configure various networking devices.

CO2: Understand the nuances of various network programming APIs and protocols of application layer protocols.

CO3: Program with raw sockets for network protocol implementation.

CO4: Configure IP addressing and routing for a network.

CO5: Understand the behaviour of TCP for congestion via simulation.

CO6: Work with network simulators.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓		✓	✓	✓			✓
CO2	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO3					✓							✓
CO4	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓		✓				✓	✓
CO6	✓	✓	✓	✓	✓			✓	✓		✓	✓

IT5512 WEB TECHNOLOGIES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To develop simple Java programs using object orientation concepts.
- To program using files and threads for concurrent operations.
- To design attractive GUI using framework.
- To create dynamic web pages using CSS, JavaScript and AJAX.
- To develop mobile based web applications in cloud environment.

LIST OF EXPERIMENTS:

1. Simple Java programs using arrays and lists.
2. Object orientation program using inheritance and polymorphism.
3. Simple association using objects (pass & return by reference).
4. Simple GUI application development using applet and SWING.
5. Implement multithreaded program for concurrent operations.
6. Develop program to set priority and synchronize java threads.
7. Input and Output manipulation on files (Read/Write).
8. Java programs on generic and collections.
9. Client-Server network application using java sockets.
10. Dynamic web page creation using Javascript, Jquery and AJAX.
11. Develop servlet and JSF application with JDBC access.
12. Manage sessions in JSP using cookies.
13. Create simple Node Javascript functions for server.
14. Android application for location based service.
15. Develop Cloud based web application.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Implement object oriented concepts using Java language.
CO2: Develop GUI application by including I/O streams and threads.
CO3: Create web pages with proper client-side features.
CO4: Design dynamic web pages with server-side and other technologies.
CO5: Develop simple android based mobile application.
CO6: Deploy web applications in a cloud based environment.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓	✓			✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓		✓		✓	✓		✓
CO3		✓	✓		✓							✓
CO4	✓	✓	✓	✓	✓		✓		✓	✓		✓
CO5		✓	✓	✓	✓		✓		✓	✓		✓
CO6	✓	✓	✓	✓	✓		✓		✓	✓		✓

IT5601 EMBEDDED SYSTEMS AND INTERNET OF THINGS L T P C
3 0 0 3

OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of Internet of Things(IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

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

Suggested Activities:

- Flipped classroom activity on different types of microcontrollers.
- Assignment on writing simple assembly codes.
- Practical - Developing simple application using assembly code.

Suggested Evaluation Methods:

- Tutorials on instruction set and programming.
- Assignments on programming using machine code.
- Quizzes on instruction set and programming.

UNIT II EMBEDDED C PROGRAMMING 9

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

Suggested Activities:

- Flipped classroom on different types of RTOS.
- Practical - Writing simple embedded C codes.
- Practical - Developing simple application using embedded C code.

Suggested Evaluation Methods:

- Tutorials on embedded C programming.
- Assignment on scheduling policies.
- Practical - Developing applications using embedded C.
- Quizzes on Embedded C and RTOS.

UNIT III IOT AND ARDUINO PROGRAMMING 9

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

Suggested Activities:

- Flipped classroom on ARM processors and its applications.
- Practical - Developing simple application using Arduino.
- Case study of different sensors used in IoTs.

Suggested Evaluation Methods:

- Tutorials on Arduino programming.
- Assignment problems on interfacing I/O based applications with Arduino board.
- Quizzes on IoT devices.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

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

Suggested Activities:

- Flipped classroom on Bluetooth, WiFi, ZigBee, GPS, GSM etc. standards.
- Practical - Developing simple application using open platform (like Raspberry Pi).
- Case study of different existing IoT related standards.

Suggested Evaluation Methods:

- Tutorials on programming with open platforms for IoT.
- Assignment on interfacing different sensors/actuators with open platform.
- Quizzes on IoT communications.

UNIT V APPLICATIONS DEVELOPMENT 9

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

Suggested Activities:

- Flipped classroom activity on different existing IoT applications.
- Designing simple applications.
- Case study on IoT based home automation solutions.

Suggested Evaluation Methods:

- Tutorials on design and development of IoT applications.
- Assignment on different IoT based smart solutions.
- Demonstrating real-time applications using embedded and IOT processors.

- Quizzes on Design of embedded systems and IoT applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand and compare various embedded processors.
CO2: Design and deploy timers and interrupts.
CO3: Write embedded C programs.
CO4: Design simple embedded applications.
Co5: Design portable IoT using Arduino/Raspberry Pi /open platform.
Co6: Analyze applications of IoT in real time scenario.

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2014.

REFERENCES:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
3. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
4. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
5. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developers Guide", Morgan Kauffman/ Elsevier, 2006.
6. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", VPT, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓				✓	✓			✓
CO2	✓	✓	✓	✓	✓		✓		✓		✓	✓
CO3	✓	✓	✓	✓	✓		✓		✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

IT5602 DATA SCIENCE AND ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of data science and big data.
- To gain in-depth knowledge on descriptive data analytical techniques.
- To gain knowledge to implement simple to complex analytical. Algorithms in big data frameworks.

- To develop programming skills using required libraries and packages to perform data analysis in Python.
- To understand and perform data visualization, web scraping, machine learning and natural language processing using various Data Science tools.

UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA 9

Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Classification of Digital Data – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools.

Suggested Activities:

- Case studies on big data application domain.
- Real world domain specific problems involving big data and listing out the challenges.
- Demonstration on data analytics tools.

Suggested Evaluation Methods:

- Student assignment on case studies related to healthcare, climate change, e-commerce, retail business, manufacturing etc.
- Group presentation on big data applications with societal need.
- Quizzes on topics like big data terminologies, big data applications, etc.

UNIT II DESCRIPTIVE ANALYTICS USING STATISTICS 9

Types of Data – Mean, Median and Mode – Standard Deviation and Variance – Probability – Probability Density Function – Types of Data Distribution – Percentiles and Moments – Correlation and Covariance – Conditional Probability – Bayes' Theorem – Introduction to Univariate, Bivariate and Multivariate Analysis – Dimensionality Reduction using Principal Component Analysis and LDA – Dimensionality Reduction using Principal Component Analysis and Linear Discriminant Analysis (LDA) – Principal Component Analysis (PCA) example with Iris Data Set from UCI repository.

Suggested Activities:

- Solving numerical problems based on statistics and probability.
- Demonstration of descriptive analysis using Python.
- Demonstrate PCA using Iris data set in Python.

Suggested Evaluation Methods:

- Assignment on data understanding using open source tools.
- Student Presentation of real world applications and the required descriptive analysis.
- Quiz on all topics in descriptive analytics using statistics.

UNIT III PREDICTIVE MODELING AND MACHINE LEARNING 9

Linear Regression – Polynomial Regression – Multivariate Regression – Multi Level Models – Data Warehousing Overview – Bias/Variance Trade Off – K Fold Cross Validation – Data Cleaning and Normalization – Cleaning Web Log Data – Normalizing Numerical Data – Detecting Outliers – Introduction to Supervised And Unsupervised Learning – Reinforcement Learning – Dealing with Real World Data – Machine Learning Algorithms –Clustering – Python Based Application.

Suggested Activities:

- Solve numerical problem solving using linear regression models.
- Demonstrate data cleaning using WEKA tool.
- Demonstration of data preprocessing and machine learning features in Python.

Suggested Evaluation Methods:

- Simple lab based activities for machine learning in Python using small benchmark datasets.
- Tool based assignments on linear, polynomial and multivariate regression using real world case studies.
- Assignment on comparative analysis of two or more data sets using their features.

UNIT IV DATA ANALYTICAL FRAMEWORKS 9

Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).

Suggested Activities:

- Case studies on applications involving usage of data analytical frameworks.
- Demonstration of Installation and configuring Hadoop and MapReduce.
- Design and develop algorithms to be executed in Map Reduce involving numerical methods for analytics.
- Installation of MongoDB and simple data management.

Suggested Evaluation Methods:

- Mini Project (Group) – Real time data collection, saving in Hive, implement analytical techniques using Map-Reduce Tasks and Result Projection.
- Practical – Programming assignments in MongoDB.
- Quiz on Hive query language.

UNIT V DATA SCIENCE USING PYTHON 9

Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Statsmodels and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python – Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python.

Suggested Activities:

- Demonstration of simple Python scripts using NumPy and SciPy Package.
- Demonstration on NumPy arrays and matrix operations.
- Simple lab activities on dimensionality reduction and feature selection using Python.
- Demonstration of experiments on data visualization using matplotlib functions.

Suggested Evaluation Methods:

- Mini Project using Python for data analytics with benchmark datasets.
- Quiz on data visualization functions.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Identify the real world business problems and model with analytical solutions.

CO2: Solve analytical problem with relevant mathematics background knowledge.

CO3:Convert any real world decision making problem to hypothesis and apply suitable statistical testing.

CO4:Write and demonstrate simple applications involving analytics using Hadoop and MapReduce.

CO5: Use open source frameworks for modeling and storing data.
CO6: Perform data analytics and visualization using Python.

TEXT BOOKS:

1. Frank Pane, “Hands On Data Science and Python Machine Learning”, Packt Publishers, 2017.
2. Seema Acharya, Subhashini Chellapan, “Big Data and Analytics”, Wiley, 2015.

REFERENCES:

1. Alberto Boschetti, Luca Massaron, “Python Data Science Essentials”, Packt Publications, 2nd Edition, 2016.
2. DT Editorial Services, Big Data, Black Book, Dream Tech Press, 2015.
3. Yuxi (Hayden) Liu, “Python Machine Learning”, Packt Publication, 2017.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	✓
CO2	✓	✓	✓	✓	✓						✓	✓
CO3	✓	✓		✓	✓				✓		✓	✓
CO4	✓	✓	✓	✓	✓				✓		✓	
CO5		✓	✓	✓	✓				✓			
CO6	✓	✓	✓	✓	✓						✓	✓

IT5603 DISTRIBUTED AND CLOUD COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To learn about the concepts of distributed systems.
- To understand distributed resource management.
- To study the basics of cloud computing.
- To study about virtualization and cloud resource management.
- To be aware of different cloud platforms.

UNIT I INTRODUCTION TO DISTRIBUTED SYSTEM CONCEPTS 11

Introduction to Distributed Systems – Characteristics – Issues in Distributed Systems – Distributed System Model – Request/Reply Protocols – RPC – RMI – Logical Clocks and Casual Ordering of Events – Election Algorithm – Distributed Mutual Exclusion –Distributed Deadlock Detection Algorithms.

Suggested Activities:

- Implement RPC and Bankers algorithm.
- Create and Distribute a Torrent file to share a file in LAN Environment.

Suggested Evaluation Methods:

- Demonstration and assessment of the working of the implemented algorithm.

UNIT II INTRODUCTION TO CLOUD COMPUTING 10

Introduction to Cloud Computing – Evolution of Cloud Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning – NIST Cloud Computing Reference Architecture– Architectural Design Challenges – Deployment Models: Public, Private and Hybrid Clouds – Service Models: IaaS – PaaS – SaaS – Benefits of Cloud Computing.

Suggested Activities:

- Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
- Explore public cloud services like Amazon, Google, Sales force, and Digital Ocean etc.

Suggested Evaluation Methods:

- Quiz on different architectural styles of cloud.
- Report Submission - Comparison of various services provided by different Cloud Service Providers (Configuration of VM, Cost, Network Bandwidth etc.).

UNIT III CLOUD ENABLING TECHNOLOGIES 9

Introduction to Web Service and Service Oriented Architecture – SOAP – REST – Basics of Virtualization – Full and Para Virtualization– Implementation Levels of Virtualization – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Desktop Virtualization – Server Virtualization.

Suggested Activities:

- Create a simple web service using Python Flask /Java /any language [Web service: Client-server model should be implemented using socket/http].
- Install Oracle Virtual Box/VMware Workstation and Create a chat application [Note: Launch two Virtual Machines for chat application].

Suggested Evaluation Methods:

- Review the web service implementation - Proper Connection should be established between the client and server to make use of the service offered by the Server.
- Review the working of Application in virtual environment.

UNIT IV CLOUD MANAGEMENT, STORAGE AND SECURITY 8

Resource Provisioning and Methods – Cloud Management Products – Cloud Storage – Provisioning Cloud Storage – Managed and Unmanaged Cloud Storage – Cloud Security Overview – Cloud Security Challenges –Security Architecture design – Virtual Machine Security – Application Security –Data Security.

Suggested Activities:

- Use security tools like ACUNETIX, ETTERCAP to scan web applications on the cloud, cloud networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.

Suggested Evaluation Methods:

- Report Submission - Generate a detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loopholes.

UNIT V CLOUD SOFTWARE AND COMPUTING PLATFORMS 7

HDFS – Map Reduce – Google App Engine (GAE) – Programming Environment for GAE – Architecture of GFS – Case Studies: Openstack, Heroku, and Docker Containers –Amazon EC2, AWS, Microsoft Azure, Google Compute Engine.

Suggested Activities:

- Install and configure OpenStack all-in-one using Devstack/Packstack and Launch VMs in OpenStack through dashboard.

Suggested Evaluation Methods:

- OpenStack Dashboard should be accessed though web browser. Verify the working of instance by logging into it / pinging the instance.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Appreciate distributed computing, distributed resource management.
CO2: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
CO3: Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
CO4: Explain the core issues of cloud computing such as resource management and security.
CO5: Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.
CO6: Establish own cloud environment using Openstack and work on it.

TEXTBOOKS:

1. Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems - Principles and Paradigms”, Second Edition, Pearson, 2006.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.

REFERENCES:

1. Mukesh Singhal, “Advanced Concepts In Operating Systems”, McGraw Hill Series in Computer Science, 1994.
2. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, John Wiley, 2011.
3. John W. Rittinghouse, James F. Ransome, “Cloud Computing: Implementation “Management and Security”, CRC Press, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓							✓			
CO3	✓	✓	✓	✓		✓			✓			
CO4	✓	✓	✓	✓		✓			✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5611 EMBEDDED SYSTEMS AND INTERNET OF THINGS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To learn tools relevant to Embedded System and IoT development.
- To write simple assembly programs that use various features of the processor.
- To explore Embedded C Programs for different embedded processors.
- To develop simple applications using Arduino/Raspberry Pi/open platform.
- To design and develop IOT application for real world scenario.

LIST OF EXERCISES:

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Using interrupts generate waveforms and test Timers.
5. Write assembly language experiments using Kit to test interfaces and interrupts using Traffic Generator, DAC, ADC, Stepper Motor (2).
6. Write Basic and arithmetic Programs Using Embedded C.
7. Write Embedded C program to test interrupt and timers.
8. Develop Real time applications – clock generation, wave form generation, counter – using embedded C.
9. Explore ARM/PIC based controllers using Embedded C.
10. Explore different communication methods with IoT devices.
11. Develop simple application – testing infrared sensor – IoT Applications – using Aurdino.
12. Develop simple application – testing temperature, light sensor – IOT Application – using open platform/Raspberry Pi.
13. Deploy IOT applications using platforms such as Bluemix.

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1: Write and implement simple assembly programs that use various features of the processor.
CO2: Write an Embedded C Program, debug and interpret the results.
CO3: Develop micro controller based application.
CO4: Test and experiment different sensors for application development.
CO5: Develop IoT applications using Arduino/Raspberry Pi/open platform.
CO6: Explore deployment platforms for IoT applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	-	✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

IT5612 DATA ANALYTICS AND CLOUD COMPUTING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To provide hands-on experience to cloud and data analytics frameworks and tools.
- To use the Python packages for performing analytics.
- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as MapReduce tasks.

LIST OF EXERCISES:

Analytics Using Python:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
   (i) Reading data from text file, Excel and the web.
   (ii) Exploring various commands for doing descriptive analytics on Iris data set.
2. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   (i) Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   (ii) Bivariate analysis: Linear and logistic regression modeling
   (iii) Multiple Regression analysis
   Also compare the results of the above analysis for the two data sets.
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.
4. Apply and explore various plotting functions on UCI data sets.

Cloud Computing:

5. Installation of OpenStack.
6. Creation of VMs and installing applications and executing simple programs in OpenStack.
7. Simple applications for communication across VMs.

Hadoop, MapReduce, HDFS, Hive:

8. Install and configure Hadoop in its two operating modes: Pseudo distributed and fully distributed.
9. Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files and deleting files.
10. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.
11. Install HIVE and implement the above retail schema definition and perform CRUD operations.

TOTAL:45 PERIODS

OUTCOME:

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

CO1: Install analytical tools and configure distributed file system.
CO2: Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
CO3: Develop, implement and deploy simple applications on very large datasets.
CO4: Implement simple to complex data modeling in NoSQL databases.
CO5: Develop and deploy simple applications in OpenStack cloud.
CO6: Implement real world applications by using suitable analytical framework and tools.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓					✓		✓	✓
CO2	✓	✓	✓	✓	✓				✓		✓	✓
CO3	✓	✓	✓	✓	✓				✓		✓	✓
CO4	✓	✓	✓		✓				✓			
CO5	✓	✓	✓	✓					✓			
CO6	✓	✓	✓	✓	✓						✓	✓

IT5613 SOCIALLY RELEVANT PROJECT LABORATORY L T P C
0 0 2 1

OBJECTIVES:

- To identify socially relevant problems.
- To design solutions for socially relevant problems.
- To develop projects based on software design process.
- To implement solutions for societal valued projects using relevant state of the art technologies.
- To test the implemented project based on user needs and usefulness.

Students are expected to take up problems that would directly benefit the society and design and implement an IT based solution for the problem, based on the courses undertaken up to that semester. The domains of the problems may reach out to sectors like but not limited to Energy, Education, Material, Environment, Telecommunications, Defense, Healthcare, Entertainment and Agriculture. The societal value of the project is to be evaluated based on the need of the hour and request from stakeholders. The evaluation of the project would be based on the usefulness of the problem statement, formulation of the problem, stakeholders need, and the usage statistics of the solution and the technical merit of the solution.

The project design, development and testing phases can be as shown below:

REQUIREMENTS ENGINEERING PHASE:

- Problem identification.
- Feasibility study of domain.
- Requirement elicitation and analysis.

DESIGN PHASE:

- Architectural design.
- UI design.
- Component Design.
- Database design.

IMPLEMENTATION PHASE:

- Coding in a suitable language using necessary platforms and tools.

TESTING AND VALIDATION PHASE:

- Component Testing
- System Testing
- Acceptance Testing

TOTAL : 30 PERIODS

OUTCOMES:

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

CO1: Analyze social problems and provide technical solutions.

CO2: Benefit the society by providing IT based solutions for social problems.

CO3: Design, develop and implement solutions for social problems.

CO4: Develop innovative technical solutions of social relevance.

CO5: Design, develop and implement standard solutions to social problems applying CO6: Software engineering methodologies.

CO6: Evaluate the solution based on usefulness, effectiveness and user satisfaction.

REFERENCES:

1. https://www.niti.gov.in/.
2. https://www.sih.gov.in/.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓		✓						
CO2	✓	`✓	✓			✓			✓			
CO3	✓	✓	✓	✓	✓							
CO4		✓	✓	✓	✓	✓			✓		✓	
CO5			✓			✓		✓	✓			
CO6							✓		✓	`✓	✓	

IT5701 ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

OBJECTIVES:

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To know the automated learning techniques.
- To study the techniques of knowledge representation.
- To explore the adaption of artificial intelligence techniques in real-time scenarios.

UNIT I INTELLIGENT AGENTS AND SEARCH TECHNIQUES 12

Agents and Environments – Good Behavior: The Concepts of Rationality – The Nature of Environments – The Structure of Agents – Problem Solving by Search – Uninformed Search – Searching with Costs – Informed State Space Search – Heuristic Search: Greedy – A* Search – Problem Reduction Search – Game Search – Constraint Satisfaction Problems.

Suggested Activities:

- Flipped classroom on structure of agents.
- Uninformed search - Searching with costs.
- Solve puzzles with uninformed and informed searches.
- Practical - Implementation of search through Python/other languages.

Suggested Evaluation Methods:

- Tutorials on various topics of the unit.

- Assignments on puzzles with uninformed and informed searches.
- Quizzes on agents, environments and search
- Evaluation of the programming exercises.

UNIT II REASONING WITH LOWER ORDER LOGICS 9

Logical Agent – Proposition Logic – Syntax and Semantics – Theorem Proving – Model Checking – Inference in First Order Logic: Forward Chaining – Backward Chaining – Resolution.

Suggested Activities:

- Reasoning methods through puzzles and real life scenarios.
- Practical - Inference through Prolog/Python.
- Practical - Programming through Prolog/ Python for various topics such as reasoning through resolution.

Suggested Evaluation Methods:

- Tutorials on reasoning methods.
- Assignment problems on different topics of the unit.
- Quizzes on inference techniques in logic.
- Evaluation of the programming exercises.

UNIT III KNOWLEDGE REPRESENTATION 6

Knowledge Representation Issues – Approaches for Knowledge Representation: Simple Relational Knowledge – Inherited Knowledge – Semantic Nets – Frames – Semantic Web – Ontology.

Suggested Activities:

- Examples of knowledge representation through different methods and reasoning.
- Practical - Ontology creation using a tool like Protégé.

Suggested Evaluation Methods:

- Tutorials on different topics of the unit.
- Assignments on knowledge representation through different methods and reasoning.
- Quizzes on different methods of knowledge representation.
- Evaluation of the programming exercise.

UNIT IV AI PLANNING AND NATURAL LANGUAGE PROCESSING 9

Classical Planning – Types – Partial Order Planning – Graph Plan and SAT Plan – Natural Language Processing Basics: Syntax – Semantics – Introduction to Statistical NLP.

Suggested Activities:

- Flipped classroom on planning types and the background of plan.
- Out of class activity – Classical Planning, Boolean satisfiability.
- In class – Graph plan.
- Practical - Programming through PDDL/Python to develop a plan for block world, cargo world etc.

Suggested Evaluation Methods:

- Tutorials on planning types and the background of plan.
- Assignments on graph plan.
- Quizzes on planning and natural language processing basics.
- Evaluation of the programming exercise.

UNIT V LEARNING AND APPLICATIONS 9

Logical Formulation of Learning – Knowledge in Learning – Explanation-based Learning – Learning using Relevance Information – Application with NLP: Developing a Simple Chatbot – Types of Chatbot.

Suggested Activities:

- Flipped classroom on knowledge in learning.
- Assignments on problem solving in learning techniques.
- Practical - Programming exercises using Python/other programming languages such as: Programming for HMM.
- Explore the available Chatbot models such as Watson and adapt to a specific domain such as Education or Customer relations.

Suggested Evaluation Methods:

- Tutorials on knowledge in learning.
- Evaluation of the programming exercise.
- Quizzes on knowledge in learning.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of the course, the student will be able to:
CO1: Understand the search techniques.
CO2: Apply the search techniques to real-time problems.
CO3: Apply the reasoning techniques to real world problems.
CO4: Understand the representation of knowledge.
CO5: Understand the learning techniques.
CO6: Apply AI techniques in developing real world applications.

TEXT BOOKS:

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence - A Modern Approach”, Third Edition, Pearson Publishers, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, Third Edition, Tata McGraw-Hill Education, 2008.

REFERENCES:

1. Dheepak Khemani, “A first course in Artificial Intelligence”, McGraw Hill Education Pvt Ltd., NewDelhi, 2013.
2. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, O’Reilly, 2009, https://www.nltk.org/book/.
3. Nils J. Nilsson, “Artificial Intelligence: A New Synthesis”, Morgan Kaufmaan Publishers Inc; Second Edition, 2003.
4. NPTEL, “Artificial Intelligence”, http://nptel.ac.in/courses/106105079/2.
5. Udacity, “Introduction to Artificial Intelligence”, https://in.udacity.com/course/intro-to-artificial-intelligence--cs271.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							
CO2	✓	✓	✓		✓							
CO3	✓	✓	✓	✓	✓							

CO4	✓			✓	✓							
CO5	✓	✓			✓							
CO6	✓	✓	✓	✓	✓				✓			✓

IT5702 MOBILE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To learn the basics of wireless communication and cellular networks.
- To study the popular cellular networking technologies.
- To explore various protocols that support mobility at network layer and transport layer.
- To understand the intricacies of UI required by mobile applications and the design aspects of mobile application.
- To study various mobile app development platforms and learn developing mobile applications.

UNIT I WIRELESS COMMUNICATION AND CELLULAR NETWORKS 9

Electromagnetic Spectrum – Antenna – Propagation Ranges and Effects – Multipath Propagation – Spread Spectrum –Multiple Access Techniques: FDMA, TDMA, CDMA, OFDMA – Duplexing Techniques: FDD, TDD – Cellular Networks – Tessellation, Frequency Reuse and Handoff – Generations of Cellular Networks – 2G Systems.

Suggested Activities:

- External learning - Performing a survey of popular mobile phones and exploring their configuration (performance in terms of processor core, clock speed, RAM), display (technology, screen size and resolution), camera features and battery features, LTESim and Players in 5G networks and exploring the structure and operation of a cell phone tower.
- Exploring frequency reuse and reuse factor in cellular network deployment.
- Flipped classroom on CDMA2000, WCDMA, HSPA, HSDPA, HSUPA and HSPA+.

Suggested Evaluation Methods:

- Assignments on features of modern mobile phones and structure and operation of a cell phone tower.
- Solving frequency reuse relayed problems.
- Quiz and discussion on CDMA and its variants and HSPA and its variants.

UNIT II 3G AND 4G WIRELESS MOBILE NETWORKS 9

3GPP – UMTS and IMT-2000: Architecture, User Equipment, RNS, UTRAN, Node B, RNC Functions – IP Multimedia Subsystem – 4G Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC And NAC – IMT– Advanced Standard – Features Of LTE– Advanced.

Suggested Activities:

- External learning - Explore 5G networks.
- Flipped classroom on IP multimedia subsystem.
- Analysis and requirements of cellular networks.

Suggested Evaluation Methods:

- Assignments on 5G networks.
- Quiz and discussion on IP multimedia subsystem.
- Design a cellular network for the given case study.

UNIT III MOBILITY SUPPORT IN IP AND TCP 9

Mobile IP – Mobile Agent, Foreign Agent, Care of Address, Registration, Advertisement and Discovery, Tunneling, IP within IP – Mobility Support in IPV6 – Mobility Header, Mobility Options, Dynamic Home Agent Address Discovery, Cache Management, Bidirectional Tunneling – TCP Over Wireless Networks – Indirect TCP –Snoop TCP – Mobile TCP.

Suggested Activities:

- External learning - Performing a survey of popular wireless routers and exploring their configuration (Built in radio interfaces in terms of IEEE 802.11 and its variants, support for MU - MIMO technology, external antennas, clock speed of the processor, data rate supported).
- Exploring the task list required to configure mobile IP and getting familiar with the networking operating system commands required to configure mobile IP.
- Flipped classroom on mobility support in IPv6.

Suggested Evaluation Methods:

- Assignments on features of wireless routers and their configuration.
- Configuring mobile IP using network operating system commands.
- Quiz and discussion on mobility support in IPv6.

UNIT IV APPLICATION DESIGN 9

Aspects of Mobility – Middleware and Gateways – Mobile Devices and Profiles – Generic UI Development – Multimodal and Multichannel UI – Mobile Memory Management – Design Patterns for Limited Memory – Work Flow for Application Development – Techniques for Composing Applications – Dynamic Linking – Plug-ins and Rule of Thumb for Using DLLs – Concurrency and Resource Management – Look and Feel, Intents and Services – Storing and Retrieving Data – Communication via the Web – Notification and Alarms.

Suggested Activities:

- External learning - Exploring XForms processing model and location based services.
- Flipped classroom on GUI features supported in WAP, J2ME, BREW and Microsoft platforms.
- Analyzing problems in designing mobile applications where location and energy are the constraints.

Suggested Evaluation Methods:

- Assignments on XForms and location based services.
- Quiz and discussion on GUI features supported in WAP, J2ME, BREW and MS platforms.
- Designing and implementing location and energy constrained mobile applications.

UNIT V APPLICATION DEVELOPMENT 9

Google Android Platform – Eclipse Simulator – Android Application Architecture – Event Based Programming – Apple Iphone Platform – UI Tool Kit Interfaces – Cross Platform Design and Tools – Event Handling and Graphics Services – Layer Animation – Location

Based Services – Resilient Programming Practices – Packaging and Deployment – Security And Hacking.

Suggested Activities:

- Flipped classroom on Android emulator, DDMS, Debug– bridge, SQLite quick– start guides.
- External learning - Performing a comparative study of Android TV vs. Google Chromecast.
- Developing mobile apps using Android web APIs, location based services APIs.
- Flipped classroom on targeting different device configurations and languages.

Suggested Evaluation Methods:

- Quiz and discussion on Android emulator, DDMS, Debug-bridge and SQLite.
- Assignments on Android TV and Google chromecast.
- Developing and testing simple mobile apps in Android and Apple iOS.
- Quiz and discussion on device configurations and languages.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Have knowledge on the architecture and protocols of 2G, 3G, and 4G cellular system.
2. Deploy various protocols that support mobility at network layer and transport layer.
3. Design and implement the user interfaces for mobile applications.
4. Design the mobile applications that are aware of the resource constraints of mobile devices.
5. Develop advanced mobile applications that access the databases and the web.
6. Understand the intricacies in deploying cellular networks and developing mobile applications based on resilient programming practices.

TEXT BOOKS:

1. Clint Smith, Daniel Collins, “Wireless Networks”, Third Edition, McGraw Hill Publications, 2014.
2. Share Conder, Lauren Darcey, “Android Wireless Application Development”, Volume I, Third Edition, Pearson, 2014.

REFERENCES:

1. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson, 2009.
2. Paul Bedell, “Cellular networks: Design and Operation – A real world Perspective”, Outskirts Press, 2014.
3. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, “Programming Android”, O’Reilly, 2011.
4. Alasdair Allan, “iPhone Programming”, O’Reilly, 2010.
5. Donny Wals, “Mastering iOS 12 Programming”, Packt, 2018.
6. Reza B’Far, “Mobile Computing principles”, Cambridge University Press, 2005.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓		✓						
CO2	✓	✓	✓				✓					
CO3	✓	✓	✓	✓		✓	✓		✓			

CO4	✓	✓	✓	✓			✓	✓	✓		✓	
CO5	✓	✓	✓	✓				✓			✓	
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5703 CRYPTOGRAPHY AND SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of cryptography and number theory.
- To use the standard security algorithms to provide confidentiality, integrity and authentication for any applications.
- To make use of application protocols to design and manage a secure system.
- To learn the configuration and manage Firewall and WLAN Security.
- To understand the importance of system security and its vulnerabilities.

UNIT I INTRODUCTION TO SECURITY AND NUMBER THEORY 9

Basics of Security – CIA Triad – Threats, Attacks and Services – Classical Cryptography – Substitution – Transposition – One-time Pad – Cryptanalysis – Number Theory – Modular Arithmetic – Euclidean Theorem – Extended Euclidean Theorem – Algebraic Structures – Galois Field – Prime Numbers – Fermat's Theorem – Euler's Phi function – Euler's Theorem – Chinese Remainder theorem – Modular Exponentiation –Logarithms – Elliptic Curve Arithmetic.

Suggested Activities:

- In-class activity - Practice cryptanalysis of classical cryptography and break the classical algorithms using cryptographic attack.
- In-class activity - Solve modular exponentiation and multiplicative inverse using Fermat and Euler theorem.
- Practical - Classical cryptography algorithms using Cryptool.

Suggested Evaluation Methods:

- Assignments on cryptanalysis of classical cryptography, additive Inverse, Multiplicative Inverse and modular exponentiation using the theorem.
- Quiz on classical cryptography and number theory.
- Demonstration of the classical cryptography algorithms using Cryptool.

UNIT II SYMMETRIC CRYPTOGRAPHY 9

Modern Cryptography – Symmetric Cipher – Block and Stream Cipher – Feistel Ciphers – Data Encryption Standard (DES) – DES Structure – Key Generation – Simplified DES – Linear and Differential cryptanalysis –Triple DES – Advanced Encryption Standard (AES) – Basic Structure – Transformations – Key Expansions Process – Analysis of AES – Modes of operation – RC4.

Suggested Activities:

- Explain the importance of key size and explore some examples with brute force attack to break the key.
- Demonstrate the working of DES and AES algorithms using CrypTool.
- Demonstrate various cryptographic attacks on DES and AES.

Suggested Evaluation Methods:

- Assignments on key generation, linear and differential cryptanalysis of symmetric cryptography.
- Quiz on modes of operation and internal structure of DES and AES.

UNIT III ASYMMETRIC KEY CRYPTOGRAPHY 9

Public Key Cryptosystems – RSA Algorithm – ElGamal Cryptosystems – Diffie-Hellman key exchange – Elliptic curve cryptography – Hash functions – Hash algorithms – Secure Hash Algorithm SHA – MD5 – Message Authentication Codes – Quantum Cryptography – Quantum Key Distribution – Threshold Cryptography.

Suggested Activities:

- Highlight the mathematics behind RSA, Diffie-Hellman Key exchange and Elliptic Curve Cryptography.
- Demonstrate the Hash code generation using MD5 and SHA 256 algorithm.
- Practical - Verify the Message Integrity using Hashing Techniques such as MD5 and SHA256.
- Case studies on Quantum and Threshold Cryptography.

Suggested Evaluation Methods:

- Assignments on RSA and ECC generation for encryption and decryption process.
- Quiz on mathematics behind the public key algorithms, Quantum and Threshold Cryptography.

UNIT IV SECURITY APPLICATIONS 9

Digital Signatures Schemes– Digital Certificate – Key Management – Kerberos – Key Agreement and Distribution – PKI – X.509 Certificate – E-Mail Security – PGP – S/MIME – IP security – Virtual Private Network (VPN) – Web Security – Secure Socket Layer (SSL) – Transport Layer Security – Secure Electronic Transaction (SET) – Blockchain.

Suggested Activities:

- Case studies on understand the components of X.509 Certificate and Blockchain.
- Demonstrate IP security and configure VPN connection.
- Implement the SSL/TLS in Web Server for a Web Application.

Suggested Evaluation Methods:

- Assignment on configuration of IP security and VPN connection in networks and Blockchain.
- Quizzes on Key Management, SSL, TLS and Blockchain.

UNIT V FIREWALL & WIRELESS SECURITY 9

Buffer Overflow and Malicious Software – Password Management – Introduction to Firewall – Firewall Generations – Intrusion Detection System – Types of IDS – Intrusion Prevention System – Wireless LAN – Wireless LAN Security – Network Access Control and Cloud Security.

Suggested Activities:

- Teaching with case studies: access control and cloud security.
- Configure the Access Control List and using firewall, mitigate DoS attack.
- Understand the safety measures during the implementation of security in WLAN.
- Simulate the importance of various security standards in WLAN.

Suggested Evaluation Methods:

- Assignments on buffer overflow, malicious software and types of IDS.

- Quizzes on firewall generation, WLAN security and cloud security.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Apply the basic security algorithms and policies required for a computing system.
2. Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.
3. To identify any network security issues and resolve the issues.
4. To manage the firewall and WLAN security.
5. Evaluate the system related vulnerabilities and mitigation.
6. To design secured web applications in real-time.

TEXT BOOKS:

1. William Stallings, “Cryptography and Network security Principles and Practices”, Pearson/PHI, Seventh Edition, 2017.

REFERENCES:

1. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2004.
2. Pfleeger and Pfleeger, “Security in computing”, Third Edition , PHI/Pearson, 2003.
3. Behourz Forouzan, Debdeep Mukhopadyay, “Cryptography and Network Security”, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010.
4. Gilles van Assche, “Quantum Cryptography and Secret-Key Distillation”, Cambridge University Press, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓	✓	✓	✓			✓				
CO3		✓	✓					✓				
CO4					✓				✓	✓		✓
CO5			✓	✓	✓	✓	✓	✓	✓	✓		✓
CO6		✓	✓			✓	✓	✓	✓	✓		✓

IT5711 MOBILE AND SECURITY LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To do several hands-on exercises to reinforce the students’ knowledge and understanding of the various security aspects.
- To explore the sequence of cryptographic algorithms by implementing using a programming language.
- To understand vulnerabilities and security flaws in the various applications.
- To develop simple and location specific applications in android environment.
- To analyse the performance of mobile networks using Network simulator.

LIST OF EXERCISES:

The following exercises are based on the cryptographic algorithms. They can be implemented using any Programming Language.

1. Write a program to perform encryption and decryption using the following algorithms:
    a. Caesar cipher
    b. Affine Cipher
    c. Hill Cipher
    d. Transposition Cipher.
2. Perform cryptographic attack on the cipher-text generated using any of the algorithms implemented in exercise 1.
3. Write a program to demonstrate symmetric key encryption process using DES and AES algorithm.
4. Write a program to implement RSA algorithm and demonstrate the key generation and encryption process.
5. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.
6. Write a program to sign and verify a document using DSA algorithm.
7. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like kali Linux.
8. Develop a Mobile application for event handling and push notification in Android.
9. Create animations and graphical primitives in Android environment.
10. Develop a Location based services such as tracking, geofencing, and activity recognition using Google play services.
11. Develop a Mobile application for recognizing and authorizing using camera and sensors.
12. Performance analysis of various node deployment strategies in mobile environment using network simulators such as NS2/NS3/OPNET/GloMoSim/NetSim.

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Attain knowledge to program both symmetric and asymmetric key cryptography.
2. Implement specific encryption/decryption algorithms.
3. Analyse the vulnerabilities in any application using penetration testing.
4. Develop basic mobile applications in Android environment.
5. Use both hardware and sensors to develop applications.
6. Explore the performance analysis of mobile network using network simulator.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2	✓	✓							✓			
CO3	✓	✓	✓			✓						✓
CO4	✓	✓	✓			✓	✓	✓	✓	✓		
CO5	✓			✓	✓	✓	✓		✓	✓		✓
CO6	✓	✓	✓			✓	✓		✓			

IT5001 **VIRTUALIZATION** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concept of virtualization.
- To understand the various issues in virtualization.
- To be familiar with the virtualization of various components/functionalities.
- To compare and analyze various virtual machines products.
- To work with virtualization platforms.

UNIT I INTRODUCTION TO VIRTUALIZATION 9

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded & Direct Interpretation – Binary Translation – Full and Para-Virtualization – Types of Hypervisor – Types of Virtualization.

Suggested Activities:

- Install Oracle Virtual Box/VMware workstation and create a blackboard application [Hint: One VM should act as a master and other VMs acts as a listeners, when any content is written by the master VM, the content should be displayed in all the Listener VMs]

Suggested Evaluation Methods:

- Quizzes on process virtual machines and system virtual machines.
- Assignments on types of virtualization tools and products.
- Report submission virtualization tools and products.

UNIT II SERVER VIRTUALIZATION 8

Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization – Business Cases for Sever Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform.

Suggested Activities:

- Install any one sever virtualization tool (e.g., VMware ESX, Xen, KVM) and run and create two VMs and configure one VM as Web Server and another as File Server.

Suggested Evaluation Methods:

- Review the working of installed server virtualization tools (access the service offered by remote virtual machine via web browser).

UNIT III NETWORK VIRTUALIZATION 10

Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer 3 VRF Instances Layer 2 – VFIs Virtual Firewall Contexts Network Device Virtualization – Datapath Virtualization Layer 2: 802.1q – Trunking Generic Routing Encapsulation – IPSec L2TPv3 Label Switched Paths – Control-Plane Virtualization – Routing Protocols – VRF- Aware Routing – Multi-Topology Routing.

Suggested Activities:

- Create and configure a VLAN using Cisco packet tracer.
- Connect the created VLANs using router in Cisco packet tracer.

Suggested Evaluation Methods:

- Demonstration - Inter VLAN Communication.

UNIT IV STORAGE VIRTUALIZATION 8

Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA Shared Storage Model Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual Tape Libraries.

Suggested Activities:

- Setup iSCSI Target and initiator in Linux.

Suggested Evaluation Methods:

- Assessing if the created storage LUNs are accessible from target/remote system.

UNIT V APPLYING VIRTUALIZATION 9

Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level – Shared Kernel – Enterprise Solutions: Vmware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box – Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration – Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop – Network and Storage Virtualization: VPN, VLAN, SAN and VSAN, NAS.

Suggested Activities:

- Mini Project - Use Virtualization Tools.

Suggested Evaluation Methods:

- Demonstration of the mini project.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Create a virtual machine and extend it to a virtual network.
2. Discuss various virtual machine products.
3. Perform server virtualization.
4. Explain the concept of network virtualization.
5. Discuss various tasks in storage virtualization.
6. Compile all types of virtualization techniques and utilize them in design of virtual machines.

TEXT BOOKS:

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

REFERENCES:

1. William von Hagen, “Professional Xen Virtualization”, Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches”, Prentice Hall, October 2009.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2	✓	✓							✓			
CO3	✓	✓	✓			✓						✓
CO4	✓	✓	✓			✓	✓	✓	✓	✓		
CO5	✓			✓	✓	✓	✓		✓	✓		✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

IT5002 **UNIX INTERNALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn about the design of the Unix operating system.
- To become familiar with the various data structures used learn the various low-level algorithms used in Unix.
- To understand the Unix file system and its system calls.
- To study about process management and scheduling in Unix.
- To learn about memory management and I/O systems.

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 Concept – 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.

Suggested Activities:

- Flipped classroom on operating system services.
- Practical -
    - Implement the system call ‘cat’ using command line arguments and generate the executable version of the program and invoke the executable file using exec system calls (fork, wait etc).
    - Implement a scenario resulting to an incorrect linked list because of context switch.
    - Implement the five scenarios in the getblk algorithm by using first in first out scheme.
    - Simulate the function of bread(), breada(), bwrite and brelse.

Suggested Evaluation Methods:

- Quiz on operating system services.
- Evaluation of the functions implemented.

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.

Suggested Activities:

- Flipped classroom on files and directory structure.
- Practical -
    - Implement the five scenarios in the iget algorithm by using least recently used scheme.
    - Implement the bmap algorithm and find the block number and the byte offset in file system for the given offset. Assume the disk block contain 1024 bytes.
        - 96000
        - 9999999
    - Simulate the function of iput, ialloc, ifree, alloc and ifree.
    - Write a program to display the directory entries(i.e., byte offset , inode number and the file name).

Suggested Evaluation Methods:

- Quiz on files and directory structure.
- Evaluation of the functions implemented.

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.

Suggested Activities:

- Flipped classroom on file system and system calls.
- Practical -
    - How does the command mkdir work? (Hint: When mkdir completes, what are the inode numbers for "." and ".."?).
    - Simulate the function of chown, chmod, stat and fstat.
    - Set the whole-file lock with fcntl() and lockf().
    - Write a program to print the mount table whenever an external device is connected to the Unix system.

Suggested Evaluation Methods:

- Quiz on file system calls.
- Checking the functions implemented.

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 – 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.

Suggested Activities:

- Flipped classroom on context switching
- Practical -
    - Implement the algorithm for allocating and freeing memory pages and page tables. Which data structures would allow best performance?
    - Design an algorithm that translates virtual address to physical addresses, given the virtual address and the address of the region entry.
    - Implement an algorithm that exchange messages over pipe (use of pipe and dup and fork).

- Write a program to communicate between two process using signals.

Suggested Evaluation Methods:

- Quiz on context switching.
- Evaluation of the functions implemented.

UNIT V MEMORY MANAGEMENT AND I/O 9

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

Suggested Activities:

- Flipped classroom on virtual memory concepts
- Practical -
  - Write a program that tracks the allocation of space on a swap device.
  - Write a program that verifies that the file systems on a disk do not overlap. The program should take two arguments: a device file that represents a disk volume and a descriptor file that gives section numbers and section lengths for the disk type. The program should read the super blocks to make sure that file systems do not overlap.
  - Implement sty command: with no parameters, it retrieves the values of terminal settings and report them to the user.
  - Encode a line disciple that writes the machine name at the beginning of each line of output.

Suggested Evaluation Methods:

- Quiz on virtual memory concepts.
- Evaluation of the functions implemented.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand UNIX architecture and describe the component of operating system.
2. Explain how they interact with computer hardware.
3. Gain a deeper understanding of system calls in Unix operating system.
4. Apply the concepts of operating systems design to practical problems.
5. Design and implement the subsystems of an operating system.
6. Critically analyze different data structures and algorithms used in the building of a kernel.

TEXT BOOK:

1. Maurice J. Bach, “The Design of the Unix Operating System”, Pearson Education, 1986.

REFERENCES:

1. B. Goodheart, J. Cox, “The Magic Garden Explained”, Prentice Hall of India,1986.
2. S. J. Leffler, M. K. Mckusick, M. J. .Karels, J. S. Quarterman., “The Design and Implementation of the 4.3 BSD Unix Operating System”, Addison Wesley, 1998.
3. Robert Love, “Linux Kernel Development”, Third Edition, Addison Wesley, 2010.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										

CO2	✓	✓		✓	✓				✓			
CO3	✓	✓	✓	✓	✓				✓	✓		✓
CO4	✓	✓	✓	✓		✓	✓	✓	✓	✓		
CO5	✓	✓	✓	✓	✓				✓	✓		✓
CO6	✓	✓	✓						✓	✓		✓

IT5003 HETEROGENEOUS COMPUTING L T P C
3 0 0 3

OBJECTIVES:
- To understand the development of parallel and massively parallel systems.
- To understand the challenges in heterogeneous processing systems.
- To Use shared programming models for parallel programs.
- To learn to program heterogeneous systems.
- To learn to provide effective parallel solutions for GPGPU architectures.

UNIT I PARALLEL COMPUTING BASICS 9

Importance of Parallelism – Processes, Tasks and Threads – Modifications to von-Neumann model – ILP – TLP – Parallel Hardware – Flynns Classification – Shared Memory and Distributed Memory Architectures – Cache Coherence – Parallel Software – Performance – Speedup and Scalability – Massive Parallelism – GPUs – GPGPUs.

Suggested Activities:
- Identify parallelism in day-to-day activities.
- Study the configuration of the multi-core processors and GPUs used in laptops, PCs and smart phones.
- Review the configuration of top 500 super computers over the last 10 years.
- Problems on cache coherence in class.
- Flipped classroom on GPGPUs.

Suggested Evaluation Methods:
- Pair-wise/group discussion on the studies conducted.
- Assignment on various topics of the unit.
- Quiz on speedup and scalability calculation.
- Quiz on GPGPUs.

UNIT II SHARED MEMORY PROGRAMMING WITH OPENMP 9

OpenMP Program Structure – OpenMP Clauses and Directives – Scheduling Primitives – Synchronization Primitives – Performance Issues with Caches – Case Study – Tree Search.

Suggested Activities:
- Write simple OpenMP programs.
- Interpret given OpenMP program and identify bugs.
- Write OpenMP programs for sorting.
- Experiment with change of cache configuration.
- Mini project: identify a problem to solve using OpenMP/CUDA.

Suggested Evaluation Methods:
- Execute and Demonstration the OpenMP programs.

- List the bugs and fix the bugs.
- Evaluate the programs for different configurations of cache size/number of cores etc.
- Mini project: Check feasibility of project.

UNIT III PROGRAMMING GPUS 9

GPU Architectures – Data Parallelism – CUDA Basics – CUDA Program Structure – Threads, Blocks, Grids – Memory Handling**.**

Suggested Activities:

- Write simple CUDA programs to understand threads, blocks and grids.
- Experiment with different sizes for threads, blocks and grids.
- Write CUDA programs for memory–intensive programs and experiment with different memory options.
- Mini project: Devise a solution for the problem identified in the earlier unit using CPU and GPU.

Suggested Evaluation Methods:

- Demonstration of the CUDA programs.
- Plot graphs of execution time versus various parameters.
- Mini project: Check design of the solution.

UNIT IV PROGRAMMING WITH CUDA 9

Parallel Patterns – Convolution – Prefix Sum – Sparse matrix – Vector Multiplication – Imaging Case Study.

Suggested Activities:

- Write CUDA programs for matrix operations and imaging applications.
- Experiment with different sizes for threads, blocks, grids and memory options.
- Identify the pattern and parameters for different applications.
- Mini project: Write CUDA code as per the solution devised in the earlier unit.

Suggested Evaluation Methods:

- Demonstration of the CUDA programs.
- Quiz to check understanding of patterns and effect of parameters.
- Mini project: Code demo/walkthrough.

UNIT V OTHER GPU PROGRAMMING PLATFORMS 9

Introduction to OpenCL – OpenACC – C++AMP – Thrust – Programming Heterogeneous Clusters – CUDA and MPI.

Suggested Activities:

- Write and execute simple OpenCL programs.
- Study the OpenACC programming model and identify the reduction in programming complexity.
- Identify and compare the different available parallel programming accelerator tools.
- Mini project: Compare OpenMP and CUDA versions of code.

Suggested Evaluation Methods:

- Demonstration of programs.
- Demonstration of use of tools.
- Mini project: Check performance analysis graph.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify parallelism in an application.
2. Choose the right parallel processing paradigm for a given problem.
3. Write parallel programs using OpenMP.
4. Devise solutions for an application on a heterogeneous multi-core platform.
5. Program GPUs using CUDA / OpenCL.
6. Compare characteristics of and evaluate different GPU programming platforms.

TEXT BOOKS:

1. Peter Pacheco, "Introduction to Parallel Programming", Morgan Kauffman, 2011.
2. David B. Kirk, Wen–mei W. Hwu, "Programming Massively Parallel Processors", Third Edition, Morgan Kauffman, 2016.

REFERENCES:

1. Shane Cook, "CUDA Programming – A Developers Guide To Parallel Computing with GPUs", Morgan Kauffman, 2013.
2. B.R. Gaster, L. Howes, D.R. Kaeli, P. Mistry, D. Schaa, " Heterogeneous Computing with OpenCL 2.0", Morgan Kauffman, 2015.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓	✓	✓						✓	
CO3	✓	✓	✓	✓	✓							
CO4	✓	✓	✓	✓	✓				✓		✓	
CO5	✓	✓	✓	✓	✓							
CO6	✓	✓	✓	✓	✓		✓		✓		✓	

IT5004 GRAPH THEORY **L T P C**
3 0 0 3

OBJECTIVES:

- To comprehend graphs as modeling and analysis tools.
- To introduce various data structures with graph theory.
- To learn graph theoretic algorithms.
- To understand graph coloring and covering.
- To learn the usage and applications of graphs in social networking and media.

UNIT I INTRODUCTION **9**

Graphs: Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits – Connectedness – Components – Euler Graphs – Hamiltonian paths and circuits.

Suggested Activities:

- Solving simple Graph problems.
- Flipped classroom on isomorphism.
- External learning - Traveling salesman problem.

- Practical -
    - Implement a program to determine isomorphic graphs.
    - Implement a program to determine Hamiltonian circuits and Hamiltonian paths in a graph.
- Applications in real life problems.

Suggested Evaluation Methods

- Tutorials on graph algorithms.
- Assignment problems on isomorphism, hamiltonian graphs.
- Quizzes on connected components.

UNIT II TREES AND CONNECTIVITY 9

Trees – Properties of Trees – Distance and Centers in Tree – Rooted and Binary Trees. Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network Flows – 1–Isomorphism – 2–Isomorphism.

Suggested Activities:

- Solving problems on tree properties and cut sets.
- Flipped classroom on spanning trees and fundamental circuits.
- External learning – Network flows.
- Practical -
    - Find all spanning trees of a graph.
    - Find all cut-sets in a graph.
- Applications in real life problems.

Suggested Evaluation Methods:

- Tutorials on spanning trees and cut sets.
- Assignment problems on fundamental circuits and cut sets.
- Quizzes on network flows.

UNIT III PLANARITY, COLOURING AND COVERING 9

Combinational and Geometric Graphs – Planar Graphs – Kuratowski's Two Graphs – Different Representation of a Planar Graph – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem.

Suggested Activities:

- Solving Problems on planar graphs, chromatic number.
- Flipped classroom on matching and covering.
- External learning - Self-dual graphs and digraphs.
- Practical -
    - Implement a program to determine if a given graph G is planar or nonplanar
    - Finding all maximal independent sets
- Applications in real life problems.

Suggested Evaluation Methods:

- Tutorials on planar graphs.
- Assignments on matching and covering.
- Quizzes on planar graphs, chromatic number.

UNIT IV DIRECTED GRAPH AND GRAPH THEORETIC ALGORITHMS 9

Directed Graphs – Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Digraphs – Graph Theoretic Algorithms – Connectedness

and Components – A set of Fundamental Circuits.

Suggested Activities:

- Solving problem on Euler digraphs.
- Flipped classroom on directed graphs.
- External learning - Cut-Vertices and Separability.
- Practical - Implementation of graph algorithms.
- Finding connected components.
- Finding a set of fundamental circuits in a graph.
- Applications in real life problems.

Suggested Evaluation Methods:

- Tutorials on directed graphs .
- Assignments on Euler digraphs.
- Quizzes on graph theoretic algorithms.

UNITV GRAPHS IN SOCIAL AND DIGITAL MEDIA 9

Dominant Social Networking/Media Platforms – Collecting Data from Social Media Sites – Social Media Graphs – Graph Storage Formats and Visualization – Applications of Graph Analysis.

Suggested Activities:

- Flipped classroom on social network analysis using graphs.
- External learning - Algebraic graph analysis.
- Practical -
    - Study of an interactive visualization tool such as Gephi for social networks.
- Applications in real life problems.

Suggested Evaluation Methods:

- Tutorials on social network analysis using graphs.
- Assignments on graph storage formats and visualization.
- Quizzes on interactive visualization tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Demonstrate understanding of the fundamental theorems of graph theory.
2. Identify and differentiate the potential use of special graphs and describe the basic properties of each kind.
3. Design and develop programs involving basic graph algorithms.
4. Introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields.
5. Apply the abstract concepts of graph theory in modeling and solving non-trivial problems in different fields of study.
6. Analyze and formulate solutions using graphs for social networking and media.

TEXTBOOKS:

1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Dover Publications Inc., 2016.
2. Ioannis Pitas, “Graph-Based Social Media Analysis”, Chapman and Hall/CRC Press, 2015.

REFERENCES:

1. Clark J., Holton D. A., “A First Look at Graph Theory”, Allied Publishers, 1995.

2. Mott J. L., Kandel A., Baker T. P., “Discrete Mathematics for Computer Scientists and Mathematicians”, Prentice Hall of India, 1996.
3. Liu C. L., “Elements of Discrete Mathematics”, McGraw Hill, 1985.
4. Rosen K. H., “Discrete Mathematics and Its Applications”, McGraw Hill, 2007.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓							✓		✓
CO2	✓	✓	✓							✓		✓
CO3	✓	✓	✓	✓	✓				✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

IT5005 HUMAN COMPUTER INTERACTION 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 understand components of interfaces and screens, including windows, menus and controls.
- To understand user interface design principles, and apply them to designing an interface.
- To understand the rationale and guidelines for an effective interface design methodology.

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.

Suggested Activities:

- Practical - Analyze various web interfaces.
- Flipped classroom on basic knowledge on the HCI design process.
- External learning - Exploration of various scenarios for creating HCI system.
- Practical - Implementation of a simple user interface design using simple components

Suggested Evaluation Methods:

- Comparison table creation of web interfaces.
- Tutorials on basic design process.

- Assignment on various design paradigms.
- Demonstration of a simple user interface created using simple components.

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.

Suggested Activities:

- Practical - Design UIs using various tools like Sketch, Flinto, Adobe XD, React.
- Flipped classroom on designing a good user interface system based on design rules.
- External learning - Techniques related to evaluation of HCI design.
- Practical - Development and validation of user interfaces using various evaluation techniques.

Suggested Evaluation Methods:

- Demonstrations of created UIs and obtained evaluation metrics.
- Tutorials on UI design rules.
- Assignments on techniques related to UI evaluation.

UNIT III MODELLING INTERFACES 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 – Socio Technical Models – Communication and Collaboration Models – Task Models – Task Analysis And Design Dialogue Notations And Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual – Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship With Dialogue – Formalisms – Formal Notations – Interstitial Behavior.

Suggested Activities:

- Practical - To implement interfaces using design rules and various models.
- Flipped Classroom on basic knowledge of various models used in HCI design.
- External learning - Design and implementation of various models used in HCI design.

Suggested Evaluation Methods:

- Demonstration of created UI with design rules.
- Tutorial on models of HCI design.
- Assignments on models of HCI 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.

Suggested Activities:

- Practical - Statistical analysis and user testing on existing user interfaces.
- Flipped classroom on basic concepts of probability and statistics.
- External learning - Practical problems related to hypothesis testing.

Suggested Evaluation Methods:

- Demonstration of user testing with arrived results.

- Tutorials on basic probability and statistical questions related to HCI design evaluation.
- Assignments on UI design evaluation strategies.
- Quizzes on evaluation methods.

UNIT V CURRENT TRENDS 9

Virtual Reality – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor-Based Systems – Groupware – Applications – Ubiquitous Computing – Virtual Reality – Wearable User Interfaces – User Interfaces For MR Applications.

Suggested Activities:

- Flipped classroom on basic concepts of dialogue notations and design.
- External learning - Usage of Virtual Reality in various real time UI application design.
- Practical - Implementation of Mixed Reality based UI design, Wearable user interfaces.

Suggested Evaluation Methods:

- Tutorials on various dialog notations and design.
- Assignments on development of VR based real time UI.
- Demonstration of multi modal user interfaces.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Interpret the contributions of human factors and technical constraints on human-computer interaction.
2. Apply HCI techniques and methods to the design of software.
3. Apply exploratory and experimental research methods in HCI.
4. Design and develop various models that suit real time interface development.
5. Design and develop real time human computer interaction (HCI) system.
6. Be equipped with the principles and guidelines of user centered interface design process, evaluation methodologies and tools to analyze the interfaces.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Prentice Hall, 2004.
2. Preece, J., Sharp, H., Rogers, Y., “Interaction Design: Beyond Human-Computer Interaction”, Fourth Edition, Wiley, 2015.

REFERENCES:

1. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction”, Wiley, 2010.
2. Ben Shneiderman, Catherine Plaisant, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Fifth Edition, Addison Wesley, 2009.
3. Jeff Johnson, “Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules”, Second Edition, Morgan Kaufmann, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓						✓					
CO2	✓	✓	✓		✓							
CO3			✓	✓	✓							
CO4					✓	✓	✓		✓			

CO5						✓	✓			✓		
CO6						✓	✓	✓	✓	✓		

IT5006 LOGIC AND APPLICATIONS IN COMPUTER SCIENCE L T P C
3 0 0 3

OBJECTIVES:
- To know the mathematical background of logic.
- To learn the basics of lower order logic.
- To study the background of higher order logic.
- To explore the real world applications with lower order logic.
- To explore the real world applications with higher order logic.

UNIT I PROPOSITION LOGIC 9
Introduction to Logic – Foundation in Mathematics – Natural Deduction – Formal language Syntax and Semantics – Normal Forms – SAT Solvers.

Suggested Activities:
- Flipped classroom on natural deduction.
- In-class activity - Solving puzzles through proposition logic.
- Programming exercises for SAT solver.

Suggested Evaluation Methods:
- Quiz on deduction.
- Assignments on natural deduction and SAT solvers.
- Programming exercises must be evaluated.

UNIT II PREDICATE LOGIC 9
Syntax and Semantics – Natural Deduction Rules – Expressiveness – Micromodels of Software –Inference Mechanisms in AI.

Suggested Activities:
- Flipped classroom on micromodels of software.
- In-class activity - Problem solving exercise.

Suggested Evaluation Methods:
- Quiz on reasoning methods.
- Assignment problems on inference mechanisms in AI.

UNIT III MODAL LOGIC INTRODUCTION 9
Higher Order Logic – Modal Logic Syntax – Semantics – Accessibility Relation – Types of Modal Logic – Natural Deduction.

Suggested Activities:
- Flipped classroom on types of modal logic.
- In-class activity - Entailment through Kripke semantics.

Suggested Evaluation Methods:
- Quiz on different accessibility relations.
- Assignment problems based on Kripke structures.

UNIT IV TEMPORAL LOGIC 9

Linear Temporal Logic – Syntax – Semantics – Model Checking – Computational Tree Logic –Syntax – Semantics – Application in Operating Systems and Distributed systems.

Suggested Activities:

- Flipped Classroom on applications.
- In-class activity - Solving problems with Model checking.
- Model checking on the programming assignments.

Suggested Evaluation Methods:

- Quiz on model logic with types, temporal logic syntax and semantics.
- Assignment problems on semantics.
- Programming assignment on model checking.

UNIT V EPISTEMIC LOGIC 9

Logic of Knowledge – Syntax – Semantics – Natural Deduction – Multi-agent Reasoning – Applications in Distributed Systems.

Suggested Activities:

- Flipped classroom on multi-agent reasoning.
- In-class activity - Solving puzzles like muddy children and three wise men puzzle.

Suggested Evaluation Methods:

- Quiz on reasoning methods using muddy children and three wise men puzzle.
- Assignment problems on deduction and other reasoning methods.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the mathematical underpinnings of logic.
2. Apply proposition logic to computer science domains.
3. Understand the reasoning process of predicate logic.
4. Understand the advantages of higher order logic over lower order logic.
5. Apply temporal logic to distributed systems.
6. Design Multi-agent systems using epistemic logic .

TEXT BOOK:

1. Michael Huth, Mark Ryan, “Logic in Computer Science, Modelling and Reasoning about Systems”, Second Edition, Cambridge University Press, 2005.

REFERENCES:

1. Johan van Benthem, Hans van Ditmarsch, Jan van Eijck, Jan Jaspars, “Logic in Action”, http://www.logicinaction.org/, 2016.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓			✓							
CO3	✓	✓										
CO4	✓	✓										

CO5	✓	✓	✓		✓							
CO6	✓	✓	✓		✓							

IT5007 ADVANCES IN DATABASES L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of data modeling and design in advanced databases.
- To study the working principles of distributed databases.
- To have an introductory knowledge about the query processing in object-based databases and its usage.
- To understand the basics of spatial, temporal and mobile databases and their applications.
- To learn emerging databases such as XML, Data warehouse and NoSQL.

UNIT I DISTRIBUTED DATABASES 9

Distributed Systems – Introduction – Architecture – Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

Suggested Activities:

- Practical - Design of distributed database with fragmentation using any DBMS.
- Flipped classroom on distributed transaction protocols.
- Writing distributed queries and optimizing the queries.

Suggested Evaluation Methods:

- Evaluation of designed Distributed Database system.
- Quizzes on distributed transactions.
- Tutorials on distributed queries and optimization.

UNIT II NOSQL DATABASES 9

NoSQL – CAP Theorem – Sharding - Document based – MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment – Using MongoDB with PHP / JAVA – Advanced MongoDB Features – Cassandra: Data Model, Key Space, Table Operations, CURD Operations, CQL Types – HIVE: Data types, Database Operations, Partitioning – HiveQL – OrientDB Graph database – OrientDB Features.

Suggested Activities:

- Exploring MongoDB using JAVA/Python/Ruby/PHP.
- Perform Database Operations using MongoDB/Cassandra/HIVE.
- Scenario based query development for database applications.

Suggested Evaluation Methods:

- Evaluation of the database operations.
- Tutorial on scenarios to analyze the need for DB in various applications.
- Quizzes on query language features.

UNIT III ADVANCED DATABASE SYSTEMS 9

Spatial Databases: Spatial Data Types, Spatial Relationships, Spatial Data Structures, Spatial Access Methods – Temporal Databases: Overview – Active Databases – Deductive

Databases – Recursive Queries in SQL – Mobile Databases: Location and Handoff Management, Mobile Transaction Models, Concurrency – Transaction Commit Protocols – Multimedia Databases.

Suggested Activities:

- Individual/group activities for application specific data handling.
- Discussion about advantages and drawbacks of transaction models for different applications involving spatial-temporal data.

Suggested Evaluation Methods:

- Tutorials on active and deductive databases.
- Assignments on spatial databases.
- Quizzes on mobile database transactions.

UNIT IV XML AND DATAWAREHOUSE 9

XML Database: XML – XML Schema – XML DOM and SAX Parsers – XSL – XSLT – XPath and XQuery – Data Warehouse: Introduction – Multidimensional Data Modeling – Star and Snowflake Schema – Architecture – OLAP Operations and Queries.

Suggested Student Activities:

- Flipped classroom on demonstrate the operations on XML data and data warehouse.
- Practical - Use tools to solve data access scenarios.

Suggested Evaluation Methods:

- Assignments on XML parsers, XSL and XQuery.
- Demonstration and presentation of the practical assignments.

UNIT V INFORMATION RETRIEVAL AND WEB SEARCH 9

IR concepts – Retrieval Models – Queries in IR system – Text Preprocessing – Inverted Indexing – Evaluation Measures – Web Search and Analytics – Current trends.

Suggested Student Activities:

- Flipped classroom on queries in IR.
- Practical - Install any IR framework such as SOLR, and experiment with it.

Suggested Evaluation Methods:

- Practical demonstration on IR Queries.
- Quizzes on IR frameworks and related tools.

OUTCOMES:

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

1. Design a distributed database system and execute distributed queries.
2. Use NoSQL database systems and manipulate the data associated with it.
3. Have knowledge of advanced database system concepts.
4. Design a data warehouse system and apply OLAP operations.
5. Design XML database systems and validating with XML schema.
6. Apply knowledge of information retrieval concepts on web databases.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education/Addison Wesley, 2017.

REFERENCES:

1. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Jiawei Han, Micheline Kamber , Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition, Morgan Kaufmann, 2012.
3. Brad Dayley, “Teach Yourself NoSQL with MongoDB in 24 Hours”, Sams Publishing, 2014.
4. Shashank Tiwari, “Professional NoSQL”, O’Reilly Media, 2011.
5. Vijay Kumar, “Mobile Database Systems”, John Wiley & Sons, 2006.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓				✓	✓		
CO2	✓	✓		✓	✓				✓			
CO3	✓	✓	✓					✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓			✓	✓	✓		
CO5	✓	✓	✓	✓	✓				✓	✓		✓
CO6	✓	✓	✓						✓	✓		✓

IT5008 COMPUTER GRAPHICS L T P C
3 0 0 3

OBJECTIVES:

- To know the mathematical basis of computer graphics.
- To train the students to acquire knowledge in Computer Graphics modeling, animation, and rendering.
- To create graphical applications.
- To acquire knowledge about tools and technologies related to graphics.
- To create visually realistic animations.

UNIT I INTRODUCTION TO COMPUTER GRAPHICS 9

Graphics Display Devices – Graphics Input Primitives and Devices – OpenGL Basic Graphic Primitives – Line Drawing Algorithms DDA and Bresenham – Windows And Viewports – Clipping Algorithms for Lines, Regular Polygons, Circles and Arcs – Parametric Form for a Curve – Visibility Algorithms – Review of Vectors – Representations of Key Geometric Objects – Lines And Planes.

Suggested Activities:

- Flipped classroom on basic vector and arithmetic operations on vector.
- Practical - Use OpenGL to create visual objects using lines and apply clipping algorithms.
- Assignment problems on line drawing algorithms and clipping algorithms.

Suggested Evaluation Methods:

- Tutorials on arithmetic operations on vector.

- Demonstration of line drawing algorithms and applying clipping algorithms over the created objects.
- Solving problems on vectors.

UNIT II MODELING AND TRANSFORMATIONS OF OBJECTS 9

Introduction to Transformations – Two Dimensional Transformations – 3D Affine Transformations – Homogeneous Coordinates – Matrix Representation – Drawing 3D Scenes Interactively – Introduction to Solid Modeling with Polygonal Meshes – Mesh Approximations to Smooth Objects – Particle Systems and Physically Based Systems.

Suggested Activities:

- Practical - Creating three dimensional solid objects and apply transformations.
- Brainstorming session on different modeling techniques.
- Assignments on three dimensional transformations.

Suggested Evaluation Methods:

- Demonstration on creation of three-dimensional solid objects and applying various transformations.
- Creativity and production of impressive visual imagery.
- Quizzes on transformation.

UNIT III VIEWING AND VISUAL REALISM 9

Three-Dimensional Viewing – Hidden Surface Removal – Illumination Models-Depth Cueing – Perspective Projections of 3D Objects – Introduction to Shading Models – Flat Shading and Smooth Shading – Adding Texture to Faces – Morphing – To Add Shadows of Objects – OPENGL Shading Language – Manipulating Pixmaps – Manipulating Symbolically Defined Regions – Aliasing and Anti Aliasing Techniques – Creating More Shades and Colours.

Suggested Activities:

- Assignments on hidden surface removal methods.
- Practical - To add shadows and lighting effects on modeled objects.

Suggested Evaluation Methods:

- Tutorials on hidden surface removal algorithms.
- Demonstrations by creating visually aesthetic scenes.

UNIT IV SURFACE DESIGN 9

Describing Curves using Polynomials – Bezier Curves – Blending Functions – The B-Spline Basis Functions – Modeling Curved Surfaces – Rational Splines and NURBS – Interpolation – Modeling Curved Surfaces – Color Theory – Overview of the Ray Tracing Process – Intersecting Rays with other Primitives – Adding Shadows for Greater Realism – Reflections and Transparency – Boolean Operations on Objects – Ray Casting.

Suggested Activities:

- Assignments on generating different types of curves.
- Practical - Drawing curves and curved objects.

Suggested Evaluation Methods:

- Demonstration on drawing curves and curved objects.
- Creativity and production of impressive three dimensional objects.
- Quizzes on color models and rendering methods.

UNIT V ANIMATIONS 9

Design of Animation Sequence – Animation Function – Raster Animation – Key Frame Systems – Motion Specification – Morphing – Tweening – Types of Animation – Fractals – Tools for Animation Creation.

Suggested Activities:

- Practical - To create realistic animations.
- External learning - Process of animation movie making.

Suggested Evaluation Methods:

- Demonstration of animated movies created using various techniques.
- Quizzes on animation movie making.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Articulate the concepts and techniques used in three-dimensional graphics.
2. Understand and Implement algorithms related to graphics creation.
3. Design and model graphical structures.
4. Understand and comprehend the graphical algorithms.
5. Design visually realistic graphical applications.
6. Design and develop simple and realistic animations.

TEXTBOOKS:

1. F. S. Hill, Jr., Stephen M. Kelley, Jr., “Computer graphics using OpenGL”, Pearson Prentice Hall, Third Edition, 2007.
2. Donald D. Hearn, M. Pauline Baker, W. Carithers., “Computer Graphics with Open GL”, Fourth Edition, Pearson Eduction, 2010.

REFERENCES:

1. Tay Vaughan., “Multimedia: Making it Work”, Ninth Edition, McGraw-Hill Education, 2014.
2. Alan Watt, “3D Computer Graphics”, Third Edition, Pearson Addison Wesley, 2000.
3. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Systems”, Springer, 2004.
4. Mark S. Drew, Zee Nian Li, “Fundamentals of multimedia”, Prentice Hall, 2006.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓	✓									
CO3			✓	✓	✓							
CO4			✓	✓	✓							
CO5					✓	✓			✓			
CO6					✓	✓			✓	✓		

IT5009 **MULTIMEDIA TECHNOLOGIES** **L T P C**
3 0 0 3

OBJECTIVES:

- To enrich student learning in multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge on multimedia architecture.
- To learn about the multimedia elements in a comprehensive way.

UNIT I INTRODUCTION TO MULTIMEDIA ELEMENTS 9

Multimedia – Medium – Properties of a Multimedia System – Traditional Data Stream Characteristics – Data Stream Characteristics of Continuous Media – Basic Sound Concepts – Speech – Images and Graphics – Computer Image Processing – Video and Animation – Computer Based Animation.

Suggested Activities:

- Flipped classroom on multimedia concepts.
- Practical - Creating and editing visual elements using tools like Audacity, Fontographer, Blender, Photoshop and flash.

Suggested Evaluation Methods:

- Demonstration on creating visual elements using audio and video editing tools.
- Creativity and visual appearance.
- Quizzes on multimedia elements and their characteristics.

UNIT II MULTIMEDIA COMPRESSION 9

Storage Space – Coding Requirements – Hybrid Coding – JPEG: Image Preparation, Lossy Mode, Lossless Mode, Hierarchical Mode – H.261 – MPEG: Video Encoding, Audio Encoding, Data Stream, MPEG 3, MPEG 7, MPEG 21 – DVI – Audio Encoding.

Suggested Activities:

- Flipped classroom on different compression techniques.
- Practical - Adobe Premier Pro for digital video concepts.
- External learning - Adobe After Effects, Adobe Media Encoder, Adobe Audition.

Suggested Evaluation Methods:

- Demonstration on Adobe Packages.
- Assignment on compression techniques.
- Quizzes on video based visual effects.

UNIT III MULTIMEDIA ARCHITECTURES 9

User Interfaces – OS multimedia support – Multimedia Extensions – Hardware Support – Distributed multimedia applications – Real time protocols – Play back Architectures – Synchronization – Document and document architecture – Hypermedia concepts – Hypermedia design – Digital copyrights – Digital Library – Multimedia Archives.

Suggested Activities:

- Flipped classroom on concepts of Multimedia hardware architectures.
- External learning - Digital Repositories.

Suggested Evaluation Methods:

- Tutorials on OCR/OMR
- Quizzes on various multimedia storage

UNIT IV MULTIMEDIA OPERATING SYSTEM AND DATABASES 9

Real Time – Resource Management – Process Management – File systems – Interprocess communication and synchronization – Memory management – Device Management – Characteristics of MDBMS – Data Analysis – Data structures – Operations on data – Integration in a database model.

Suggested Activities:

- Flipped classroom on Multimedia Database and indexing structures.
- External learning - Data structures for storing multimedia data.

Suggested Evaluation Methods:

- Tutorials on memory and process management algorithms.
- Quizzes on deadlocks and synchronization.

UNIT V MULTIMEDIA COMMUNICATION &APPLICATIONS 9

Tele Services – Implementation of Conversational Services, Messaging Services, Retrieval Services, Tele Action Services, Tele Operation Services – Media Consumption – Media Entertainment – Virtual Reality – Interactive Audio – Interactive Video – Games.

Suggested Activities:

- Practical - Designing user interfaces and developing simple games.
- External learning - Mixed Reality.

Suggested Evaluation Methods:

- Demonstration of developed applications.
- Quizzes on virtual reality and augmented reality.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Handle the multimedia elements effectively.
2. Encode and decode the multimedia elements.
3. Understand the underlying multimedia computing architectures used for media development.
4. Develop effective strategies to deliver Quality-of-Experience in multimedia applications.
5. Design and implement algorithms and techniques related to multimedia objects.
6. Design and develop multimedia applications in various domains.

TEXTBOOKS:

1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia computing, communications, and applications”, Pearson India, 2009.
2. Ranjan Parekh, “Principles of Multimedia”, Second Edition, McGraw Hill Education, 2017.
3. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Systems”, Springer IE, 2004.

REFERENCES:

1. Tay Vaughan, “Multimedia: Making it Work”, McGraw – Hill Education, Ninth Edition, 2014.
2. Mark S Drew, Zee Nian Li, “Fundamentals of multimedia”, Prentice Hall, 2006.
3. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. “Baker Digital Compression for Multimedia: Principles and Standards”, Elsevier, 2006.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓							
CO2	✓	✓		✓	✓				✓			✓
CO3	✓	✓	✓					✓	✓	✓		✓
CO4	✓	✓	✓			✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓				✓	✓		✓
CO6	✓	✓	✓	✓	✓				✓	✓		✓

IT5010 FUNDAMENTALS DIGITAL SIGNAL PROCESSING LT P C
3 0 0 3

OBJECTIVES:

- To get an idea on designing analog and digital filters.
- To acquire knowledge related to Fourier transform and its applications.
- To learn the design of infinite and finite impulse response filters for filtering undesired signals.
- To understand signal processing concepts in systems having more than one sampling frequency.
- To design applications that involve signal and image processing.

UNIT I SIGNALS AND SYSTEMS 9

Basic Elements of DSP – Concepts of Frequency in Analog and Digital Signals – Sampling Theorem – Discrete – Time Signals, Systems – Analysis of Discrete Time LTI Systems – Z Transform – Inverse Z Transform – Convolution – Correlation.

Suggested Activities:

- In-class activity - Problems based on Z transform Circular and linear convolution.
- Testing of frequency transformation and convolution problems using Matlab.

Suggested Evaluation Methods:

- Tutorials on Z transform circular and linear convolution.
- Assignment problems Z transform.
- Quizzes on signals and systems.

UNIT II FREQUENCY TRANSFORMATIONS 9

Introduction to DFT – Properties of DFT – Circular Convolution – Filtering -Methods Based on DFT – FFT Algorithms – Decimation in Time Algorithms, Decimation in Frequency Algorithms – Use of FFT in Linear Filtering – DCT – Use and Application of DCT.

Suggested Activities:

- Tutorials on DFT, FFT problems.
- FFT computation in real world problems.
- DFT and FFT computation using a tool like Matlab.

Suggested Evaluation Methods:

- Tutorials on DFT and FFT.

- Assignments on FFT - DIT and DIF.
- Quizzes on frequency transformations.

UNIT III IIR FILTER DESIGN 9

Structures of IIR – Analog Filter Design – Discrete Time IIR Filter from Analog Filter – IIR Filter Design by Impulse Invariance, Bilinear Transformation, Approximation of Derivatives – (LPF, HPF, BPF, BRF) Filter Design using Frequency Translation.

Suggested Activities:

- Analog filter design using Butterworth and Chebyshev approximation.
- Filter implementation using Matlab.

Suggested Evaluation Methods:

- Tutorials on IIR filter structures and design.
- Assignments on LPF,HPF, BRF, BRF filter design,
- Quizzes on filter design.

UNIT IV FIR FILTER DESIGN 9

Structures of FIR – Linear Phase FIR Filter – Fourier Series – Filter Design using Windowing Techniques – Rectangular Window, Hamming Window, Hanning Window, Frequency Sampling Techniques – Finite Word Length Effects in Digital Filters: Errors, Limit Cycle, Noise Power Spectrum.

Suggested Activities:

- FIR filter design.
- Filter implementation using Matlab.
- Analysis on finite world length errors.

Suggested Evaluation Methods:

- Tutorials on FIR filter structures and design.
- Assignments on finite word length effects in digital filters.
- Quizzes on filter design.

UNIT V APPLICATIONS 9

Multirate Signal Processing: Decimation, Interpolation, Sampling Rate Conversion by a Rational Factor – Adaptive Filters: Introduction, Applications of Adaptive Filtering to Equalization, Echo Cancellation – Speech processing – Image processing – Case Study.

Suggested Activities:

- Signal processing activities using Matlab.

Suggested Evaluation Methods:

- Tutorials on multirate signal processing.
- Assignments on adaptive filters,
- Mini project using Matlab.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Analyze and apply appropriate frequency transformations for any class of signal.
2. Analyze and design filters for a given signal processing application.
3. Identify and compute the errors encountered in a digital signal processing systems.
4. Design applications that involve signal and image processing by adopting appropriate transformation and filtering techniques.
5. Justify and apply possible extensions to digital filters for a given application.

6. Design a signal processing system.

TEXT BOOK:

1. John G Proakis, Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Fourth Edition, Pearson Education, 2007.

REFERENCES:

1. A. V. Oppenheim, R. W. Schafer, J. R. Buck, “Discrete-Time Signal Processing”, Eighth Indian Reprint, Pearson, 2006.
2. I. C. Ifeachor, B.W. Jervis, “Digital Signal Processing - A Practical Approach”, Pearson Education, 2002.
3. M. H. Hayes, “Schaum's Outline of Theory And Problems of Digital Signal Processing “, Tata McGraw Hill, 1999.
4. Sanjit K. Mitra, “Digital Signal Processing: A Computer-Based Approach”, Fourth Edition, The McGraw-Hill Companies, Inc, 2013.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓				✓			✓
CO2	✓	✓	✓	✓	✓	✓	✓				✓	✓
CO3	✓	✓		✓	✓	✓						✓
CO4	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓			✓		✓	✓
Overall	✓	✓	✓	✓	✓	✓			✓		✓	✓

IT5011 MULTIMEDIA CODING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To enrich in the fundamentals of multimedia coding and standards.
- To acquire knowledge in text coding.
- To acquire knowledge behind the theory of image and video coding & decoding with standards.
- To learn principles of audio coding and standards.
- To get comprehensive learning in multimedia standard content description and formats.

UNIT I LOSSLESS AND LOSSYCODING 9

Components of Multimedia – Basics of Information Theory – Entropy – Lossless Compression – Text Compression – Run Length Coding – Variable Length Coding – Shannon Fano Coding – Huffman and Adaptive Huffman Coding – Dictionary Based Coding – Arithmetic Coding – Lossy Compression Algorithms – Rate Distortion Theory – Quantization – Transform Coding – Wavelet Based Coding.

Suggested Activities:

- Flipped classroom on text coding concepts.
- Practical – Implement basic text coding and decoding algorithm using Python program.

- Case study of WinZip, RAR.

Suggested Evaluation Methods:
- Estimate complexity and coding efficiency of a given algorithm.
- Numerical problem solving in coding theory.
- Quizzes on fundamentals of information theory, text based coding techniques etc.

UNIT II IMAGE PROCESSING AND CODING 9

Image Formation – CIE Chromaticity Diagram – Color Models: RGB, CMY, LMS, HSV, HSL – Color Balancing – Gamma Correction – Image Coding and Decoding Standards: JPEG, JPEG-2000, JPEG-LS, GIF, PNG, TIFF, EXIF, BMP.

Suggested Activities:
- Flipped classroom on different image coding techniques.
- Practical – EXIF format for given camera.
- Analyze effects of change in RGB components in a digital color image.
- Case study on Google's WebP image format.

Suggested Evaluation Methods:
- Program output of implementing effects quantization, color change etc.
- Assignment on image file formats.
- Quizzes on color models, color processing, image coding standards etc.

UNIT III VIDEO PROCESSING AND CODING 9

Video Color Transform: YUV, YIQ, YcbCr – Chroma Subsampling – Standard Digital Video Formats – CIF – QCIF – HDTV – UHDTV – Resolutions – 4K, 8K, 16K – Video Compression based on Motion Compensation – Search for Motion Vectors – H.261 – H.264 – Motion Compensation in MPEG – MPEG-1, MPEG-2, MPEG-4.

Suggested Activities:
- Flipped classroom on concepts of video coding standards.
- Calculation of file size in different resolution and standards.
- Complexity estimation of different motion vector search methods.
- Measurement of video quality using tools.
- Case study of Google's WebM video format.

Suggested Evaluation Methods:
- Program output of implementing effects quantization, chroma sub-sampling etc.
- Mini project processing of coded video.
- Quizzes on video formats, H.26x, MPEG-x standards etc.

UNIT IV AUDIO PROCESSING AND CODING 9

Digitization of Audio: PCM, ADPCM – Waveform Audio File Format – Synthetic Sounds – Musical Instrument Digital Interface – Vocoders – MPEG Audio – MP-3 – Advance Audio Coding – High-Efficiency Advanced Audio Coding – MPEG-4 – Home Theatre Systems.

Suggested Activities:
- Flipped classroom on audio coding standards.
- External learning – Dolby, DTS systems in cinema theatres.
- Case study of a multi-channel home theatre system.

Suggested Evaluation Methods:
- Numerical problems on digital audio.
- Real-time demos on surround sound.

- Quizzes on audio compression techniques, MPEG audio, home theatre systems etc.

UNIT V MULTIMEDIA CONTENT DESCRIPTION AND FRAMEWORK 9

Hypermedia Coding – Multimedia and Hypermedia Expert Group – Multimedia Content Description Interface – MPEG-7 – Multimedia Framework – MPEG-21 – High Efficiency Coding and Media Delivery in Heterogeneous Environments – MPEG-H – Dynamic Adaptive Streaming over HTTP – MPEG-DASH.

Suggested Activities:

- Practical – Designing, structure and user interface.
- Case study of media coding used by YouTube, Netflix etc.
- External learning – Media streaming for TV.

Suggested Evaluation Methods:

- Responsive web design using hypermedia.
- Demonstration of media streaming through internet.
- Quizzes on Hypermedia coding, MHEG, MPEG-7 & 21, MPEG-DASH etc.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Articulate the concepts and techniques used in multimedia basics and standard coding techniques.
2. Develop competence in implementing text coding.
3. Design and implement algorithms for image and video coding.
4. Choose and analyze suitable audio coding for a given multimedia application.
5. Design and develop multimedia projects with standard content formats and frameworks.

TEXTBOOK:

1. Mark S. Drew, Zee Nian Li, “Fundamentals of Multimedia”, Prentice Hall, 2014.

REFERENCES:

1. Ralf Steinmetz, Klara Nahrstedt, “Multimedia Computing, Communications, and Applications”, Innovative Technology Series, Prentice Hall, 1995.
2. Jerry D. Gibson, Toby Berger, Tom Lookabaugh, Dave Lindergh, Richard L. Baker “Digital Compression for Multimedia: Principles and Standards”, Elsevier, 2006.
3. Ranjan Parekh, “Principles of Multimedia”, McGraw Hill Education, Second Edition, 2017.
4. Fred Halsall, “Multimedia Communications: Applications, Networks, Protocols and Standards”, Pearson Education, 2002.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓					✓	✓	✓		✓
CO4	✓	✓	✓			✓	✓	✓	✓	✓		✓
CO5	✓	✓										
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5012 **PATTERN RECOGNITION** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide basic knowledge about the fundamentals of pattern recognition and its applications.
- To understand about unsupervised algorithms suitable for pattern classification.
- To familiarize with the feature selection algorithms and methods of implementing them in applications.
- To learn about the basis of algorithms used for training and testing the dataset.
- To learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern Recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network, Naive Bayesian Classifier.

Suggested Activities:

- Discussion on pattern recognition applications like image classification.
- Implementation of Bayesian belief network using MatLab.
- Implementing Naive Bayesian classifier using MatLab.

Suggested Evaluation Methods:

- Quizzes on pattern recognition applications like image classification.
- Programming assignments on various pattern classifier techniques.

UNIT II CLUSTERING 9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering – Density Based Clustering.

Suggested Activities:

- Implement hierarchical Clustering using MatLab.
- Implement EM Algorithm Using GMM using MatLab.

Suggested Evaluation Methods:

- Quizzes on various clustering techniques.
- Programming assignments on generating clusters for an unlabelled dataset.

UNIT III FEATURE EXTRACTION AND SELECTION 9

Entropy Minimization – Karhunen Loeve Transformation – Feature Selection Through Functions Approximation – Binary Feature Selection – K-NN.

Suggested Activities:

- Implementation of K-NN in MatLab.
- Implementation of decision tree in MatLab.

Suggested Evaluation Methods:

- Quizzes on feature selection methods.
- Programming assignments on KL transformation.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES 6

State Machines – Hidden Markov Models: Maximum Likelihood for the HMM, The Forward and Backward Algorithm, Sum-Product Algorithm for the HMM, Scaling Factors, The Viterbi Algorithm, Extensions Of The Hidden Markov Model – Support Vector Machines: Maximum Margin Classifiers, Relevance Vector Machines.

Suggested Activities:

- Implement HMM algorithm in MatLab.
- Implement SVM classifier in MatLab.

Suggested Evaluation Methods:

- Quizzes on working principle of HMM.
- Programming assignments on SVM.

UNIT V RECENT ADVANCES 12

Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network For Pattern Recognition, Hebbnet, Perceptron, ADALINE, Back Propagation.

Suggested Activities:

- Develop a supervised model to train neural net that uses the AND/OR/XOR gate functions.
- Create and view custom neural networks using MatLab.

Suggested Evaluation Methods:

- Quizzes on basic fuzzy and neural logic.
- Programming assignments on fuzzy classification methods.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement basic pattern classifier algorithms.
2. Have knowledge about the working principle of unsupervised algorithms.
3. Have knowledge about functionality of classifiers.
4. Perceive the recent advancement in pattern recognition.
5. Apply SVM and HMM algorithms for real time applications.
6. Implement advanced methodologies over image processing applications.

TEXT BOOK:

1. Andrew Webb, “Statistical Pattern Recognition”, Arnold publishers, London, 1999.

REFERENCES:

1. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
2. R. O. Duda, P. E. Hart, D. G. Stork, “Pattern Classification”, John Wiley, 2001.
3. M. Narasimha Murthy, V. Susheela Devi, “Pattern Recognition”, Springer 2011.
4. Menahem Friedman, Abraham Kandel, “Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches”, World Scientific publishing Co. Ltd, 2000.
5. Robert J. Schalkoff, “Pattern Recognition Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc., 1992.
6. S. Theodoridis, K. Koutroumbas, “Pattern Recognition”, Fourth Edition, Academic Press, 2009.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓	✓		
CO2	✓	✓				✓	✓	✓				✓
CO3	✓	✓						✓				✓
CO4	✓	✓				✓	✓	✓				✓
CO5	✓	✓	✓	✓	✓	✓	✓					
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5013 VISUALIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of data visualization.
- To know the working principles of various information visualization tools.
- To acquire knowledge about the issues in data representation.
- To visualize the complex engineering design.
- To gain skill in designing real time interactive Information visualization system.

UNIT I INTRODUCTION 9

Introduction – Visualization Stages – Computational Support – Issues – Different Types of Tasks – Data representation – Limitation: Display Space– Rendering Time – Navigation Links**.**

Suggested Activities:

- Blended Learning – Displaying Different types visualization images.
- Flipped classroom on the task of representing information.
- External learning – Practical problems related to acquiring data.
- Practical – Representing various varieties of data.

Suggested Evaluation Methods:

- Tutorials on different data visualizing images.
- Assignment on different data acquiring methods.
- Quizzes on various issues and solutions in different visualization applications.
- Demonstration – Techniques used for data representation.

UNIT II DATA REPRESENTATION 9

Human Factors – Foundation for a Science of Data Visualization – Optics – Optimal Display – Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out – Types of Data – Data Complexity – Encoding of Values – Encoding of Relation – Relation and Connection – Alternative Canvasses.

Suggested Activities:

- Blended Learning – Human visual and auditory system.
- Flipped classroom on color formats.
- Practical – Implementation of the interactive forms.

- External learning – Survey on different human computer interaction and types of user interface.

Suggested Evaluation Methods:

- Assignment on human visual and auditory system.
- Quizzes on color format.
- Assessment on design and creativity.
- Assignment on various human computer interaction user interface.

UNIT III DATA PRESENTATION 9

Human Vision – Space Limitation – Time Limitations – Design – Exploration of Complex Information Space – Figure Caption in Visual Interface – Visual Objects and Data Objects – Space Perception and Data in Space – Images, Narrative and Gestures for Explanation.

Suggested Activities:

- Blended learning – Drawing charts for display.
- Flipped classroom on various presentation techniques.
- External learning – Different font and font styles, symbols and gesture representation.
- Practical – Implementation of these presentations through interfaces in computers.

Suggested Evaluation Methods:

- Assignment on chart preparation
- Tutorials on various presentation techniques.
- Assignment on gesture presentation.
- Demonstration – Designed interface layout.

UNIT IV INTERACTION 9

Norman's Action Cycle – Interacting with Visualization – Interaction for Information Visualization – Interaction for Navigation – Interaction with Models – Interacting with Visualization – Interactive 3D Illustrations with Images and Text.

Suggested Activities:

- Flipped classroom on various interacting Techniques.
- Practical – Implementations of interactive interfaces.
- External learning – Interaction facilities and high level support for animation design.

Suggested Evaluation Methods:

- Tutorials on interaction models.
- Demonstration based on interactivity.
- Assignment on animation design.

UNIT V CURRENT TRENDS 9

Design – Virtual Reality: Interactive Medical Application – Tactile Maps for visually challenged People – Animation Design for Simulation – Integrating Spatial and Nonspatial Data – Innovating the Interaction.

Suggested Activities:

- Flipped classroom on implementation of virtual reality environment.
- Mini project for designing and implementing innovative interfaces.

Suggested Evaluation Methods:

- Demonstration – Mini Project.
- Tutorials on virtual reality application.

TOTAL: 45 PERIODS

OUTOMES:

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

1. Apply mathematics and basic science knowledge for designing information visualizing system.
2. Collect data ethically and solve engineering problem in visualising the information.
3. Implement algorithms and techniques for interactive information visualization.
4. Conduct experiments by applying various modern visualization tool and solve the space layout problem.
5. Analyze and design systems to visualize multidisciplinary multivariate Data individually or in teams.
6. Develop a cost effective and a scalable information visualization system.

TEXT BOOKS:

1. Colin Ware, “Information Visualization Perception for Design”, Third Edition, Morgan Kaufmann Publishers, 2012.
2. Robert Spence, “Information Visualization An Introduction”, Third Edition, Pearson Education, 2014.

REFERENCES

1. Benjamin B. Bederson, Ben Shneiderman, “The Craft of Information Visualization” Morgan Kaufmann Publishers, 2003.
2. Thomas Strothotte, “Computational Visualization: Graphics, Abstraction and Interactivity”, Springer, 1998.
3. Matthew O. Ward, George Grinstein, Daniel Keim, “Interactive Data Visualization: Foundation, Techniques and Applications”, Second Edition, A. K. Peters/ CRC Press, 2015.
4. Robert Spence, “Information Visualization Design for Interaction”, Second Edition, Pearson Education, 2006.
5. Joerg Osarek, “Virtual Reality Analytics”, Gordon’s Arcade, 2016.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									
CO2		✓		✓								
CO3	✓	✓										
CO4				✓	✓	✓						
CO5												
CO6							✓		✓	✓	✓	✓

IT5014 **C# AND .NET PROGRAMMING** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the technologies of the .NET framework.

- To cover all segments of programming in C# starting from the language basics, followed by the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To introduce advanced topics namely data connectivity, WPF, WCF 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- Assemblies – Shared Assemblies – CLR Hosting – Appdomains.

Suggested Activities:

- Installation of .Net framework and experimenting simple C# programs using IDE.
- Flipped Classroom on CLR internals.
- Creation of shared assemblies.

Suggested Evaluation Methods:

- Quiz on CLR internals.
- Tutorials on C# programming fundamentals.

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.

Suggested Activities:

- Implementing delegates and handling events.
- Practical – Generic collections, memory management and exception handling.

Suggested Evaluation Methods:

- Demonstration of implemented programs.
- Tutorial case studies on advanced C# features.

UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9

Diagnostics Tasks – Threads and Synchronization – Manipulating XML – SAX and DOM – Manipulating files and the Registry – Transactions – Data access with ADO.NET: Introduction, LINQ to Entities and the ADO.NET Entity Framework, Querying a Database with LINQ – Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project – Data Bindings Between Controls and the Entity Data Model – Dynamically Binding Query Results.

Suggested Activities:

- Implementation of Threads and Synchronization based application.
- Practical – Programs on XML and operations using parsers.
- Application development with ADO.NET.

Suggested Evaluation Methods:

- Tutorials on SAX and DOM parsers.
- Presentation of ADO.NET based application.

UNIT IV WINDOW AND WEB BASED APPLICATIONS 9

Window Based Applications – Core ASP.NET – ASP.NET Web Forms – Server Controls, Data Binding – ASP.NET State Management, Tracing, Caching, Error Handling, Security, Deployment, User and Custom Controls – Windows Communication Foundation (WCF) – Introduction to Web Services.

Suggested Activities:

- Practical – Programs using ASP.NET and State management controls.
- Flipped classroom on web services with .NET.
- Tutorials on WCF framework.

Suggested Evaluation Methods:

- Quizzes on different topics of ASP .NET.
- Demonstration of the implemented programs on ASP.NET web services.

UNIT V .NET COMPACT FRAMEWORK 9

Reflection – .Net Remoting-.Net Security – Localization – Peer-to-Peer Networking – Building P2P Applications – .Net Compact Framework – Compact Edition DataStores – Testing and Debugging – Optimizing performance – Packaging and Deployment.

Suggested Activities:

- Demonstration of programs using .Net Remoting and .net Security APIs.
- Demonstration of programs using .Net compact framework.

Suggested Evaluation Methods:

- Presentation of .NET compact framework application.
- Evaluation of programs using .Net remoting and .Net security APIs.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the difference between .NET and Java framework.
- Work with the basic and advanced features of C# language.
- Create applications using various data providers.
- Create web applications using ASP.NET
- Create mobile applications using .NET compact framework.
- Integrate all the features of C# language and build complex web applications in .NET framework.

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, “Professional C# and .NET 4.5”, Wiley, 2012.
2. Andrew Troelsen, “Pro C# 5.0 and the .NET 4.5 Framework”, Apress publication, 2012.

REFERENCES:

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, “Programming C# 4.0”, Sixth Edition, O’Reilly, 2010.
2. Andy Wigley, Daniel Moth, Peter Foot, “Mobile Development Handbook”, Microsoft Press, 2011.
3. Herbert Schildt, “C# The Complete Reference”, Tata McGraw Hill, 2004.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓						
CO2				✓		✓						
CO3		✓		✓		✓		✓	✓			
CO4				✓		✓	✓	✓	✓		✓	✓
CO5				✓	✓	✓	✓	✓	✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5015 SOFTWARE TESTING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basics and necessity of software testing.
- To provide various testing techniques along with concepts of software bugs and its impact.
- To develop and validate a test plan.
- To build a testing team required.
- To understand the need for and challenges in test automation and to develop testing scripts.

UNIT I TESTING PRINCIPLES AND AXIOMS 9

Testing as a Process – Testing Axioms –Software Testing Principles – Origins and Cost of Defects – Defect Classes and Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention Strategies.

Suggested Activities:

- Flipped classroom on testing axioms.
- Identify and analyze syntax error, semantic error, bug and defect for programs.

Suggested Evaluation Methods:

- Quiz and discussion on testing axioms.
- Identifying fallacies in requirements specification.
- Identify the various types of errors, bugs and defects for a case study.

UNIT II BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY 9

Test Case Design Strategies – Black Box Approach – Boundary Value Analysis – Equivalence Class Partitioning – State-Based Testing – User Documentation Testing – White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Cyclomatic Complexity – Test Adequacy Criteria.

Suggested Activities:

- Flipped classroom on test adequacy criteria.
- External learning – Exploring white box testing tools like veracode, eclemma, rcunit, cppunit, Junit, JSUnitetc.
- Analyzing the cyclomatic complexity of code segments.

Suggested Evaluation Methods:

- Quiz and discussion on cyclomatic complexity.
- Assignments on white box testing tools like Selenium, Appium, Robotium and carrying out simple BBT and WBT using tools.
- Solving problems related to cyclomatic complexity.

UNIT III LEVELS OF TESTING 9

Unit Test – Planning – Designing the Unit Test Process – Running the Unit Tests and Recording Results – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – Ad-Hoc Testing – Alpha, Beta Tests.

Suggested Activities:

- External learning – Exploring the integration testing tools for various programming languages – VectorCAST/C++, CITRUS (Java), FitNesse (open source), Rational test integration tester, Protractor (Angular, Angular JS), Jasmine (JavaScript), Spock (Java) and the regression testing tools – Sahi Pro, Watir, IBM Rational Regression Tester, TestDrive etc.
- Flipped classroom on alpha and beta testing.
- Analyzing various levels of testing required for a software product.

Suggested Evaluation Methods:

- Assignments on integration testing tools and regression testing tools.
- Quiz and discussion on alpha and beta testing.
- Identifying and performing various levels of testing for a case study.

UNIT IV TEST MANAGEMENT 9

Organization Structures For Testing Teams – Testing Services – Test Planning Attachments – Locating Test Items – Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group.

Suggested Activities:

- Flipped classroom on reporting test results.
- External learning – Exploring the organization structures and organizational behaviour in the context of software testing.
- Analyzing how to build testing groups for various types of projects and organizations.

Evaluation Methods:

- Quiz and discussion on reporting test results.
- Finding out the organization structure and organizational behaviour for given case studies.
- Building test groups for given case studies.

UNIT V TEST AUTOMATION 9

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics – Maintenance of Documents During Testing.

Suggested Activities:

- Flipped classroom on Test metrics and measurements.
- External learning – Exploring the risks involved in automated testing and exploring the ways to improve your testing skills apart from using testing tools.

- Practical – Install and learn popular software testing tools like Selenium, WinRunner, LoadRunner, Performance Tester etc.
- Learning to write test scripts.

Suggested Evaluation Methods:

- Quiz and discussion on test metrics and measurements.
- Assignments on evaluating the risks involved in automated testing for given case studies.
- Assignments on writing test scripts to carry out various types of testing in test automation tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Obtain an insight to software testing.
- Apply both black box testing and white box testing.
- Understand and apply multiple levels of testing.
- Understand the role of a tester as an individual and as a team member.
- Apply software testing for large projects using automated testing tools.
- Maintain documentation on testing.

TEXT BOOKS:

1. Paul C. Jorgensen, “Software Testing: A Craftsman’s Approach”, Fourth Edition, CRC Press, 2013.
2. Dorothy Graham, Mark Fewster, “Experiences of Test Automation: Case Studies of Software Test Automation”, Pearson Education, 2012.

REFERENCES:

1. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, Third Edition, John Wiley & Sons, 2012.
2. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2009.
3. Boris Beizer, “Software Testing Techniques”, Dream Tech Press, 2009.
4. Mauro Pezze, Michal Young, “Software Testing and Analysis Process Principles and Techniques”, Wiley India, 2008.
5. Ali Mili, Fairouz Chier, “Software Testing: Concepts and Operations”, Wiley, 2015.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓								✓			✓
CO2	✓	✓		✓					✓			
CO3	✓	✓	✓	✓	✓				✓			
CO4		✓	✓	✓	✓				✓	✓		
CO5	✓	✓	✓	✓	✓				✓	✓	✓	✓

IT5016 **E-LEARNING TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the various E-learning approaches and Components.
- To explore Design Thinking.
- To understand the types of design models of E-learning.
- To learn about E-learning Authoring tools.
- To know about evaluation and management of E-learning solutions.

UNIT I INTRODUCTION **9**

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

Suggested Activities:

- External learning - E-learning approaches and components.
- Discussion on design thinking.

Suggested Evaluation Methods:

- Assignment on E-learning approaches and components.
- Quizzes on design thinking.

UNIT II DESIGNING E-LEARNING COURSE CONTENT **9**

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

Suggested Activities:

- Discussion on design models.
- External learning - E-Learning instructional methods.

Suggested Evaluation Methods:

- Assignment on design models of E-learning.
- Quiz on E-learning instructional methods.

UNIT III CREATING INTERACTIVE CONTENT **9**

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources– Courseware Development – Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

Suggested Activities:

- Discussion on creation of story boards.
- Discussion on courseware creation.
- External learning - Types of authoring tools.

Suggested Evaluation Methods:

- Demonstration of story boards creation with Moodle.
- Demonstration of creation of a complete courseware with Moodle.

- Quiz on authoring tools.

UNIT IV LEARNING PLATFORMS 9

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

Suggested Activities:

- Discussion on LMS categories for E-learning.
- External learning - Functional areas of E-learning.

Suggested Evaluation Methods:

- Assignment on proprietary and open source LMS.
- Quiz on LMS solutions.

UNIT V COURSE DELIVERY AND EVALUATION 9

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

Suggested Activities:

- Discussion on planning and documentation.
- External learning - Evaluation and delivery methods.

Suggested Evaluation Methods:

- Assignment on planning and documentation.
- Quiz on evaluation and delivery methods.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Distinguish the phases of activities in models of E-learning.
2. Identify appropriate instructional methods and delivery strategies.
3. Choose appropriate E-learning Authoring tools.
4. Create interactive E-learning courseware.
5. Evaluate the E-learning courseware.
6. Manage the E-learning courseware.

TEXT BOOK:

1. Clark, R. C., Mayer, R. E., “E-Learning and the Science of Instruction”. Third Edition, 2011.

REFERENCE BOOKS:

1. Crews, T. B., Sheth, S. N., Horne, T. M., “Understanding the Learning Personalities of Successful Online Students”, Educause Review, 2014.
2. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
3. Madhuri Dubey, “Effective E–learning Design, Development and Delivery”, University Press, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓	✓			✓	✓		✓
CO2	✓	✓		✓		✓	✓		✓	✓	✓	✓

CO3	✓				✓	✓			✓	✓	✓	✓
CO4	✓		✓		✓	✓			✓	✓	✓	✓
CO5	✓	✓	✓			✓	✓		✓	✓		✓
CO6	✓				✓	✓			✓	✓	✓	✓
Over all	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓

IT5017 INFRASTRUCTURE MANAGEMENT L T P C
3 0 0 3

OBJECTVE:

- To know the basics of IT Infrastructure.
- To study the basics of data centre and its performance metrics.
- To study the basics of compute and storage services provided in cloud.
- To learn the basics of cloud platforms and technologies.
- To study the Security issues associated with cloud infrastructure.

UNIT I INTRODUCTION TO INFRASTRUCTURE 9

Introduction to IT Building Blocks – Infrastructure – Nonfunctional Attributes – Calculating Availability – Availability Percentages and Intervals – Mean Time Between Failures (MTBR) – Mean Time to Repair (MTTR) – Sources of Unavailability – Availability Patters – Introduction to Performance – Performance During Infrastructure Design – Performance of a Running System – Performance Patterns.

Suggested Activities:

- Identifying IT building blocks for various applications development.
- Flipped classroom on IT projects failure articles or white papers.
- Study of performance metrics for IT infrastructure.

Suggested Evaluation Methods:

- Presentation on IT building blocks.
- Quizzes on IT project articles white papers.
- Tutorials on IT infrastructure performance measure.

UNIT II DATA CENTERS 9

Introduction – Datacenter Building Blocks – Datacenter Categories – Location of the Datacenter – Physical Structure – Power Supply – Cooling – Fire Prevention, Detection, And Suppression – Equipment Racks – Datacenter Cabling and Patching – Datacenter Energy Efficiency – Datacenter Availability – Availability Tiers – Redundant Datacenters – Datacenter Performance – Datacenter Security.

Suggested Activities:

- Collection of major data center facilities across the world and their features.
- Discussion on technical details related to data center building.

Suggested Evaluation Methods:

- Presentation on major data center facilities.
- Quizzes on data centre performance and security.

UNIT III COMPUTE & STORAGE 9

Introduction – Compute Building Blocks – Memory – Interfaces – Compute Virtualization – Container Technology – Mainframes – Midrange Systems – X86 Servers – Supercomputers – Compute Availability – Compute Performance – Compute Security – Popular Operating Systems – Operating System Availability – Operating System Performance – Operating System Security – Storage Building Blocks – DAS – NAS – SAN – Software Defined Storage – Storage Availability – Storage Performance – Storage Security.

Suggested Activities:

- Discussion on compute and storage building blocks
- Flipped classroom on technical details of DAS, NAS and SAN.

Suggested Evaluation Methods:

- Quizzes on virtualization and compute performance.
- Presentation on technical details of DAS, NAS and SAN.

UNIT IV INFRASTRUCTURE DEPLOYMENTS 9

Introduction – Hosting Options – Enterprise Infrastructure Deployment – Converged Infrastructure – Cloud Computing At A Glance – Cloud Computing Platforms And Technologies – Cloud Reference Model – Types of Cloud – Economics of Cloud – Open Challenges – Cloud Platforms in Industry – Amazon Web Service – Google AppEngine – Microsoft Azure.

Suggested Activities:

- Study on web application hosting in cloud platform.
- Creating and deploying applications in AWS/Google AppEngine/Microsoft Azure.

Suggested Evaluation Methods:

- Quizzes on web application hosting in cloud.
- Demonstration of deployed cloud application.

UNIT V INFRASTRUCTURE SECURITY 9

Introduction – Risk Management – Risk Response – Exploits – Security Controls – Attack Vectors – Identity and Access Management – Segregation of Duties and Least Privilege – Layered Security – Cryptography – Monitoring – Vulnerability Patching – Go Live Process/Checklist – Decommissioning a Service/Device.

Suggested Activities:

- Study of risks associated with Infrastructure.
- Deployment of application with secured features.

Suggested Evaluation Methods:

- Quizzes on Infrastructure risks.
- Demonstration of security features in the deployed cloud application.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the fundamentals of IT Infrastructure.
2. Know the data centre infrastructure and its associated performance metrics.
3. Have knowledge on infrastructure services (IaaS) provided by different vendors.
4. Be familiar with various Cloud platforms and associated technologies.
5. Understand various security issues associated with data centers and cloud applications.

6. Apply the infrastructure concepts to analyze, design, build, maintain and optimize IT operations.

TEXT BOOKS:

1. SJaak Laan, "IT Infrastructure Architecture – Infrastructure Building Blocks and Concepts", Third Edition, Lulu Press Inc, 2017.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Prentice Hall, 2013.

REFERENCES:

1. IBM, "Introduction to Storage Area Networks and System Networking", Redbooks. 2012, https://www.redbooks.ibm.com/Redbooks.nsf/domains/san?Open&start=46.
2. Ray J. Rafael, "Cloud Computing: From Beginning to End", Second Edition, Wiley, 2018.
3. Matthew Portnoy, "Virtualization Essentials", John Wiley, 2012.
4. Lee Brotherson, Amanda Berlin, "Defensive Security Handbook: Best Practices for securing Infrastructure", O'Reilly, 2017.
5. Microsoft, "Microsoft High Availability Overview", White Paper, 2008.
6. Microsoft, "Overview of Failover Clustering with Windows Server 2008", White Paper, 2007.
7. VMware, "Understanding Full Virtualization, Para-virtualization, and Hardware Assist", White paper, 2007.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓							✓	✓		
CO2	✓	✓						✓				✓
CO3	✓	✓						✓				✓
CO4	✓	✓						✓				✓
CO5	✓	✓	✓									
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5018 QUANTUM COMPUTING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I FUNDAMENTAL CONCEPTS 9

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information.

Suggested Activities:

- Flipped classroom on quantum algorithms, information processing.
- Tutorials on applications of algorithms.

Suggested Evaluation Methods:

- Quiz on quantum bits.
- Problem solving assignment on quantum computation.
- Programming assignment on quantum algorithms.

UNIT II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS 9

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications – EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

Suggested Activities:

- Flipped classroom on postulates, computational models.
- Computational analysis of common problems like Travelling Salesman.

Suggested Evaluation Methods:

- Quiz on postulates and computational models.
- Problem solving assignment on application of quantum mechanics.
- Programming assignment on Turing machines.

UNIT III QUANTUM COMPUTATION 9

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers

Suggested Activities:

- Flipped classroom on simulation, Fourier transform.
- Simulation Exercises.
- Tutorials on quantum search algorithms.

Suggested Evaluation Methods:

- Quiz on the quantum algorithm and quantum circuits.
- Problem solving assignment on text book exercise questions.
- Programming assignment on search algorithms.

UNIT IV QUANTUM INFORMATION 9

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy

Suggested Activities:

- Flipped classroom on quantum operations.
- Tutorials on examples and application of quantum operations.

Suggested Evaluation Methods:

- Quiz on quantum operations.
- Problem solving assignment on applications of quantum operations.

UNIT V QUANTUM INFORMATION THEORY 9

Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography.

Suggested Activities:

- Flipped classroom on data compression, noisy quantum channels.
- Extra reading and discussion from reference books.

Suggested Evaluation Methods:

- Quiz on data compression and noisy quantum channels..
- Problem solving assignment on text book exercise questions.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basics of quantum computing.
2. Understand the background of Quantum Mechanics.
3. Analyse the computation models.
4. Model the circuits using quantum computation.
5. Understand the quantum operations such as noise and error–correction.
6. Appreciate the need of quantum computing.

TEXT BOOK:

1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.

REFERENCES:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓										
CO3	✓	✓							✓	✓		✓
CO4	✓	✓	✓	✓	✓				✓	✓		✓
CO5	✓	✓	✓			✓	✓	✓				
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5019 **SOFT COMPUTING** **L T P C**
3 0 0 3

OBJECTIVES:

- To give students knowledge of soft computing theories and fundamentals.
- To design a soft computing system required to address a computational task and use heuristics based on human experience.
- To understand fuzzy sets and fuzzy logic for problem solving.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

UNIT I FUZZY COMPUTING 9

Basic Concepts of Fuzzy Logic – Fuzzy Sets and Crisp Sets – Fuzzy Set Theory and Operations – Properties of Fuzzy Sets – Fuzzy and Crisp Relations – Fuzzy to Crisp Conversion – Membership Functions – Interference in Fuzzy Logic – Fuzzy If-Then Rules, Fuzzy-Implications and Fuzzy Algorithms – Fuzzifications and Defuzzificataions – Fuzzy Controller – Industrial Applications.

Suggested Activities:

- Install MatLab Fuzzy Logic Toolbox and ANN toolbox to design and simulate systems.

Suggested Evaluation Methods:

- Quizzes on basic concepts of fuzzy logic and operations.

UNIT II FUNDAMENTALS OF NEURAL NETWORKS 9

Neuron, Nerve Structure and Synapse – Artificial Neuron and its Model – Activation Functions – Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks – Various Learning Techniques: Perception and Convergence Rule, Auto-Associative and Hetero-Associative Memory.

Suggested Activities:

- Practical – Develop a supervised model to train neural net that uses the AND/OR/XOR two input binary/bipolar input and output data and learn linear models to understand the importance of initialization parameters.

Suggested Evaluation Methods:

- Implementation evaluation with appropriate input set.

UNIT III BACK PROPAGATION NETWORKS 9

Back Propagation Networks Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model – Back Propagation Learning Methods – Effect of Learning Rule Co-Efficient – Factors Affecting Back Propagation Training – Applications.

Suggested Activities:

- Train neural net that uses the XOR three input binary/bipolar input and output data and learn linear models to understand the importance of learning parameters.
- Train a linear / non linear model with one hidden layer, two hidden layers.
- Observe the performance with different learning rates and draw the graph depicting the error rate with iterations.

Suggested Evaluation Methods:

- Implementation evaluation with new input set.

UNIT IV COMPETETIVE NEURAL NETWORKS 9

Kohenen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization, Learning by LVQ – Adaptive Resonance Theory – Learning procedure – Applications.

Suggested Activities:

- Train a neural net that uses any dataset and plot the cluster of patterns.

Suggested Evaluation Methods:

- Implementation evaluation with new input set.

UNIT V GENETIC ALGORITHM 9

Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA – Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Mutation, Generational Cycle – Applications.

Suggested Activities:

- Implement GA for the Travelling Salesman problem to find the shortest path that visits all cities in a set exactly once.

Suggested Evaluation Methods:

- Implementation evaluations by testing the code on different route maps and checking the optimal solution.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to optimization problems.
5. Design neural networks for pattern classification and regression problems.
6. Compare different neural network approaches.

TEXTBOOKS:

1. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India, 2010.
2. J.S.R. Jang, C.T. Sun, E. Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education, 2004.

REFERENCES:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, Wiley-India, 2007.
2. Siman Haykin, "Neural Networks", Prentice Hall of India, 1999.
3. Timothy Ross, "Fuzzy Logic with Engineering Applications", Wiley Publications, 2016.
4. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 2008.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓		✓	✓				✓	✓		
CO3	✓	✓	✓		✓				✓			
CO4	✓	✓	✓	✓	✓				✓	✓		✓
CO5	✓	✓	✓		✓				✓		✓	✓
CO6	✓	✓		✓	✓					✓		

IT5020 SOCIAL NETWORK ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To gain knowledge about the empirical and theoretical study of social networks, its structure and social network data sources.
- To study about the semantic technologies for social network analysis.
- To gain knowledge on visualization of social networks and its applications.
- To gain knowledge about social network analysis software for characterizing the network structure.
- To engage in critical thinking regarding the applicability of social network theory to various sociological phenomena.

UNIT I INTRODUCTION 9

Social Network Analysis: Definition and Features – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Ties, Density, Path, Length, Distance, Betweenness, Centrality, Clique – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities, Web-based Networks – Applications of Social Network Analysis.

Suggested Activities:

- Practical – Study of existing social networks and calculate the social network related metrics.
- Flipped classroom on fundamental mathematical knowledge on graphs and tutorial activity.
- External learning – Problems on calculation of ties, density, path, length, distance, betweenness, centrality, clique.

Suggested Evaluation Methods:

- Demonstration of social network creation and calculating the related metrics.
- Tutorial on graphs and its related terminologies.
- Assignments on calculation of ties, density, path, length, distance, betweenness, centrality, clique.

UNIT II SOCIAL NETWORK ANALYSIS 9

Introduction to Social Networks Profiles – Types of Commercial Social Network Profiles (CSNP) – Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – Case Study.

Suggested Activities:

- Practical – Analysis of social network dataset.
- Flipped classroom on emerging applications of data mining based social network analysis techniques.
- External learning – Case study related to SNA.

Suggested Evaluation Methods:

- Demonstration of the analysis of social network log dataset.
- Tutorials on data mining applications.
- Assignments on data mining on SNA.

UNIT III SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS 9

Introduction to Ontology based Knowledge Representation – Ontology Languages for the Semantic Web – RDF and OWL – Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations.

Suggested Activities:

- Practical – Use of the features available in various ontology tools like Protégé.
- Flipped classroom on basic concepts of semantic web and ontology.
- External learning – Knowledge on semantic technology.

Suggested Evaluation Methods:

- Demonstration of created ontology.
- Tutorials on semantic web related terminologies.
- Quizzes on semantic technology for SNA.

UNIT IV SOCIAL NETWORK MINING 9

Detecting and Discovering Communities in Social Network: Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms –Ethical Practices in Social Network Mining – Understanding and Predicting Human Behavior for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities – Inferential Methods in Social Network Analysis.

Suggested Activities:

- Practical – Detection and mining of communities using various tools.
- Flipped classroom on basic concepts of online social networks (OSNs) and social network mining algorithms.
- External learning – Practical problems related to evaluation of community metrics.

Suggested Evaluation Methods:

- Demonstration – Community creation and mining.
- Tutorials on Social Network Mining.
- Assignments on community detection methods.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Visualization of Social Networks Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations –Matrix and Node-Link Diagrams – Hybrid Representations – Visualizing Online Social Networks – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks – Data Privacy in Social Networks

Suggested Activities:

- Practical – Knowledge about tools related to social networks and implementation of social network visualizations using tools such as Gephi, Cytoscape.
- Flipped classroom on applications of social networks.
- External learning – How visualization is used in various real time SN applications.

Suggested Evaluation Methods:

- Demonstration of visual social networks
- Tutorials on applications of social networks.
- Quizzes on types of visualizations for social networks
- Group discussion on privacy and security of Aadhar.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand basic principles behind network analysis algorithms and develop practical skills of network analysis.
2. Model and represent knowledge for social semantic Web.
3. Apply data mining techniques on social networks.
4. Use extraction and mining tools for analyzing Social networks.
5. Develop secure social network applications.
6. Develop personalized visualization for Social networks.

TEXT BOOKS:

1. Peter Mika, “Social Networks and the Semantic Web”, Springer, 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 2010.
3. Song Yang, Franziska B. Keller, Lu Zheng, “Social Network Analysis: Methods and Examples”, Sage Publication, 2016.

REFERENCES:

1. GuandongXu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking Techniques and Applications”, Springer, 2011.
2. Max Chevalier, Christine Julien, Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling”, IGI Global, 2009.
3. John G. Breslin, Alexandre Passant, Stefan Decker, “The Social Semantic Web”, Springer, 2009.
4. John Scott, Peter J. Carrington, “The SAGE Handbook of Social Network Analysis”, Sage Publication, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓	✓	✓								

CO3				✓	✓	✓						
CO4					✓	✓	✓					
CO5							✓	✓				
CO6						✓			✓			
Overall	✓	✓	✓	✓	✓	✓	✓	✓	✓			

IT5021 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 ontology management.
- To learn the applications related to semantic web.

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.

Suggested Activities:

- Flipped classroom on semantic web background and tutorial activity.
- Brainstorming session – Various knowledge representation formats.
- Practical – Design of simple ontology on their domain of interest using tools like Protégé.
- Practical – Installing EasyRdf in the system and including this in PHP (EasyRdf is a PHP library, which can be used to consume and produce RDF).

Suggested Evaluation Methods:

- Tutorials on semantic web basics.
- Quizzes on knowledge representation formats
- Demonstration of simple implemented ontology.

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.

Suggested Activities:

- Flipped classroom on comparison of various semantic web related languages and tutorial.

- Practical – Creation of RDF documents.
- Practical – Use of OWL language to represent relationships, properties and to provide inferences from created ontology.

Suggested Evaluation Methods:

- Quizzes on various ontology related languages
- Demonstration of knowledge inference from created ontologies.

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 – Methods for Evaluating Ontologies.

Suggested Activities:

- Flipped classroom on natural language processing techniques like statistical text analysis, term extraction, word sense disambiguation, concept extraction and tutorial activity.
- Practical – Term extraction and term disambiguation from corpus using Alchemy like API.
- Extended Reading from the site – https://nlp.stanford.edu/fsnlp/.

Suggested Evaluation Methods:

- Tutorials on language processing techniques.
- Demonstration on term extraction and term disambiguation.

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.

Suggested Activities:

- Flipped classroom on study of various ontology related tools.
- Practical – Use of any tool to apply SPARQL queries and implement reasoning for avoiding inconsistencies
- Practical – Merging two ontologies, applying association rules, applying clustering algorithms

Suggested Evaluation Methods:

- Tutorials on ontology related tools like Protege, Ontolingua, Webonto.
- Demonstration of clustering, merging ontologies and Sparql queries.

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 – Rule Interchange Format.

Suggested Activities:

- Flipped classroom on other applications of semantic web.
- Practical – Simple application like chat bot, semantic search engine creation using topic map data models extracted from Ontopia/Mappa.
- Practical – Creating intelligent expert systems using semantic Wikis like SMW+.

Suggested Evaluation Methods:

- Quizzes on semantic web applications
- Demonstration of applications created using tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Create ontology for a given domain.
2. Develop an application using ontology languages and tools.
3. Understand the concepts of semantic web.
4. Use ontology related tools and technologies for application creation.
5. Design and develop applications using semantic web.
6. Understand the standards related to semantic web.

TEXT BOOKS:

1. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.
2. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with Examples from the Areas of Knowledge Management, E-Commerce and the Semantic Web", Springer, 2004.

REFERENCES:

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004.
2. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.
3. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology –Driven Knowledge Management", John Wiley, 2003.
4. John Davies, Rudi Studer, Paul Warren, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley, 2006.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓									
CO2	✓	✓	✓	✓	✓							
CO3	✓											
CO4		✓	✓	✓	✓							
CO5			✓	✓	✓				✓			
CO6								✓				

IT5022 INFORMATION RETRIEVAL L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of Information Retrieval and its various models.
- To learn about the preprocessing techniques and query languages used in IR system.
- To understand the performance metrics of IR System.

- To learn the usage and design of Web Search Engines.
- To study the basics of recommender systems and information extraction system.

UNIT I INTRODUCTION 9

Introduction – Goals and History of IR – The Impact of the Web on IR – The Role of Artificial Intelligence (AI) in IR – Basic IR Models – Boolean and Vector Space Retrieval Models – Ranked Retrieval – Text similarity metrics – TF-IDF (term frequency/inverse document frequency) Weighting – Cosine Similarity.

Suggested Activities:

- Understanding the basics of IR.
- Study of other retrieval models.
- Practical – Implementation of the retrieval model with Lemur Tool kit and test the performance of different retrieval algorithms.

Suggested Evaluation Methods:

- Quizzes on IR and other retrieval models.
- Assignments on retrieval models.

UNIT II PREPROCESSING 9

Basic Tokenizing – Indexing and Implementation of Vector Space Retrieval – Simple Tokenizing – Stop Word Removal and Stemming – Inverted Indices –Efficient Processing with Sparse Vectors – Query Operations and Languages – Relevance Feedback – Query Expansion – Query Languages.

Suggested Activities:

- Study of indexing techniques.
- Practical – Implementation of vector space model.
- Flipped classroom on query expansion with thesaurus.

Suggested Evaluation Methods:

- Case studies on tokenization, stop word removal and stemming.
- Tutorials on query operations and languages.

UNIT III METRICS 9

Experimental Evaluation of IR – Performance metrics Recall, Precision and F measure – Evaluations on Benchmark Text Collections – Text Representation – Word Statistics – Zipf's Law – Porter Stemmer – Morphology – Index Term Selection using Thesauri –Metadata and Markup Languages – Web Search Engines – Spidering – Metacrawlers – Directed Spidering – Link Analysis Shopping Agents.

Suggested Activities:

- Practical – Implementation of evaluation metrics.
- Study and implementation of PageRank algorithm.
- Study of web page duplicate detection technique.

Suggested Evaluation Methods:

- Tutorials on web search and crawling.
- Quizzes on precision, recall and f-measure.
- Assignments on web search engines.

UNIT IV CATEGORIZATION AND CLUSTERING 9

Text Categorization and Clustering – Categorization Algorithms – Naive Bayes – Decision Trees and Nearest Neighbor – Clustering Algorithms – Agglomerative Clustering – k Means

– Expectation Maximization (EM) – Applications to Information Filtering – Organization and Relevance Feedback.

Suggested Activities:

- Study of different classification techniques and its uses in different applications.
- Practical – Implementation of classification and clustering techniques with WEKA tool.
- Assignments on clustering algorithms.

Suggested Evaluation Methods:

- Quizzes on different categorization and clustering methods.
- Exercise on categorization and clustering algorithms for real time applications.

UNIT V EXTRACTION AND INTEGRATION 9

Recommender Systems – Collaborative Filtering – Content Based Recommendation of Documents and Products – Information Extraction and Integration – Extracting Data from Text – XML – Semantic Web – Collecting and Integrating Specialized Information on the Web.

Suggested Activities:

- Study of types of collaborative filtering techniques.
- Flipped classroom on semantic web.

Suggested Evaluation Methods:

- Assignments on item based and user based collaborative filtering techniques.
- Quizzes on semantic web.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Build an Information Retrieval system using the available tools.
2. Apply indexing and query expansion techniques for efficient retrieval.
3. Apply performance metrics to validate any information retrieval system.
4. Apply machine learning techniques for text classification and clustering for efficient Information Retrieval.
5. Design and analyze the Web content structures.
6. Design and implement recommender and information extraction system.

TEXT BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze," Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Ricci, F. Rokach, L. Shapira, B. Kantor, P.B. "Recommender Systems Handbook", Springer, 2011.

REFERENCES:

1. Brusilovsky, Peter, "The Adaptive Web Methods and Strategies of Web Personalization", Springer, 2007.
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Second Edition, Cambridge University Press, 2014.
3. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press books, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓				✓	✓		
CO2	✓	✓	✓	✓					✓	✓		
CO3	✓	✓	✓		✓			✓				✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓	✓			✓	✓	✓				
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5023 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To learn the basic concepts of digital image processing and various image transforms.
- To familiarize the student with the image enhancement techniques.
- To expose the student to a broad range of image processing techniques and their applications.
- To appreciate the use of current technologies that are specific to image processing systems.
- To expose the students to real-world applications of image processing.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9

Introduction – Applications of Image Processing – Steps in Image Processing Applications – Digital Imaging System – Sampling and Quantization – Pixel Connectivity – Distance Measures – Colour Fundamentals and Models – File Formats – Image Operations.

Suggested Activities:

- Discussion on image processing applications.
- External learning – Open source tools like Octave/SciLab/OpenCV , types of images.
- Practical – Reading and writing of images in Matlab and OpenCV/Octave/SciLab.

Suggested Evaluation Methods:

- Tutorials on image operations, image connectivity and distance measures.
- Assignments on sampling, quantization and image operations.
- Quizzes on image types.

UNIT II IMAGE ENHANCEMENT 9

Image Transforms: Discrete Fourier Transform – Fast Fourier Transform – Discrete Cosine Transform – Image Enhancement in Spatial and Frequency Domain – Grey Level Transformations – Histogram Processing –Spatial Filtering – Smoothing And Sharpening – Frequency Domain: Filtering in Frequency Domain.

Suggested Activities:

- Discussion of mathematical transforms.
- Numerical problem solving using Fourier transform.

- External learning – image noise and types of noises.
- Practical – Implementation of simple spatial filters like low pass filters and high pass filters in Matlab/OpenCV.

Suggested Evaluation Methods:
- Tutorials on image transforms, image smoothing.
- Assignments on histogram specification and equalization, spatial filters.
- Quizzes on noise modeling.

UNIT III IMAGE RESTORATION AND MULTI-RESOLUTION ANALYSIS 9

Multi Resolution Analysis: Image Pyramids – Multi Resolution Expansion – Wavelet Transforms – Image Restoration – Image Degradation Model – Noise Modeling – Blur – Order Statistic Filters – Image Restoration Algorithms.

Suggested Activities:
- Discussion on image artifacts and blur.
- Discussion on the role of wavelet transforms in filter and analysis.
- Practical – Implementation of noise modeling in Matlab/Octave/SciLab.
- Practical – Implementation of wavelet transforms and deconvolution algorithms in Matlab/Octave.

Suggested Evaluation Methods:
- Tutorials on wavelet transforms.
- Assignments ion order statistics ilters and multi resolution expansions.
- Quizzes on wavelet transforms.

UNIT IV IMAGE SEGMENTATION AND FEATURE EXTRACTION 9

Image Segmentation – Detection of Discontinuities –Edge Operators –Edge Linking and Boundary Detection – Thresholding – Region based Segmentation – Image Features and Extraction – Image Features – Types of Features – Feature extraction – SIFT, SURF and Texture – Feature reduction algorithms.

Suggested Activities:
- Flipped classroom on importance of segmentation.
- External learning – Discussion of features, feature selection and reduction.
- Practical – Implementation of SIFT, SURF in Matlab/Octave/SciLab.
- Practical – Implementation of PCA in Matlab/Octave.

Suggested Evaluation Methods:
- Tutorials on image segmentation and edge detection.
- Assignments on feature extraction and reduction.
- Quizzes on feature selection and extraction.

UNIT V IMAGE PROCESSING APPLICATIONS 9

Image Classifiers – Supervised Learning – Support Vector Machines, Image Clustering – Unsupervised Learning – Hierarchical and Partition based Clustering Algorithms – EM Algorithm.

Suggested Activities:
- Discussion on machine learning in image processing.
- Discussion on image classifiers.
- Discussion on biometrics such as iris, fingerprint and face recognition.
- Discussion on image security such as steganography and digital watermarking.

- External learning – Medical imaging and remote sensing.
- External learning – Study of visual effects and Forensic applications.
- Practical – Image classifier using SVM in Matlab/Octave.
- Practical – Extraction of features in fingerprint using Matlab/Octave.

Suggested Evaluation Methods:

- Tutorials on image classifier and clustering.
- Assignments on support vector machines and em algorithm.
- Quizzes on image processing applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement basic image processing operations.
2. Apply and develop new techniques in the areas of image enhancement and restoration.
3. Understand the image segmentation algorithms.
4. Extract features from images.
5. Apply classifiers and clustering algorithms for image classification and clustering.
6. Design and develop an image processing application that uses different concepts of image processing.

TEXT BOOKS:

1. Rafael Gonzalez, Richard E. Woods, “Digital Image Processing”, Fourth Edition, Pearson Education, 2018.
2. S. Sridhar, “Digital Image Processing”, Second Edition, Oxford University Press, 2016.

REFERENCES:

1. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing Analysis and Machine Vision”, Fourth Edition, Cengage India, 2017.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓	✓		
CO2	✓	✓	✓	✓				✓	✓	✓		✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓	✓			✓	✓	✓				
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5024 **MIXED REALITY** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart the fundamental aspects and principles of mixed reality technologies.
- To know the internals of the hardware and software components involved in the development of mixed reality enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about mixed reality application development.
- To evaluate the mixed reality based applications.

UNIT I INTRODUCTION **9**

Introduction to Virtual Reality – Definition – Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR – System Structure of Augmented Reality – Key Technology in AR – 3D Vision – Approaches to Augmented Reality – Alternative Interface Paradigms – Spatial AR – Input Devices – 3D Position Trackers – Performance Parameters – Types Of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

Suggested Activities:

- Flipped classroom on the use of MR applications.
- Experience the virtual reality effect by watching videos.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:

- Tutorials on MR applications.
- Brainstorming session – VR effects.
- Quizzes on difference between VR and Multimedia applications.

UNIT II MR COMPUTING ARCHITECTURE **9**

Computing Architectures of VR – Rendering Principle – Graphics and Haptics Rendering – PC Graphics Architecture – Graphics Accelerators – Graphics Benchmarks – Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures – Multi-pipeline Synchronization – Collocated Rendering Pipelines – Distributed Virtual Environments – AR Architecture.

Suggested Activities:

- Flipped classroom on basic graphics pipeline.
- External learning – Different types of graphics architectures and workstations.
- Practical – GPU programming.

Suggested Evaluation Methods:

- Tutorials on graphics pipeline.
- Brainstorming session – Graphics architectures.
- Quizzes on various topics of the unit.
- Demonstration of GPU programs for creating simple multimedia Applications.

UNIT III MR MODELING **9**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants – Object Hierarchies – Viewing The 3D World – Physical Modeling – Collision

Detection – Surface Deformation – Force Computation – Force Smoothing And Mapping – Behavior Modeling – Model Management.

Suggested Activities:

- Flipped classroom on modeling three dimensional objects.
- External learning – Collision detection algorithms.
- Practical – Creating three dimensional models.

Suggested Evaluation Methods:

- Tutorials on 3D modeling techniques.
- Brainstorming session – Collision detection algorithms.
- Demonstration of three dimensional models.

UNIT IV MR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of World Toolkit and Java 3D – GHOST – People Shop – Human Factors in VR – Methodology And Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding – Trajectories through Mixed Reality Performance – Mobile Interface Design – Quantitative Evaluation – Qualitative Evaluation.

Suggested Activities:

- External learning – Different types of programming toolkits.
- Practical – Create VR scenes using toolkits like World ToolKit, Java 3D, Ghost, PeopleShop, Unity.

Suggested Evaluation Methods:

- Tutorial on different programming toolkits for MR.
- Demonstration of MR scene creation.

UNIT V APPLICATIONS 9

Medical Applications of MR – Education, Arts and Entertainment – Military MR Applications – Emerging Applications of MR – MR Applications in Manufacturing – Applications of MR in Robotics – Information Visualization –Wearable Computing – Games.

Suggested Activities:

- External learning – Learn different types of available MR applications.
- Practical – Develop MR application in any domain of your interest.
- Tutorials on MR applications

Suggested Evaluation Methods:

- Evaluation of the developed MR application.
- Demonstration of MR application development and appropriate evaluation.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Discuss the basic concepts of Mixed Reality.
2. Design and develop the Mixed Reality applications in different domains.
3. Design various models using modeling techniques.
4. Perform Mixed Reality Programming with toolkits.
5. Understand the working principles of input output devices used in mixed reality applications.
6. Evaluate mixed reality based applications.

TEXTBOOKS:

1. Grigore C. Burdea, Philip Coiffet, “Virtual Reality Technology”, Second Edition, Wiley India, 2006.
2. Benford, S., Giannachi G., “Performing Mixed Reality”, MIT Press, 2011.

REFERENCES:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile”, Packt Publisher, 2018.
2. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
3. William R. Sherman, Alan B.Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓							
CO2			✓			✓						
CO3			✓		✓							
CO4			✓		✓							
CO5	✓				✓					✓		
CO6						✓					✓	

IT5025 GAME PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9

Game – Definition – Genres of Games, Basics of 2D and 3D Graphics, Game Objects Design – 2D and 3D Transformations – Projections – Colour Models – Illumination and Shader Models – Animation – Controller based Animation.

Suggested Activities:

- Discussion about computer and video games origin and history.
- Discussion of graphics objects, open source language for game development like Pygame and Processing.py - a Language for Creative Arts.
- External learning - Practical problems in translation, scaling, zooming and rotation of 2D and 3D objects.
- Practical - Installation of Pygame and Pygame Zero and Implementation of colour models and shading models in Python.

Suggested Evaluation Methods:

- Tutorials on 2D and 3D transformations.

- Evaluation of programming exercises for Python implementation.
- Assignments on image projections and colour models.
- Quizzes on 2D and 3D game object transforms.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration –Game Balancing –Core Mechanics – Principles of Level Design – Proposals – Writing for Pre-production, Production and Post-Production.

Suggested Activities:

- Flipped classroom on animation.
- Creation of game script in natural language and story creation.
- External learning - Practical problems in game level design.
- Practical - Producing game level design document, detailed document.

Suggested Evaluation Methods:

- Tutorials on script writing.
- Assignments on game proposal writing.
- Quizzes on game design document.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine – Collision Detection – Game Logic – Game AI – Path Finding.

Suggested Activities:

- Flipped classroom on rendering.
- External learning - Image rendering and animation.
- Practical - Implementation of simple animations in Pygame and Processing.py

Suggested Evaluation Methods:

- Tutorials on collision detection.
- Assignments on game AI and path finding.
- Quizzes on rendering.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

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

Suggested Activities:

- Flipped classroom on gaming environments.
- External learning - Unity Game Engine.
- Practical - Installation of Unity and scripts.
- Practical - Pygame routines for character rendering, transformations and sound processing.

Suggested Evaluation Methods:

- Tutorials on collision detection.
- Assignments on Unity Game Engine.
- Quizzes on all topics related to Unity and Pygame.

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and3D Interactive Games using Pygame – Avatar Creation – 2D and 3D

Graphics Programming – Incorporating Music and Sound – Asset Creations – Game Physics Algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based Games – Overview of Puzzle Games.

Suggested Activities:

- External learning - Writing Unity scripts and assets.
- Practical - Implementation of simple games.

SUGGESTED EVALUATION METHODS :

- Tutorials on 2D and 3D graphics programming.
- Programming problems like asset creation
- Quizzes on game development in Pygame.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Have knowledge on the concepts of 2D and 3D graphics.
2. Know about games and their genres with their origin and history.
3. Prepare game design documents.
4. Understand the implementation of gaming engines.
5. Survey gaming environments and frameworks.
6. Implement a simple game in Pygame.

TEXT BOOK:

1. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison-Wesley Professional, 2013.

REFERENCES:

1. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress Publishers, 2007.
2. Paul Craven, “Python Arcade games”, Apress Publishers, 2016.
3. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press, 2006.
4. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓											
CO3		✓							✓	✓		
CO4		✓	✓		✓							
CO5	✓			✓								
CO6	✓		✓		✓				✓			

IT5026 **INTELLECTUAL PROPERTY RIGHTS** **L T P C**
3 0 0 3

OBJECTIVES:

- To have basic knowledge on Intellectual property rights and the importance of protecting it.
- To understand the classifications of IPR.
- To have awareness on International treaties of IPR.
- To learn the basics of Indian IPR legislations.
- To study the patents related information in Electronics and IT.

UNIT I INTRODUCTION TO IPR **9**

Basic types of property – Tangible and Intangible property – Movable Property and Immovable Property – Intellectual Property – Invention and Creativity – Innovation – Intellectual Property (IP) – Importance – Protection of IPR.

Suggested Activities:

- Study of basics of intellectual property.
- Understanding protection mechanisms of IPR.

Suggested Evaluation Methods:

- Quizzes on IPR basics.
- Tutorials on downloading and understanding IPR documents.

UNIT II CLASSIFICATIONS OF IPR **9**

IP – Patents – Patent databases - Prior-art search – Patent drafting – Patent filing - Copyrights and related rights – Trade Marks and Rights Arising from Trademark Registration – Definitions – Industrial Designs and Integrated Circuits – Protection of Geographical Indications At National And International Levels – Application Procedures.

Suggested Activities:

- Study of different kinds of inventions protected by a patent.
- Exploring free databases for searching patents, copyrights, trademarks and Industrial designs.
- Study of different types of trademarks.
- Study of industrial designs and integrated circuits.
- Flipped classroom on various IPR.

Suggested Evaluation Methods:

- Case studies – Intellectual property rights search.
- Assignments on patent drafting.

UNIT III INTERNATIONAL TREATIES ON IPR **9**

International Convention Relating to Intellectual Property – TRIPS Agreement – Madrid Agreement – Hague Agreement – Budapest Treaty – Berne Convention – Patent Cooperation Treaty-Paris Convention-Lisbon Agreement – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Suggested Activities:

- Study of principal, administrative and financial provisions of various treaties.
- Study of functioning of the patent co-operation treaty system.

Suggested Evaluation Methods:

- Quizzes on treaties.
- Assignments on international treaties.

UNIT IV INDIAN IPR LEGISLATIONS 9

Indian Position vs. WTO and Strategies – The Patent Act, 1970 – Inventions Non-Patentable – Compulsory Licensing – Patents of Addition – Commitments to WTO-Patent Ordinance and the Bill – Draft of a National Intellectual Property Policy – Present against Unfair Competition.

Suggested Student Activities:

- Study of Patent Act and Biological Diversity Act.
- Assignments on drafting a national intellectual property.

Suggested Evaluation Methods:

- Quizzes on Patent Act.
- Tutorials on patent ordinance.

UNIT V IPR IN ELECTRONICS AND INFORMATION TECHNOLOGY 9

IPR in Electronics & Information Technology – Case Studies on Patents Pertaining to Electronics & Information Technology – Software Patents International Scenario – Patent & Copyright Protection for Software& Electronic inventions – IPR in Electronics and Information Technology.

Suggested Student Activities:

- Study of protection of computer programs under patents and copyright.
- Study of international norms concerning copyright protection of software inventions.

Suggested Evaluation Methods:

- Quizzes on patents pertaining to Electronics and IT.
- Tutorials on analyzing software inventions.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basics of IPR and its importance.
2. Know and classify IPR under various categories.
3. Have basic knowledge of International treaties on IPR.
4. Have familiarity with the basics of Indian IPR legislations.
5. Have awareness on patents relating to Electronics and IT.

TEXT BOOKS:

1. Bare Act, “Indian Patent Act 1970 Acts & Rules”, Universal Law Publishing, 2007.
2. Richard W. Stim, “ Intellectual Property: Copyrights, Trademarks and Patents”, Cengage Learning, 2008.
3. Deborah E. Bouchoux, “Intellectual Property Rights”, Cengage Learning, 2005.

REFERENCES:

1. Prabuddha Ganguli, “Intellectual Property Rights”, Tata McGraw-Hill, 2001.
2. V. Sople Vinod, “Managing Intellectual Property” by Prentice Hall of India, 2010
3. P. Narayanan, “Patent Law”, Third Edition, Eastern Law House, 1998.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓		✓	✓	✓		
CO2	✓	✓						✓	✓	✓		
CO3	✓									✓		
CO4	✓					✓			✓	✓		
CO5	✓	✓			✓	✓		✓	✓	✓		
CO6												

IT5027 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 know about software effort estimation and activity planning.
- To explore risk and people management.
- To learn about project monitoring and control mechanisms.
- To know about software quality management.

UNIT I INTRODUCTION 9

Project – Software Projects versus Other Types of Project – Contract Management and Technical Project Management – Activities – Plans, Methods and Methodologies – Requirement Specification – Management Control – Overview of Project Planning – Introduction to Step Wise Project Planning – Programme Management and Project Evaluation.

Suggested Activities:

- Discussion on software project management planning.
- External learning - Process models.

Suggested Evaluation Methods:

- Assignment on project management framework.
- Quiz on process models.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING 9

Software Effort Estimation: Problems with Over and Under Estimates – Basis of Software Estimating – Techniques – Expert Judgment – Cosmic Full Function Points – A Procedural Code Oriented Approach – COCOMO: A Parametric Model – Activity Planning: Objectives – Project Schedules – Projects and Activities – Sequencing and Scheduling Activities – Network Planning Models – Formulating A Network Model – Identifying Critical Path – Shortening the Project Duration – Identifying Critical Activities – Activity-on-arrow Networks.

Suggested Activities:

- Discussion on software effort estimation methods.
- External learning - Software activity planning.

Suggested Evaluation Methods:

- Quiz on software effort estimation methods.

- Assignment on activity planning of a case study.

UNIT III SOFTWARE RISK AND PEOPLE MANAGEMENT 9

Categories of Risk – Framework for Dealing with Risk – Risk Identification – Risk Assessment – Risk Planning – Risk Management – Evaluating Risks to the Schedule – Applying the PERT Technique – Monte Carlo Simulation – Critical Chain Concepts – Resource Allocation: Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Cost Schedules – Scheduling Sequence.

Suggested Activities:

- Discussion on risk management approaches.
- External learning - People Management.

Suggested Evaluation Methods:

- Assignment on risk management.
- Quiz on people management.

UNIT IV SOFTWARE PROJECT MONITORING AND CONTROL 9

Creating the Framework – Collecting the Data: Partial Completion Reporting – Risk Reporting – Visualizing Progress: Gantt chart – Slip chart – Ball Charts – The Timeline – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting the Project Back to Target – Change Control.

Suggested Activities:

- Discussion on project monitoring.
- External learning - Software control mechanisms.

Suggested Evaluation Methods:

- Assignment on project monitoring.
- Quiz on software control mechanisms.

UNIT V SOFTWARE QUALITY MANAGEMENT 9

Managing Contracts: The ISO 12207 Approach, Supply Process, Types, Stages, Contract Management Managing People and Organizing Teams: Understanding Behaviour, Organizational Behaviour, Motivation, The Oldham– Hackman Job Characteristics Model, Decision Making, Leadership, Dispersed And Virtual Teams, Software Quality – Importance, Defining Software Quality, ISO 9126, Software Quality Measures, Product Versus Process Quality Management, External Standards, Quality Plans.

Suggested Activities:

- Discussion on components of software quality management.
- External learning - Software quality measures.

Suggested Evaluation Methods:

- Assignment on various SQM standards and bodies.
- Quiz on software quality measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Differentiate between various software process models.
2. Prepare project planning documents.
3. Estimate the software cost for projects.
4. Perform effective activity planning.

5. Prepare effective project scheduling work product.
6. Perform software quality management activities.

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Fourth Edition, Tata McGraw-Hill, 2011.
2. Walker Royce, “Software Project Management: A Unified Framework”, Pearson Education, 2004.

REFERENCES:

1. S. A. Kelkar, “Software Project Management: A Concise Study Paperback”, Prentice Hall of India, 2013.
2. Ramesh Gopalaswamy, “Managing Global Software Projects”, Tata McGraw Hill, 2001.
3. Humphrey Watts, “Managing the software process”, Addison Wesley, 1989.
4. Ashfaque Ahmed, “Software Project Management Process Driven Approach”, Auerbach Publications, 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓	✓		✓	✓	-	✓
CO2	✓	✓	✓			✓	✓		✓	✓	✓	✓
CO3	✓				✓	✓			✓	✓	✓	✓
CO4	✓		✓	✓		✓			✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO6	✓			✓		✓			✓	✓	✓	✓

IT5028 SERVICE ORIENTED ARCHITECTURE AND MICROSERVICES L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic principles of service orientation.
- To analyze various software architectures.
- To introduce service-oriented and micro-services architecture.
- To analyze and implement web service based applications.
- To understand the technology underlying service design and micro-services applications.

UNIT I SOFTWARE ENGINEERING PRACTICES 9

Software Engineering Principles – SDLC – Agile Development Methodologies – Emergence of Devops Architecture – Need for Software Architecture – Types of IT Architecture – Pattern & Style – Architecting Process for Software Applications – High Level Architecture – Solution Architecture – Software Platforms – Enterprise Applications – Custom Software Applications – Cloud Computing Platforms.

Suggested Activities:

- Sample application for each type of architecture.
- Study of popular enterprise applications.
- Cloud computing platforms comparison.
- DevOPs solution fundamentals.

Suggested Evaluation Methods:

- Quiz on various concepts.
- Simple development based on the solutions and study.

UNIT II SOA AND MICROSERVICE ARCHITECTURE BASICS 9

SOA and MSA – Basics – Evolution of SOA & MSA – Drivers for SOA – Dimensions, Standards and Guidelines for SOA – Emergence of MSA – Enterprise-wide SOA – Strawman and SOA Reference Architecture – OOAD Process & SOAD Process – Service Oriented Application – Composite Application Programming Model.

Suggested Activities:

- Applications of SOA and MSA.
- OOAD and SOAD comparison.
- Identifying simple services based on SOA and MSA.

Suggested Evaluation Methods:

- Case studies of various SOA applications.
- Application based comparison.

UNIT III WEB SERVICES 9

XML – DOM and SAX Processors – SOAP – WSDL – UDDI – JSON – WS – Security – Web Services Standards – Java, .NET, Python Web Services – RESTful Web Services – Middleware Services for IoT – Mobile Services.

Suggested Activities:

- XML processing.
- Exploring the structure of SOAP, WSDL and UDDI.
- Creation of web services in Java/.NET/Python environment.
- RESTful web services.
- Study of middleware services for IoT.

Suggested Evaluation Methods:

- Implementing XML, DOM and SAX.
- Programming exercises.

UNIT IV SERVICE ORIENTED ANALYSIS AND DESIGN 9

Principles of Service Design – Design of Activity, Data, Client, Business Process Services – Resilience Services –Technologies for SOA – Service Enablement – Integration – Orchestration – SOA Governance – Design Time and Run Time Governance – SOA Best Practices – EA and SOA for IT Alignment.

Suggested Activities:

- Study for various service design.
- SOA best practices case studies.

Suggested Evaluation Methods:

- Quiz on service design principles.
- Practical - Programming exercises on service orchestration.

UNIT V MICROSERVICE BASED APPLICATIONS 9

Implementing Microservices with Python – Microservice Discovery Framework – Coding, Testing & Documenting Microservices – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

Suggested Activities:

- Implementation of microservices architecture with python.
- Creation of container services.
- Cloud deployment.

Suggested Evaluation Methods:

- Micro service based application case study.
- Cloud deployment in different platforms.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Analyze and design SOA based solutions.
2. Understand the basic principles of service orientation.
3. Analyze and implement a web service based applications.
4. Understand the technology underlying service design.
5. Implement SOA with Micro Services applications.
6. Classify and make reasoned decision about the adoption of different SOA platforms.

TEXT BOOKS:

1. Shankar Kambhampaty, “Service-oriented Architecture & Microservice Architecture: For Enterprise, Cloud, Big Data and Mobile”, Third Edition, Wiley, 2018.
2. Tarek Ziadé , “Python Microservices Development”, O'REILLY publication,2017.

REFERENCES:

1. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.
2. Ron Schmelzer et.al, “XML and Web Services”, Pearson education, 2002.
3. Leonard Richardson, Sam Ruby, “RESTful Web Services”, O'REILLY publication, 2007.
4. Nicolai M. Josuttis, “SOA in Design – The Art of Distributed System Design”, O'REILLY publication, 2007.
5. Raj Balasubramanian, Benjamin Carlyle, Thomas Erl, Cesare Pautasso, “SOA with REST – Principles, Patterns & Constraints for Building Enterprise Solutions with REST”, Prentice Hall, 2013.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓				✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓				✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO6	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

IT5029 **SOFTWARE QUALITY ASSURANCE** **L T P C**
3 0 0 3

OBJECTIVES:

- To give a clear picture on quality management, documentation and control for software quality.
- To provide knowledge on standards, models and tools used for quality management.
- To perform measurement and assessment of software quality.
- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9

Need For Software Quality – Quality Challenges – Software Quality Assurance (SQA) – Definition And Objectives – Software Quality Factors – McCall's Quality Model – SQA System and Architecture – Software Project Life Cycle Components – Management of SQA components – Pre-Project Software Quality Components – Contract Review – Development and Quality Plans.

Suggested Activities:

- External learning – Software quality models.
- Practical - Preparation of report on quality plans.

Suggested Evaluation Methods:

- Assignment on quality models and quality plans.

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE 9

Software Development Methodologies – Quality Assurance Activities in the Development Process – Verification, Validation & Qualification – Reviews: Objectives – Formal design Review – Peer Review – Quality of Software Maintenance Components – Pre-Maintenance Software Quality Components – Maintenance Software Quality Assurance Tools – Assuring the Quality of External participants contributions: Objectives, Types, Risks & Benefits, Tools – CASE Tools and Their effect on Software Quality.

Suggested Activities:

- Discussion on software quality assurance components.
- External learning - Quality assurance tools.

Suggested Evaluation Methods:

- Quizzes on software quality assurance components.
- Assignment on quality assurance tools.

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures And Work Instructions – Supporting Quality devices – Templates – Checklists – Staff Training and Certification – Corrective and Preventive Actions – Configuration Management – Software Change Control – Configuration Management Audit – Documentation Control – Storage and Retrieval.

Suggested Activities:

- Discussion on configuration management audit.
- Discussion on documentation control.

Suggested Evaluation Methods:

- Assignment configuration management audit report.
- Quizzes on documentation control.

UNIT IV SOFTWARE QUALITY MANAGEMENT, METRICS & STANDARDS 9

Project Process Control – Computerized Tools – Software Quality Metrics – Objectives of Quality Measurement – Process Metrics – Product Metrics – Implementation – Limitations of Software Metrics – Cost of Software Quality – Classical Quality Cost Model – Extended Model – Application of Cost Model. Quality Management Standards – ISO 9001 And ISO 9000–3 – Capability Maturity Models (CMM & CMMI) – Organization of Quality Assurance – Department Management Responsibilities – Project Management Responsibilities – SQA Units And Other Actors In SQA Systems.

Suggested Activities:

- Discussion on ISO quality standards.
- External learning - Software quality metrics.

Suggested Evaluation Methods:

- Assignment on ISO quality standards.
- Quizzes on process and product metrics.

UNIT V SOFTWARE TESTING 9

Definition and objectives – Software Testing Strategies – Software Test Classifications – White Box Testing: Data Processing, Calculation Correctness Tests, Mccabe's Cyclomatic Complexity Metrics, Software Qualification and Reusability Testing, Advantages and Disadvantages of White Box Testing – Black Box Testing: Equivalence Classes for Output Correctness Tests, Revision Factor Testing Classes, Transition Factor Testing Classes, Advantages and Disadvantages of Black Box Testing – The Testing Process – Test Case Design – Automated Testing – Alpha and Beta Site Testing Programs.

Suggested Activities:

- Discussion on test case generation and testing methods.

Suggested Evaluation Methods:

- Assignment on test case generation tools.
- Quizzes on testing procedures.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Learn to document, control and manage software quality with the aid of tools and standards.
2. Distinguish between various software quality models.
3. Measure and assess software quality through process and product metrics.
4. Distinguish between the software quality standards.
5. Perform automated testing using test tools.
6. Document the testing procedures.

TEXT BOOK:

1. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Education, 2004.

REFERENCES:

1. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, 2002.
2. Mordechai Ben-Menachem, Garry S.Marliss, "Software Quality: Producing Practical, Consistent Software", BS Publications, 2014.

3. Allan C. Gillies, “Software Quality: Theory and Management”, Cengage Learning, 2003.
4. Glenford J. Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”, Third Edition, John Wiley, 2012.
5. Ron Patton, “Software testing”, Second Edition, Pearson Education, 2009.
6. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson education, 2009.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓		✓	✓			✓			
CO2	✓	✓	✓	✓		✓	✓		✓			
CO3	✓	✓	✓		✓	✓	✓		✓		✓	
CO4	✓	✓	✓			✓	✓		✓			
CO5				✓	✓	✓			✓			
CO6				✓		✓			✓			
Overall	✓	✓	✓	✓	✓	✓			✓		✓	

IT5030 AUTONOMOUS GROUND VEHICLE SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of autonomous driving.
- To study the different ways of sensing internal states of Autonomous Ground Vehicles (AGVs).
- To learn the environment perception for autonomous driving.
- To explore the navigation techniques of AGVs.
- To learn the fundamentals of vehicle control systems and connected vehicles.

UNIT I INTRODUCTION TO AUTONOMOUS DRIVING 9

Autonomous Driving Technologies Overview – Autonomous Driving Algorithms – Autonomous Driving Client System – Autonomous Driving Cloud Platform – Components of autonomy – Difference between Unmanned and Autonomous Vehicles – Introduction to Unmanned Aerial Vehicles (UAVs).

Suggested Activities:

- Flipped classroom on autonomous driving system architecture.
- External learning - Building blocks of typical Unmanned Aerial Vehicles.
- Flipped classroom on robot operating system.
- External learning - Applications of autonomous vehicles (aerial, under water, ground vehicles).
- Assignment on the design requirement specifications of autonomous vehicles (aerial, under water, ground vehicles).

Suggested Evaluation Methods:

- Viva voce on assignment topics.
- Quizzes on Advanced Driver Assistance Systems (ADAS).
- Group Discussion on Google's self-driving car.

UNIT II SENSORS FOR AUTONOMOUS GROUND VEHICLES 9

Sensor Characteristics –Vehicle Internal State Sensing: OEM Vehicle Sensors, GPS, Inertial Measurements, Magnetometer – External World Sensing: RADAR, Lidar, Image Processing Sensors.

Suggested Activities:

- Flipped Classroom on sensor characteristics.
- External learning - Working principle of IMU/GPS/RADAR sensors.
- External learning - Exploring Velodyne Lidar sensor dataset in Veloview software.

Suggested Evaluation Methods:

- Practical - Experiments on interfacing IMU sensor to Raspberry Pi board and recording the acceleration of a dummy vehicle.
- Practical - Experiments on interfacing Lidar/RADAR sensor to Raspberry Pi board and recording the distances to the nearby objects.
- Practical - Experiments on interfacing camera to Raspberry Pi board and capturing images/videos.

UNIT III ENVIRONMENT PERCEPTION AND MODELING 9

Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm –Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features – Multiple Sensor Based Multiple Object Tracking.

Suggested Activities:

- Flipped classroom on basic mean shift algorithm.
- External learning - Lane detection algorithm.
- Flipped classroom on vehicle tracking.

Suggested Evaluation Methods:

- Practical - Implementation of Mean Shift Clustering / Mean Shift Segmentation Algorithm.
- Practical - Experiments on stationary obstacle detection algorithm using Lidar sensor.

UNIT IV NAVIGATION FUNDAMENTALS 9

Introduction – Navigation: GNSS Overview, GPS, GLONASS, Galileo, Compass – Inertial Navigation Overview: Inertial Sensor Technology – GNSS/INS Integration Overview – Case Study on Kalman Filtering.

Suggested Activities:

- Flipped classroom on GPS orbits/GPS Signals.
- External learning - Indian Regional Navigation Satellite System (IRNSS).
- Assignment on the working principles of Google Map.

Suggested Evaluation Methods:

- Quizzes on GNSS signal structure.
- Viva Voce on assignment topics.
- Practical - Simulation of Waypoint Navigation Algorithm.

UNIT V VEHICLE CONTROL AND CONNECTED VEHICLE 9

Vehicle Control: Cruise Control, Antilock Brake Systems, Steering Control and Lane Following, Parking – Connected Vehicles: Vehicle to Vehicle Communication, Vehicle to Infrastructure Communication.

Suggested Activities:

- Flipped classroom on cruise control.
- External learning - Study on proportional integral derivative (PID) control.
- Assignment - Communication protocols for connected vehicles.

Suggested Evaluation Methods:

- Viva Voce on assignment topic.
- Practical - Experiment on simple velocity control.
- Practical - Experiment on simple longitudinal motion control.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify the requirements and design challenges of AGVs.
2. Select suitable sensors to sense the internal state and external world of AGVs.
3. Implement lane detection, road detection & vehicle detection algorithms.
4. Simulate/implement ground vehicle navigation algorithms.
5. Simulate/implement ground vehicle control systems.
6. Design communication protocols for connected vehicles.

TEXT BOOKS:

1. Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, “Creating Autonomous Vehicle Systems”, Morgan & Claypool, 2018.
2. Umit Ozguner, Tankut Acarman, Keith Redmill, “Autonomous Ground Vehicles”, Artech House, 2011.

REFERENCES:

1. Hong Cheng, “Autonomous Intelligent Vehicles Theory, Algorithms, and Implementation”, Springer, 2011.
2. Mohinder S. Grewal, Angus P. Andrews, Chris G. Bartone, “Global Navigation Satellite Systems, Inertial Navigation, and Integration”, Third Edition, John Wiley & Sons, 2013.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓	✓	✓	✓	✓		
CO2	✓	✓		✓		✓	✓		✓	✓		✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓		✓	✓	✓				
CO6	✓	✓	✓	✓	✓			✓	✓	✓		✓

IT5031 **ADVANCED NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the major issues, problems and solutions in the current networks.
- To understand MPLS related concepts.
- To learn about Software Defined concepts, architectures, protocols and applications.
- To identify reliability issues and provide solutions.
- To gain in-depth coverage of SAN fundamentals.

UNIT I INTERNETWORKING **9**

IPv6 – Design issues – Scalability – Addressing – Headers – Routing – Auto configuration – Transition from IPv4 to IPv6 – Interoperability – QoS in IPv6 – Multicast support – ICMPv6 – Security in IPv6.

Suggested Activities:

- Practical - Identify IPv4 and IPv6 addresses of devices.
- Practical - Test bandwidth for different parameters using iperf tool.

Suggested Evaluation Methods:

- Assess by finding out addresses of the devices in LAN.
- Evaluate various traffic scenarios.

UNIT II MPLS **9**

MPLS Architecture and Related Protocols – Traffic Engineering (TE) and TE with MPLS – Quality of Service (QoS) with MPLS technology – Network recovery and restoration with MPLS technology.

Suggested Activities:

- Practical - Configure MPLS network using GNS3 / any open source tools.
- Practical - Simulate network recovery and restoration scenarios.

Suggested Evaluation Methods:

- Assess different network topology.
- Evaluate the scenarios.

UNIT III SOFTWARE DEFINED NETWORKING **9**

Genesis of SDN – Separation of Control Plane and Data Plane – Distributed Control Plane – IP and MPLS – Characteristics of SDN – Operation – Devices – Controller – OpenFlow Specification.

Suggested Activities:

- Practical - Configure OpenFlow switches.
- Practical - View switch configuration and capability using dpctl command in mininet.

Suggested Evaluation Methods:

- Evaluate some basic SDN applications using various open source SDN controller.

UNIT IV NETWORK FUNCTION VIRTUALIZATION **9**

Building SDN Framework – Network Functions Virtualization – Introduction –Virtualization and Data Plane I/O – Service Locations and Chaining – Applications – Use Cases of SDNs: Data Centers, Overlays, Big Data and Network Function Virtualization.

Suggested Activities:

- Practical - Develop SDN in a big data application (application–driven network control).
- Practical - Develop NFV/service chaining both in and outside the data center.

Suggested Evaluation Methods:

- Evaluating the assignments for different scenarios.
- Analyzing the effect of big data application in SDN.

UNIT V STORAGE AREA NETWORKS 9

Evolution of SAN – SAN components and Building Blocks – Servers – Storage – Interfaces – Interconnectors – Fibre Channel Topologies – Layers – Classes of Service – Data Transport – Flow control – Addressing – Fibre Channel Fabric Services.

Suggested Activities:

- Practical - Simulate data centric storage area networking using simulator such as simsans.
- Assignments on classifying the components to change storage needs based on network, application, and business environment.

Suggested Evaluation Methods:

- Evaluation to select appropriate strategies depending upon the business storage needs.
- Simulate for different scenarios.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the fundamentals of IPv6.
2. Apply traffic engineering in MPLS.
3. Analyze the need for separation of data and control plane.
4. Understand the functionality of NFV.
5. Understand design and development of SAN technology.
6. Gain an in-depth coverage of various networking technologies.

TEXT BOOK:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Elsevier/Morgan Kaufmann Publishers, 2013.
2. Bruce S. Davie, Adrian Farrel, “MPLS: Next Steps”, Morgan Kaufmann Publishers, 2011.
3. William Stallings, “Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud” Third Edition, Pearson Publications, 2019.

REFERENCES:

1. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies”, O'Reilly Media, August 2013.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, “Introduction to Storage Area Networks”, An IBM Redbooks publication, 2018.
3. Paul Goransson, Chuck Black, “Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann Publisher, June 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										
CO2			✓									
CO3				✓								
CO4	✓											
CO5			✓						✓			
CO6					✓							

IT5032 NETWORK PROGRAMMING AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To learn the basics of socket programming using TCP Sockets.
- To learn about socket options.
- To explore the features of raw sockets.
- To learn and develop macros for including objects in MIB structure.
- To have knowledge on various network management tools.

UNIT I SOCKETS AND APPLICATION DEVELOPMENT 9

Introduction to Socket Programming – System Calls – Address Conversion Functions – 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 – TCP Echo Client/Server with I/O Multiplexing.

Suggested Activities:

- Assignment on Syntax and interpretation of various Socket Programming System Calls.
- Practical - Implement basic socket programs using C.

Suggested Evaluation Methods:

- Quiz on system calls.
- Evaluation of the implemented programs with appropriate test cases.

UNIT II SOCKET OPTIONS 9

Socket Options – getsockopt and setsockopt Functions – Generic Socket Options – IP Socket Options – ICMP Socket Options – TCP Socket Options – Multiplexing TCP and UDP Sockets – Domain Name System – gethostbyname, gethostbyaddr, getservbyname and getservbyport functions – Protocol Independent Functions – getaddrinfo and freeaddrinfo Functions.

Suggested Activities:

- Assignment on socket options implementing using C for specific scenarios.

- Practical - Implementation of DNS operation with gethostbyname, gethostbyaddr, getservbyname and getservbyport functions using C.
- Practical - Implementation of protocol independent functions in C.

Suggested Evaluation Methods:
- Testing for the respective socket option's role in the scenario chosen.
- Quiz on roles of various protocols dependent and independent functions.

UNIT III ADVANCED SOCKETS 9

IPv4 and IPv6 Interoperability – Threaded Servers – Thread Creation and Termination – TCP Echo Server using Threads – Mutex – Condition Variables – Raw Sockets – Raw Socket Creation – Raw Socket Output – Raw Socket Input – Ping Program – Trace Route Program.

Suggested Activities:
- Assignments on IPv4 and IPv6.
- Practical - Programs using Pthread.
- Practical - Implementation of program in C for handling raw socket.

Suggested Evaluation Methods:
- Quiz on IPv4 and IPv6 interoperability.
- Testing the program implemented using raw sockets.

UNITIV SIMPLE NETWORK MANAGEMENT 9

SNMP Network Management Concepts – SNMPv1 – Management Information – MIB Structure – Object Syntax – Standard MIB‘s – MIB–II Groups – SNMPv1 Protocol and Practical Issues – Overview of RMON – Statistics and Collection – Alarms and Filters.

Suggested Activities:
- Assignment on SNMP architecture and features of versions.
- Assignment to develop macros for new objects in MIB.

Suggested Evaluation Methods:
- Quiz on SNMP versions.
- Test for the correct definition of the access rights for the MIB objects.

UNIT V NETWORK MANAGEMENT TOOLS & SYSTEMS 9

System Utilities – Network Status Tools – Traffic monitoring Tools – Network Routing Tools – SNMP Tools – Network Statistics measurement systems – NMS Design – Network Management Systems.

Suggested Activities:
- Practical - Examine the headers and contents of IP using tcpdump or Wireshark.
- Practical - Using suitable network monitoring tool, analyze the traffic conditions in TCP/IP network.
- Practical - Analyze the network performance (delay) using appropriate system utilities.

Suggested Evaluation Methods:
- Verification of header and contents.
- Performance evaluation for various scenarios.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Implement client/server communications using TCP and UDP Sockets.
2. Describe the usage of socket options for handling various Sockets in programming.
3. Understand handling of raw sockets.
4. Explain functionalities of SNMP and MIB structure.
5. Experiment with various tools available to manage a network.
6. Handle technical issues in a network.

TEXT BOOKS:

1. W. Richard Stevens, "UNIX Network Programming Vol I", Third Edition, PHI/ Pearson Education, 2003.
2. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Education, 2009.

REFERENCES:

1. D.E. Comer, "Internetworking with TCP/IP , Vol–I", Sixth Edition, Pearson Edition, 2013.
2. D. E. Comer, "Internetworking with TCP/IP Vol–III: Client–Server Programming and Application BSD Sockets Version", Second Edition, Pearson Education, 2003.
3. Mani Subramanian, "Network Management – Principles and Practice", Second Edition, Pearson Education, 2013.
4.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓				✓		✓	✓
CO2	✓	✓	✓	✓	✓						✓	✓
CO3	✓	✓	✓		✓				✓		✓	✓
CO4	✓	✓	✓		✓				✓			✓
CO5	✓		✓		✓				✓		✓	✓
CO6	✓		✓		✓				✓		✓	✓

IT5033 TCP/IP DESIGN AND IMPLEMENTATION L T P C
3 0 0 3

OBJECTIVES:

- To learn about the design of TCP/IP Protocol structure.
- To learn about the implementation of TCP and IP functionalities in the form of data structures.
- To learn about handling TCP input and output with synchronization.
- To learn about the importance of timers and how it is managed in a TCP communication.
- To learn about the functionality of ICMP error processing routines.

UNIT I FUNDAMENTALS 9

TCP/IP Layering – internetworking devices and concepts – IP address classes – Network APIs – System Calls and Libraries – Memory buffer – Network Implementation Overview.

Suggested Activities:

- Assignment on exploring various internetworking devices in terms of their hardware and software components.
- External learning - Configuring the devices over a network topology using tool such as packet tracer.
- Practical - Implementation of network programming concepts using Network APIs- Socket system calls.

Suggested Evaluation Methods:

- Verifying the understanding about the components by comparing with other inter networking devices in terms of their functionality and features.
- Testing the configured topology with various IP assignment.
- Evaluation of various programs implemented using system calls with possible test cases.

UNIT II ARP AND IP 9

Structure of TCP/IP in OS – Data Structures for ARP – Cache Design And Management – IP Software Design And Organization – Sending a Datagram to IP.

Suggested Activities:

- Practical - Implementation of the data structure for ARP cache using any programming language.
    i. Implement cache table.
    ii. Implement ARP broadcast.
    iii. Implement timer maintenance.
- Practical - Implementation of IP software module to perform the following:
    i. Forwarding of datagrams (IP Forwarding algorithm)
    ii. Handling of incoming datagrams.

Suggested Evaluation Methods:

- Evaluation of the program output for correctness using multiple test cases.

UNITIII IP ROUTING IMPLEMENTATION 9

Routing Table – Routing Algorithms – Fragmentation and Reassembly – Error Processing (ICMP) – Multicast Processing (IGMP).

Suggested Activities:

- Practical - Using packet tracer, design a network topology with n nodes and m routers, show the initial routing table contents of all the routers. Use any routing algorithm and show the updations in the routers.
- Tutorials on fragmentation and reassembly.
- Practical - Implementation of the operation of ICMP messages.

Suggested Evaluation Methods:

- Testing the topology with various numbers of nodes and routers and evaluating the performance.
- Verifying fragmentation and reassembly for different combinations of intermediate networks.
- Testing the functionality of respective ICMP messages.

UNITIV TCP I/O PROCESSING AND FSM 9

Data Structure and Input Processing – Transmission Control Blocks – Segment Format – Comparison – Finite State Machine Implementation – Output Processing – Mutual Exclusion – Computing TCP Data Length.

Suggested Activities:

- Practical - Implementation of the data structure for TCP FSM states using any programming language.
- Practical - Implementation of the data structure for TCP I/O processing using any programming language.

Suggested Evaluation Methods:

- Test with appropriate data to verify the operation of TCP states.
- Test with appropriate data to verify the operation of TCP I/O processing.

UNITV TCP TIMER AND FLOW CONTROL 9

Timers – Events And Messages – Timer Process – Deleting and Inserting Timer Event – Flow Control and Adaptive Retransmission – Congestion Avoidance and Control – Urgent Data Processing and Push Function.

Suggested Activities:

- Practical - Implement the data structure for timer event using any programming language.
- Practical - Implement flow control by variable window size using any programming language.

Suggested Evaluation Methods:

- Test with data to verify the operation of timer event.
- Test with variable window size.
- Quiz on TCP Congestion handling.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Configure various network devices.
2. Explain the data structures of ARP, IP and TCP software design.
3. Analyze the routing of packets by routers using its table contents.
4. Interpret the states in the TCP module.
5. Justify the need for various Timers and transmission policies in TCP module.
6. Implement data structures of TCP/IP protocol.

TEXT BOOKS:

1. Douglas E. Comer, “Internetworking with TCP/IP Principles, Protocols and Architecture”, Volume 1, Sixth Edition, Pearson Education, 2013.
2. Douglas E. Comer, “Internetworking with TCP/IP-Design, Implementation and Internals”, Volume II, Third Edition, Pearson Education, 1999.

REFERENCES:

1. W. Richard Stevens, “TCP/IP illustrated-The Protocols”, Volume I, Pearson Education, 2006.
2. W. Richard Stevens, “TCP/IP illustrated-The Implementation”, Volume II, Addison Wesley, 1995.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓				✓		✓	✓
CO2	✓	✓		✓					✓		✓	✓

CO3	✓	✓	✓	✓	✓				✓		✓	✓
CO4	✓	✓	✓		✓				✓			
CO5	✓	✓	✓	✓					✓			
CO6	✓	✓	✓	✓	✓						✓	✓

IT5034 BLOCKCHAIN TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:

- To understand Blockchain's fundamental components, and examine decentralization using blockchain.
- To explain how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics of Hyperledger and Web3.
- To know about alternative Blockchains and Blockchain projects in different domains.

UNIT I INTRODUCTION TO BLOCKCHAIN 9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

Suggested Activities:

- External learning - Programming to create your own Blockchain.
- Flipped classroom on studying Blockchain security issues.

Suggested Evaluation Methods:

- Practical assessment to be conducted to evaluate the program for creating Blockchain.

UNIT II INTRODUCTION TO CRYPTOCURRENCY 9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts.

Suggested Activities:

- External learning - Creating the Wallets.
- Flipped classroom on showing the tracking process of transactions in Cryptocurrency.

Suggested Evaluation Methods:

- Assignment to be given on cryptocurrency failures.

UNIT III ETHEREUM 9

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

Suggested Activities:

- External learning - Exploring Ethereum tools like Ganache and GO.
- Practical - Setup the Ethereum development environment.
- Practical - Develop smart contract on private Blockchain.

Suggested Evaluation Methods:

- Evaluation of developed smart contract on private Blockchain

UNIT IV WEB3 AND HYPERLEDGER 9

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

Suggested Activities:

- Practical - Creating and deploying a business network on Hyperledger Composer Playground.
- Practical - Implementation of business network in Blockchain using hyperledger Fabric.

Suggested Evaluation Methods:

- Evaluation of developed business network on hyperledger fabric.

UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS 9

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

Suggested Activities:

- External learning - Blockchain using multichain.
- Assignments on Blockchain frameworks and business applications.

Suggested Evaluation Methods:

- Practical assessment of developing Blockchain based solution using Multichain for banking system.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the technology components of Blockchain and how it works behind the scenes.
2. Identify different approaches to developing decentralized applications.
3. Understand Bitcoin and its limitations by comparing with other alternative coins.
4. Devise solution using the Ethereum model.
5. Understand and use Hyperledger and its development framework.
6. Track alternative Blockchains and emerging trends in Blockchain.

TEXTBOOK:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.

2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O’Reilly, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” CreateSpace Independent Publishing, 2016.
4. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
5. Alex Leverington, “Ethereum Programming” Packt Publishing, 2017.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓	✓			✓	✓		✓	✓		✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓		✓	✓	✓	✓				
CO6	✓	✓	✓		✓	✓		✓	✓	✓		✓

IT5035 IOT BASED SMART SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To understand smart objects and IoT Architectures.
- To learn about various IoT related protocols.
- To build simple IoT systems using open hardware such as Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To build IoT based smart systems.

UNIT I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Open Hardware Platforms for IoT.

Suggested Activities:

- Survey of different real world IoT applications.
- Assignments on operational principles of sensors and actuators.
- Mini project on building a smart system - Identify the sensors required for the system, connect sensors (such as temperature, pressure, light) to a suitable IoT hardware platform and take measurements.

Suggested Evaluation Methods:

- Evaluation of survey for breadth and depth - pair-wise comparison.
- Quiz on sensors and actuators.
- Demonstration of practical setup on connecting sensors.

UNIT II IoT PROTOCOLS - I 9

IoT Access Technologies: Physical and MAC Layers, Topology and Security of IEEE 802.15.4, 1901.2a, 802.11ah and LoRaWAN – Network Layer: Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo.

Suggested Activities:

- Assignment on access technologies (simulator could be used).
- Flipped classroom on 6LoWPAN.
- Mini project on building a smart system - Choose appropriate access technology and connect the hardware to the Internet.

Suggested Evaluation Methods:

- Quiz on access technologies.
- Quiz on 6LoWPAN.
- Demonstration of practical setup on connecting to the Internet.

UNIT III IoT PROTOCOLS - II 9

Routing over Low Power and Lossy Networks (RPL) – Application Transport Methods: Application Layer Not Present, Supervisory Control and Data Acquisition (SCADA) – Application Layer Protocols: CoAP and MQTT – Service discovery – mDNS.

Suggested Activities:

- Assignment on RPL (simulator could be used).
- Mini project on building a smart system - Choose appropriate application protocol and connect to the cloud using available open platforms (such as IBM Bluemix).

Suggested Evaluation Methods:

- Quiz on RPL for different topologies.
- Demonstration of practical setup on connecting to the cloud.

UNIT IV CLOUD, FOG AND DATA ANALYTICS FRAMEWORKS 9

Cloud and Fog Topologies – Cloud Services Model – Fog Computing – Structured versus Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Security in IoT – CISCO IoT System – IBM Watson IoT Platform.

Suggested Activities:

- Use a simulator such as FogSim to study the characteristics of fog computing.
- Mini project on building a smart system - Choose appropriate analytics mechanisms to analyze the data collected, and build the application.

Suggested Evaluation Methods:

- Quiz on fog characteristics.
- Demonstration of application with analytics.

UNIT V APPLICATIONS 9

Smart and Connected Cities: Street Layer, City Layer, Data Center Layer and Services Layer, Street Lighting, Smart Parking Architecture and Smart Traffic Control – Smart Transportation – Connected Cars.

Suggested Activities:

- Design the architecture and use cases for various smart systems (eg., agriculture, home automation, smart campus, smart hostel).

- Mini project on building a smart system - Enhance the system with additional smart features.

Suggested Evaluation Methods:

- Report and presentation of architecture solutions.
- Demonstration of complete smart system.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Explain the concept and architecture of IoT.
2. Choose the right sensors and actuators for an application.
3. Analyze various protocols for IoT.
4. Apply data analytics and use cloud/fog offerings related to IoT.
5. Analyze applications of IoT in real time scenario.
6. Design an IoT based smart system using open hardware platforms and open cloud offerings.

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, CISCO Press, 2017.

REFERENCES:

1. Perry Lea, “Internet of things for architects”, Packt, 2018.
2. Jan Ho¨ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key Applications and Protocols”, Wiley, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
5. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015
6. https://www.arduino.cc/
7. https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓										✓
CO3	✓	✓	✓	✓	✓							
CO4	✓	✓		✓	✓		✓	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

IT5036 **MACHINE LEARNING** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the basic concepts of machine learning and probability theory.
- To appreciate supervised learning and their applications.
- To understand unsupervised learning like clustering and EM algorithms.
- To understand the theoretical and practical aspects of probabilistic graphical models.
- To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

UNIT II INTRODUCTION **9**

Machine Learning – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Basic Concepts in Machine Learning – Machine Learning Process – Weight Space – Testing Machine Learning Algorithms – A Brief Review of Probability Theory – Turning Data into Probabilities – The Bias-Variance Tradeoff.

Suggested Activities:

- Flipped classroom on Artificial Intelligence and Expert Systems.
- Practical - Installing Python and exploring the packages required for machine learning including numpy, scikit-learn, and matplotlib, IPython hmmpytk and pgmpy.

Suggested Evaluation Methods:

- Assignments on different types of learnings.
- Tutorials on probability theory.

UNIT II SUPERVISED LEARNING **9**

Linear Models for Regression – Linear Basis Function Models – The Bias-Variance Decomposition – Bayesian Linear Regression – Common Regression Algorithms – Simple Linear Regression – Multiple Linear Regression – Linear Models for Classification – Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Laplace Approximation – Bayesian Logistic Regression – Common Classification Algorithms – k-Nearest Neighbors – Decision Trees – Random Forest model – Support Vector Machines.

Suggested Activities:

- Flipped classroom on basics about classification and regression.
- Practical - Collection of data from different recourses and summarize the data.
- Practical - Build linear, multi-linear, logistic regression model to predict the data.

Suggested Evaluation Methods:

- Evaluation of the practical assignment against appropriate test sets.

UNIT III UNSUPERVISED LEARNING **9**

Mixture Models and EM – K-Means Clustering – Dirichlet Process Mixture Models – Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction – Principal Component Analysis – Latent Variable Models(LVM) – Latent Dirichlet Allocation (LDA).

Suggested Activities:

- Flipped classroom on mixture models.
- External learning - Improving performance of the model using kernel methods.

Suggested Evaluation Methods:

- Assignments on mixture models.

UNIT IV GRAPHICAL MODELS 9

Bayesian Networks – Conditional Independence – Markov Random Fields – Learning – Naive Bayes Classifiers – Markov Model – Hidden Markov Model.

Suggested Activities:

- Flipped classroom on Bayesian and Markov models.
- Practical - Implementation of Naive Bayes classifier for credit card analysis.
- Practical - Implement HMM for an application.
- External learning - Gaussian Processes and Topic Modeling.

Suggested Evaluation Methods:

- Quizzes on Markov model and HMM.
- Evaluation of the HMM application.

UNIT V ADVANCED LEARNING 9

Reinforcement Learning – Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning.

Suggested Activities:

- Flipped classroom on neural networks.
- Practical - Implement bagging approach for credit card analysis.
- External learning - Deep networks.

Suggested Evaluation Methods:

- Evaluation of the practical implementation.
- Assignments on deep networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Choose and implement classification or regression algorithms for an application using an open source tool.
2. Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
3. Use a tool to implement typical clustering algorithms for different types of applications.
4. Design and implement an HMM for a sequence model type of application.
5. Implement appropriate learning algorithms for any real time application using an open source tool.
6. Identify applications suitable for different types of machine learning with suitable justification.

TEXT BOOK:

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, Prentice Hall of India, 2015.

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
3. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, CRC Press, 2014.

4. Tom Mitchell, “Machine Learning”, McGraw-Hill, 2017.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008.
6. Fabio Nelli, “Python Data Analytics with Pandas, Numpy, and Matplotlib”, Second Edition, Apress, 2018.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓			✓	✓		
CO2	✓	✓	✓				✓		✓	✓		✓
CO3	✓	✓	✓	✓	✓				✓	✓		✓
CO4	✓	✓	✓	✓	✓							
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO6	✓	✓	✓		✓	✓		✓	✓	✓		✓

IT5037 COGNITIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn – The Philosophy of Science – The Mind in Cognitive Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Neurosciences: Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

Suggested Activities:

- Flipped classroom on logic and sciences in the mind.
- Case study on how philosophy (western and eastern), pychology and neuroscience (thought process in normal persons, children and differently-abled) helps in cognition.
- Mindmap of cognition with various attributes such as mind, logic, information processing etc.
- Discussion and debate on cognition.

Suggested Evaluation Methods:

- Quiz on logic and sciences in the mind.
- Active discussion on the case study and how the factors such as learning and memory affect cognition.
- Essay writing on how various factors influence cognition.

UNIT II COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Decision making under Uncertainty – Learning – Language – Vision – Robotics.

Suggested Activities:

- Flipped classroom on knowledge based systems.
- Mindmap on different methods of cognition in computational domain.
- Discussion on the influence of human cognition systems with a link to computational domain.

Suggested Evaluation Methods:

- Quiz on knowledge based systems.
- Collaborative wiki editing of computational tools linking with cognition.
- Essay writing on the computational cognitive systems with the background of human cognitive systems.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 9

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

Suggested Activities:

- Flipped classroom on Javascript libraries.
- Exploring the existing mathematical models.
- Practical - Programming the common mathematical functions using PPL.

Suggested Evaluation Methods:

- Quiz on the basics of Javascript and WebPPL.
- Practical - Programming assignment on developing miniature programs using WebPPL for inference mechanisms.
- Evaluation of the programming assignments.

UNIT IV IMPLEMENTING THE INFERENCE MODELS OF COGNITION 9

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

Suggested Activities:

- Flipped classroom on dependence.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:

- Quiz on statistical dependence
- Practical - Automate the mathematical functions through WebPPL.
- Practical - Programming assignments on analyzing data through cognitive models with webPPL.
- Evaluation of the programming assignments.

UNIT V IMPLEMENTING THE LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models – Occam's Razor – Learning (Deep) Continuous Functions – Mixture Models.

Suggested Activities:

- Flipped classroom on mixture models.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:

- Quiz on mixture models.
- Practical - Automate the mathematical functions through WebPPL.
- Practical - Programming assignment on learning models for continuous functions.
- Evaluation of the programming assignments.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the underlying theory behind cognition.
2. Connect to the cognition elements computationally.
3. Implement mathematical functions through WebPPL.
4. Develop a cognitive inference model.
5. Develop a cognitive learning model.
6. Explore the recent trends in cognitive computing.

TEXT BOOK:

1. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, 1999.

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓			✓							
CO3		✓			✓							
CO4		✓	✓									
CO5	✓	✓	✓		✓							
CO6	✓	✓	✓		✓							

IT5038 **COMPUTATIONAL LINGUISTICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To gain knowledge about the fundamentals of language processing.
- To study about the language parsing and recognition.
- To gain knowledge on statistical language modeling.
- To understand the fundamentals of computational linguistic models.
- To engage in critical thinking regarding the applicability of computation linguistic models to various real world applications.

UNIT I FOUNDATIONS **8**

Formal Language Theory – Language Classes and Linguistic Formalisms – Regular Languages – Context-Free Languages – The Chomsky Hierarchy – Mildly Context-Sensitive Languages.

Suggested Activities:

- Assignments on problem solving using regular expressions.
- Assignments on solving exercises using context free grammars.
- In-class discussion on collected papers related with natural language applications of finite state technology.

Suggested Evaluation Methods:

- Assignment problems on regular expressions and context free grammars.
- Quizzes on different topics of the unit.

UNIT II COMPUTATIONAL COMPLEXITY IN NATURAL LANGUAGE **8**

Turing Machines and Models of Computation – Parsing and Recognition – Complexity and Semantics – Determining Logical Relationships between Sentences.

Suggested Activities:

- Mapping real world decision problems to Turing problem specifications.
- Collect natural language reviews from social network applications and identify logical relationships between reviews.
- Practical - Group activities on implementing and comparing various parsing algorithms on structured and unstructured data.

Suggested Evaluation Methods:

- Evaluation of the implemented algorithms.
- Presentations on real world applications involving semantic parsing.
- Quizzes on different topics of the unit.

UNIT III STATISTICAL LANGUAGE MODELING **10**

Introduction – Measures of Language Model Quality – Structured Language Model – Probabilistic Model – Theory of Parsing – Context–Free Grammars and Recognition – Context-Free Parsing – Probabilistic Parsing – Lexicalized Context-Free Grammars – Dependency Grammars – Tree Adjoining Grammars – Automatic Translation.

Suggested Activities:

- Solving simple problems using metrics for evaluating language models.
- Demonstrating real world applications involving language constraints using context free grammars.

Suggested Evaluation Methods:

- Case study on writing simple parsers in groups for regional languages.
- Case study on using real time parsers for various web applications.
- Assignments on CFGs.

UNIT IV COMPUTATIONAL LINGUISTIC MODELS 10

Maximum Entropy Models – Memory-Based Learning – Decision Trees – Unsupervised Learning and Grammar Induction – Artificial Neural Networks – Linguistic Annotation – Evaluation of NLP Systems.

Suggested Activities:

- Solving numerical problems using simple data sets for understanding the working of various language models.
- Demonstrating working of linguistic models using free open source tools.
- Exercises involving mapping scenarios and model selection.

Suggested Evaluation Methods:

- Quizzes on learning and grammar induction
- Mini projects using linguistic models using various free tools.

UNIT V DOMAINS OF APPLICATION 9

Speech Recognition – Statistical Parsing – Segmentation and Morphology – Computational Semantics – Information Extraction – Natural Language Generation – Question Answering.

Suggested Activities:

- Case Studies on applications involving language models.
- Demonstration of simple application specific modules using tools.

Suggested Evaluation Methods:

- Quizzes on different topics of the unit.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand basic principles behind formal language theory and grammar.
2. Apply statistical language processing for domain specific applications.
3. Recognize and represent knowledge semantics using parsing.
4. Use linguistic models for analyzing text data.
5. Develop simple applications using language models.

TEXT BOOK:

1. Ruslan Mitkov, “The Oxford Handbook of Computational Linguistics”, Oxford University Press, 2003.

REFERENCES:

1. Rodolfo Delmonte, “Computational Linguistics, Text Processing: Logical Form, Semantic Interpretation, Discourse Relations and Question Answering”, Nova Science Publishers, 2007.
2. Alfio Gliozzo, Cailo Strapparava, “Semantic Domain in Computational Linguistics”, Springer, 2009.
3. James H. Martin and Daniel Jurafsky, “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Second Edition, Pearson Education, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓							✓
CO2	✓	✓	✓	✓	✓						✓	✓
CO3	✓	✓	✓		✓						✓	✓
CO4	✓			✓	✓						✓	✓
CO5		✓	✓	✓							✓	✓
CO6	✓	✓	✓	✓	✓						✓	✓
Overall	✓	✓	✓	✓	✓						✓	✓

IT5039 **DEEP LEARNING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basic ideas and principles of neural networks.
- To understand the basic concepts of deep learning.
- To familiarize with image processing facilities like TensorFlow and Keras.
- To appreciate the use of deep learning applications.
- To understand and implement deep learning architectures.

UNIT I BASICS OF NEURAL NETWORKS **9**

Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Backpropagation Networks.

Suggested Activities:

- Discussion of role of neural networks.
- External learning - Boltzmann Machine, perceptron.
- Practical - Implementation of simple neural network in Matlab

SUGGESTED EVALUATION METHODS

- Tutorials on perceptron.
- Assignments on backpropagation networks.
- Quizzes on neural networks.

UNIT II INTRODUCTION TO DEEP LEARNING **9**

Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other Differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversial Training – Optimization for Training Deep Models.

Suggested Activities:

- Discussion of role of Gradient Descent in deep learning.
- External learning - Feature extraction and feature learning.
- Practical - Implementation of TensorFlow and Keras applications.

Suggested Evaluation Methods:

- Tutorials on gradient descent and regularization
- Assignments on optimization.
- Quizzes on deep learning regularization and optimization.

UNIT III CONVOLUTIONAL NEURAL NETWORKs 9

CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks – Applications.

Suggested Activities:

- Discussion of role of convolutional networks in Machine Learning.
- External learning - Concept of convolution and need for Pooling.

Suggested Evaluation Methods:

- Tutorials on image classification and recurrent nets.
- Assignments on image classification performances.
- Quizzes on convolutional neural networks.

UNIT IV ADDITIONAL DEEP LEARNING ARCHITECTURES 9

Long Short Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders – Representation Learning – Deep generative Models – Deep Belief Networks – Deep Generative Networks – Generative Schemes – Evaluating Generative Models.

Suggested Activities:

- Discussion of role of Deep Learning architectures.
- External learning - Compression of features using Auto-encoders.
- Practical - Implementation of simple deep learning architectures.

Suggested Evaluation Methods:

- Tutorials on LSTM and Autoencoders.
- Assignments on deep generative models, Deep Belief Networks.
- Quizzes on deep learning architectures.

UNIT V APPLICATIONS OF DEEP LEARNING 9

Images segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

Suggested Activities:

- Discussion of role of deep learning in image and NLP applications.
- External learning - NLP concepts.
- Practical - Implementation of simple deep learning for object detection and recognition in images.

Suggested Evaluation Methods:

- Tutorials on images segmentation.
- Assignments on parsing and sentiment analysis.
- Quizzes on deep learning applications

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the role of deep learning in machine learning applications.
- Get familiar with the use of TensorFlow and Keras in deep learning applications.
- Design and implement deep learning applications.
- Critically analyze different deep learning models in image related projects.
- Design and implement convolutional neural networks.
- Know about applications of deep learning in NLP and image processing.

TEXT BOOKS:

1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
2. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018

REFERENCES:

1. Phil Kim, “Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence”, Apress, 2017.
2. Ragav Venkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018.
3. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
4. Joshua F. Wiley, “R Deep Learning Essentials”, Packt Publications, 2016.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2					✓							
CO3		✓	✓									
CO4	✓				✓				✓			
CO5	✓	✓	✓		✓							
CO6	✓				✓							

MA5002 PROBABILITY AND RANDOM PROCESSES L T P C
3 1 0 4

OBJECTIVES:

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To learn the classifications of random processes with emphasis on stationarity of various orders along with strict sense stationarity, wide-sense stationarity and ergodicity.
- To understand the concepts of correlation functions and power spectral density and their properties.

- To be able to apply the knowledge gained so far with respect to linear systems with random inputs.

UNIT I RANDOM VARIABLES 12

Discrete and Continuous Random Variables – Moments – Moment Generating Functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal Distributions – Functions of a Random Variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES 12

Classification – Stationary Process – Markov Process – Poisson Process – Random Telegraph Process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

Auto-Correlation Functions – Cross-Correlation Functions and its Properties – Power Spectral Density – Cross-Spectral Density and its Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

Linear Time Invariant System – System Transfer Function – Linear Systems With Random Inputs – Auto-Correlation and Cross-Correlation Functions of Input and Output – White Noise.

TOTAL: 60 PERIODS

OUTCOMES

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

1. Analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
2. Familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
3. Appreciate wide sense stationarity with respect to Poisson and Random Telegraph processes.
4. Gain proficiency in determining the correlation functions and spectral density characteristics of random processes.
5. Demonstrate the specific applications to linear systems with random inputs and white noise models.

TEXT BOOKS:

1. Ghahramani, S. “Fundamentals of probability with: stochastic processes”, Chapman and Hall/ CRC, Fourth Edition, Boca Raton, 2018.
2. Ibe, O.C. “Fundamentals of Applied Probability and Random Processes”, Elsevier, Academic Press, Second Edition, Boston, 2014.
3. Peebles, P.Z. “Probability, Random Variables and Random Signal Principles”, Tata McGraw Hill, Fourth Edition, New Delhi, 2017.

REFERENCES:

1. George R. Cooper, Clare D. McGillem, “Probabilistic Methods of Signal and System Analysis”, Oxford University Press, 3rd Edition, New York, 2010.
2. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, McGraw Hill Education, 3rd Edition, Reprint, New Delhi, 2017.

3. Miller, S.L. and Childers, D.G., “Probability and Random Processes with Applications to Signal Processing and Communications”, Academic Press, 2nd Edition, Amsterdam, 2012.
4. Yates, R.D. and Goodman, D.J., Famolari, D. “Probability and Stochastic Processes”, John Wiley and Sons, 3rd Edition, New Jersey, 2014.

MA5356 LINEAR ALGEBRA AND NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

1. To understand Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces;
2. To understand the linear maps between vector spaces, their matrix representations, null-space and Range spaces, the Rank- Nullity Theorem;
3. To understand Inner product spaces: Cauchy-Schwarz inequality, orthonormal bases, the Gramm-Schmidt procedure, orthogonal complement of a subspace, orthogonal projection;
4. To analyze Eigenvalues and eigenvectors, diagonalizability of a real symmetric matrix, canonical forms;
5. To understand Mathematical foundations of numerical techniques for solving linear systems, eigenvalue problems and generalized inverses.

UNIT I VECTOR SPACES 12

Vector Spaces – Subspaces – Linear Combinations - Linear Span – Linear Dependence - Linear Independence – Bases and Dimensions.

UNIT II LINEAR TRANSFORMATIONS 12

Linear Transformation – Null Space, Range Space - Dimension Theorem - Matrix and Representation of Linear Transformation – Eigenvalues Eigenvectors of Linear Transformation – Diagonalization of Linear Transformation – Application of Diagonalization in Linear System of Differential Equations.

UNIT III INNER PRODUCT SPACES 12

Inner Products and Norms - Inner Product Spaces - Orthogonal Vectors – Gram Schmidt Orthogonalization Process – Orthogonal Complement – Least Square Approximations.

UNIT IV NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS 12

Solution of Linear System of Equations – Direct Methods: Gauss Elimination Method – Pivoting, Gauss Jordan Method , LU Decomposition Method and Cholesky Decomposition Method - Iterative Methods: Gauss-Jacobi Method, Gauss-Seidel Method and SOR Method.

UNIT V NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES 12

Eigen Value Problems: Power Method – Jacobi‘S Rotation Method – Conjugate Gradient Method – QR Decomposition - Singular Value Decomposition Method.

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Solve system of linear equations, to use matrix operations and vector spaces using algebraic methods.
2. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
3. Apply numerical methods to obtain approximate solutions to mathematical problems.

4. 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.
5. Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

1. Faires, J.D. and Burden, R., “Numerical Methods”, Brooks/Cole (Thomson Publications), Fourth Edition, New Delhi, 2012.
2. Friedberg, S.H., Insel, A.J. and Spence, E., “Linear Algebra”, Pearson Education, Fifth Edition, New Delhi, 2018.
3. Williams, G, “Linear Algebra with Applications”, Jones & Bartlett Learning, First Indian Edition, New Delhi, 2019.

REFERENCES:

1. Bernard Kolman, David R. Hill, “Introductory Linear Algebra”, Pearson Education, First Reprint, New Delhi, 2010
2. Gerald, C.F, and Wheatley, P.O., “Applied Numerical Analysis”, Pearson Education, Seventh Edition, New Delhi, 2004.
3. Kumaresan, S., “Linear Algebra – A geometric approach”, Prentice – Hall of India, Reprint, New Delhi, 2010.
4. Richard Branson, "Matrix Operations" , Schaum's outline series, Mc Graw Hill, New York, 1989.
5. Strang, G., “Linear Algebra and its applications”, Cengage Learning, New Delhi, 2005.
6. Sundarapandian. V, “Numerical Linear Algebra”, Prentice – Hall of India, New Delhi, 2008.

IT5040 VIDEO PROCESSING AND ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

- To have a better knowledge about video representation and its formats.
- To know the fundamental concepts of data science and analytics.
- To familiarize with video processing tools for analytics.
- To understand data analytics for processing video content.
- To expose to emerging trends in video analytics.

UNIT I VIDEO FUNDAMENTALS 9

Basic Concepts and Terminology – Analog Video Standards – Digital Video Basics – Analog to Digital Conversion – Color Representation and Chroma Sub Sampling – Video Sampling Rate and Standards Conversion – Digital Video Formats – Video Features – Colour, Shape and Textural features.

Suggested Activities:

- In-class activity - Numerical problems on sampling and standard conversions.
- Flipped classroom on description about video features.

Suggested Evaluation Methods:

- Assignments on sampling and standard conversions.
- Quiz on video features.

UNIT II MOTION ESTIMATION 9

Fundamentals of Motion Estimation – Optical Flow – 2D and 3D Motion Estimation – Block Based Point Correspondences – Gradient Based Intensity Matching – Feature Matching – Frequency Domain Motion Estimation.

Suggested Activities:

- In-class activity - Numerical problems on motion estimation.
- External learning - Survey on optical flow techniques.

Suggested Evaluation Methods:

- Quiz on optical flow techniques.
- Assignments on numerical problems in motion estimation.

UNIT III VIDEO SEGMENTATION AND ANALYTICS 9

Video Segmentation – Video Shot Boundary Detection – Model Based Annotation – Video Mining – Multimodal Approach to Image and Video Data Mining – Probabilistic Semantic Mode.

Suggested Activities:

- In-class activity - video segmentation techniques.
- Flipped classroom on description about video data mining methods.

Suggested Evaluation Methods:

- Assignments on video segmentation techniques.
- Quiz on video data mining methods.

UNIT IV MINING DATA STREAMS 9

Introduction to Streams Concept – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Video Database – Categorization of Videos – Video Query Categorization.

Suggested Activities:

- Flipped classroom on discussion on streaming data.
- External learning - Survey on video based content retrieval.

Suggested Evaluation Methods:

- Quiz on data streams.
- Assignments on video based content retrieval.

UNIT V EMERGING TRENDS 9

Affective Video Content Analysis – Parsing a Video into Semantic Segments – Video Indexing and Abstraction for Retrieval – Automatic Video Trailer Generation– Video in painting– Forensic Video Analysis.

Suggested Activities:

- External learning - Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis.
- Practical - Automatic video trailer generation.

Suggested Evaluation Methods:

- Assignments on affective video content analysis.
- Quiz on forensic video analysis.
- Evaluation based on demonstration.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Compute basic video processing functions.
2. Segment video based on its features.
3. Compute optical flow and motion estimation.
4. Visualize data using graphical presentation for analysis.
5. Index and retrieve videos for faster access.
6. Design applications for video analytics in current trend.

TEXT BOOKS:

1. A. Murat Tekalp, “Digital Video Processing”, Second Edition, Prentice Hall, 2015.
2. Oges Marques, “Practical Image and Video Processing Using MATLAB”, Wiley and Sons (IEEE Press), 2011.

REFERENCES:

1. Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. Alan C. Bovik, “Handbook of Image and Video processing”, Second Edition, Academic Press, 2005.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓	✓		
CO2	✓	✓	✓				✓		✓	✓		✓
CO3	✓	✓	✓	✓					✓	✓		✓
CO4	✓	✓	✓		✓							
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO6	✓	✓	✓		✓	✓		✓	✓	✓		✓

IT5041 FULL STACK SOFTWARE DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES:

- To get an overview of the full stack software and web development.
- To understand the object oriented structure and user interface programming through Python.
- To gain knowledge of web development using Flask Framework.
- To learn the web application deployment in real time scenarios.
- To learn to deploy the software in Linux and Windows platforms.

UNIT I OBJECT ORIENTED APPROACH IN PYTHON 9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

Suggested Activities:

- Flipped classroom on object oriented methods.

- Practical - Programming exercises involving the object oriented concepts.

Suggested Evaluation Methods:

- Quiz on object oriented methods
- Programming assignments.

UNIT II USER INTERFACE APPLICATIONS IN PYTHON AND VERSION CONTROL SYSTEM 9

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics – Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands.

Suggested Activities:

- Flipped classroom on user interface programming models.
- Practical - Design of game with functional modules.

Suggested Evaluation Methods:

- Practical - Programming assignment on developing simple applications using wx Python.
- Quiz on windows elements and collaborative version control systems.
- Setting up a version control repository and the number of commits.

UNIT III FLASK FRAMEWORK FOR WEB DEVELOPMENT 9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine.

Suggested Activities:

- Flipped classroom on HTML, shell commands and basic web development strategies
- Design of the Web layout
- Practical - Programming snippets and connection to the Mongodb database.

Suggested Evaluation Methods:

- Quiz on HTML basics, shell commands and running server with LAMP
- Programming assignment on Development of a web application with a connected database

UNIT IV REAL TIME DEPLOYMENT OF WEB APPLICATION 9

Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

Suggested Activities:

- Flipped classroom on the development cycle of web.
- Programming and actual deployment of web applications.
- Use of git.

Suggested Evaluation Methods:

- Quiz on the cycle of web development.
- Porting the developed web applications in AWS/Google cloud/Heroku.
- Number of commits in git repository.

UNIT V DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM 9

Deployment in Ubuntu Distribution – Creation of .Deb Executable File – Deployment in Windows – Creation of Standalone Executable – Test Cases.

Suggested Activities:

- Flipped classroom on the method of pacakaging the software in Windows and Linux environments.
- Sample application deployment in Linux and Windows platform.

Suggested Evaluation Methods:

- Programming assignment on packaging the software developed from Unit I and Unit II.
- Deployment in Linux and Windows platform.
- Test cases.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the object oriented approach in Python.
2. Develop GUI applications with Python.
3. Use the collaborative version control system, git.
4. Package the developed code in Linux and Windows environment.
5. Deploy the developed web application using Flask in real time scenarios such as AWS.
6. Developer of the industrial software.

TEXT BOOKS:

1. Mark Lutz, “Learning Python”, Fifth Edition, O’ Reilly 2013.
2. http://zetcode.com/wxpython/
3. Scott Chacon and Ben Straub, “Pro Git”, Free e-book under Creative commons, Second Edition, Apress, 2016.
4. Miguel Grinberg, “Flask Web Development Developing Web Applications with Python”, OReilly, 2014.

REFERENCES:

1. Karl Seguin, “The Little Mongo DB Book”, https://github.com/karlseguin/the-little-mongodb-book.
2. Gareth Dwyer, “Flask by Example”, Packt Publishers, 2016.
3. https://aws.amazon.com/education/awseducate/
4. http://packaging.ubuntu.com/html/packaging-new-software.html
5. http://www.pyinstaller.org/
6. https://pypi.org/project/py2exe/0.9.2.0/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓	✓		
CO2	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓
CO3	✓	✓	✓		✓	✓	✓		✓	✓		✓
CO4	✓	✓	✓		✓							

CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO6	✓	✓	✓		✓	✓		✓	✓	✓		✓

IT5042 WIRELESS SENSOR AND MESH NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the physical layer and MAC layer of WSNs.
- To understand the data centric computing followed in WSNs.
- To study about the routing protocols followed in WSNs.
- To explore multichannel handling and MIMO in WMNs.
- To understand enhanced routing metrics and routing protocols followed in WMNs.

UNIT I WIRELESS SENSOR NETWORKS AND MESH NETWORKS 9

Wireless Ad-Hoc and Hybrid Networks – Distributed Sensing – Sensors and Transducers – Types of Sensors – Accuracy, Resolution and Hysteresis – Architecture of a Sensor Node And WSN – Applications of WSNs – Features of WMNs – Mesh Routers and Mesh Clients – Backbone and Backhaul Networks – Types of WMNs – Applications of WMNs.

Suggested Activities:

- External learning - Exploring various sensors, their corresponding actuators and finding out their price, various motes and their configuration (sensors supported, microcontroller and the clock speed, Flash, RAM, Battery capacity, RF transceivers and data rate supported).
- Flipped classroom on accuracy, resolution and hysteresis.
- Exploring various mesh routers and their configuration (Built-in radio interfaces in terms of IEEE 802.11 and its variants, connectivity (both wired and wireless), data rate supported, number of mesh clients supported, MU– MIMO capabilities).

Suggested Evaluation Methods:

- Assignments on types of sensors and their actuators available in the market, various motes and their configuration.
- Quiz and discussion on accuracy, hysteresis and resolution.
- Assignments on various mesh routers, commercial sink node gateways and sink node placement strategies.

UNIT II MAC LAYER OF WSN AND ZIGBEE STANDARD 9

Energy Issues And Transceiver Design Considerations in WSNS – PHY Frame Structure – Roles of Nodes – End Device, Router and Coordinator – Full Function Device and Reduced Function Device – Star, Mesh and Tree Topology – Medium Access Control – Duty Cycle S–MAC Protocol – IEEE 802.15.4 Standard and ZigBee.

Suggested Activities:

- External learning - Exploring Arduino IDE and mesh Wi-Fi systems.
- Flipped classroom on roles of nodes and types of Zigbee devices.
- Analyzing duty cycle and sleep cycle of S-MAC protocol.

Suggested Evaluation Methods:

- Assignments on Arduino IDE and Mesh Wi-Fi systems.
- Quiz and discussion on roles of nodes in WSN and types of ZigBee devices.
- Problem solving related to duty cycle.

UNIT III DATA CENTRIC COMPUTING IN WSN 9

Localization and Tracking – Broadcasting and Geocasting From Sink – Data Aggregation – LMST Based Aggregation – Power Efficient Data Gathering and Aggregation (PEDAP) – In-Network Processing – Aggregate Queries – Routing Protocols – SPIN, Directed Diffusion, Energy Aware Routing, Gradient Based Routing – Introduction to Tiny OS.

Suggested Activities:

- Exploring and analyzing Contiki OS and COOJA IDE.
- Flipped classroom on TinyOS.
- External learning - Exploring sensor network platforms and tools and sensor network databases.

Suggested Evaluation Methods:

- Creating a sensor network topology in Contiki OS using COOJA IDE.
- Quiz and discussion on TinyOS.
- Assignments on sensor network platforms and tools and sensor network databases.

UNIT IV RADIO AND MAC LAYERS FOR WMN 9

Multi – Radio Networks, Multi – Channel Networks – Radio Frequency Utilization – Cognitive and Radio Spectrum Management – Adaptive Coding/Modulation And Link Adaptation – Cooperative Diversity and Cooperative Communication – IEEE 802.11s and IEEE 802.16 Based WMNs – Multichannel Single Radio protocol (MMAC) – Multichannel Unification Protocol (MUP).

Suggested Activities:

- External learning - Exploring the role of MIMO technology in WMNs and Wi-Max networks.
- Flipped classroom on non-overlapping channels in IEEE 802.11 and its variants.
- Analyzing channel allocation and utilization.

Suggested Evaluation Methods:

- Assignments on role of MIMO technology in WMNs and Wi-Max networks.
- Quiz and discussion on non-overlapping channels in IEEE 802.11 and its variants.
- Problem solving in radio frequency management, radio spectrum management, channel allocation and utilization.

UNIT V ROUTING ANDTRANSPORT LAYER IN WMN 9

Topology Discovery for Routing – Routing Metrics in WMN – Per Hop RTT, Transmission Count (ETX), Expected Transmission Time (ETT), Weighted And Cumulative ETT (WCETT), Bottleneck Capacity – Categories Of Routing Protocols – Light Client Management Routing (LCMR) – Multi Radio Link Quality Source Routing (MRLQSR) – Multipath Mesh Routing (MMESH) Protocol – Reliable Data Transport and Real Time Delivery – Datagram Congestion Control Protocol (DCCP).

Suggested Activities:

- Analyze a WMN deployment in terms of the following parameters.
    - Number of hops.
    - Number of users per hop.
    - Traffic load per hop.
    - Direction of traffic flow.
    - Number of radios in mesh nodes.
    - Range and multipath conditions.
    - Fail over conditions.

Suggested Evaluation Methods:

- Designing a WMN for the given scenario (a street, an area of a city).

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify the appropriate sensors and corresponding actuators frequently used in WSNs.
2. Understand the working of mesh routers and configuring them.
3. Identify and address the challenges regarding ZigBee MAC layer.
4. Adopt data centric computing required for WSNs.
5. Design and deploy WMNs in urban scenarios.
6. Design and deploy WSNs in unattended environment.

TEXT BOOKS:

1. Anna Forster, "Introduction to Wireless Sensor Networks", John Wiley and sons, (IEEE Press), 2016.
2. Ian F. Akyildiz, Xudong Wang, "Wireless Mesh Networks", John Wiley & Sons, 2009.

REFERENCES:

1. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2. Yan Zhang, JijunLuo, Honglin Hu, "Wireless Mesh Networking – Architectures, Protocols and Standards", Auerbach Publications, 2007.
3. Robert Faludi, " Building Wireless Sensor Networks", O'Reilly Media, 2011.
4. Timothy Kolaya, " Advances in Wireless Mesh Networks " , Clanrye International, 2015.
5. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufmann, 2004.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓				✓					✓
CO2	✓	✓	✓	✓	✓				✓		✓	✓
CO3	✓	✓	✓		✓							✓
CO4	✓	✓	✓	✓	✓	✓	✓				✓	
CO5	✓	✓	✓	✓	✓							✓
CO6	✓	✓	✓	✓	✓							✓

IT5043 **ETHICAL HACKING** **L T P C**
3 0 0 3

OBJECTIVES:

- To explore the concepts of security testing and the knowledge required to protect against the hacker and attackers.
- To understand reconnaissance and the publicly available tools used to gather information on potential targets.
- To discover the scanning techniques used to identify network systems open ports.
- To identify network system vulnerabilities and confirm their exploitability.

- To explore techniques for identifying web application vulnerabilities and attacks.

UNIT I INTRODUCTION TO HACKING 9

Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement – Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary – Reports.

Suggested Activities:

- In-class activity to understand the penetration testing methodologies.
- Practical - Use security tools in Kali Linux to assess the vulnerabilities.
- Prepare Vulnerability Assessment summary reports.

Suggested Evaluation Methods:

- Assignment on categories of penetration testing and vulnerability summary reports .
- Quiz on penetration testing methodologies, OSSTMM and OWASP.

UNIT II INFORMATION GATHERING AND SCANNING 9

Information Gathering Techniques – Active Information Gathering – Passive Information Gathering – Sources of Information Gathering – Tracing the Location – Traceroute – ICMP Traceroute – TCP Traceroute – Usage – UDP Traceroute – Enumerating and Fingerprinting the Webservers – Google Hacking – DNS Enumeration – Enumerating SNMP – SMTP Enumeration – Target Enumeration and Port Scanning Techniques – Advanced Firewall/IDS Evading Techniques.

Suggested Activities:

- Explain different ways to gather the information of a system in the network.
- Demonstrate the network command tools to identify the system.
- Understand the network protocols and port scanning techniques using Kali linux.

Suggested Evaluation Methods:

- Assignment problems on information gathering and traceroute of ICMP, DNS and SNMP.
- Quizzes on enumeration, port scanning techniques and firewall/IDS evading techniques.

UNIT III NETWORK ATTACKS 9

Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing – Promiscuous versus Nonpromiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks –Hijacking Session with MITM Attack – SSL Strip: Stripping HTTPS Traffic – DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing – Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force – Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.

Suggested Activities:

- Familiarizing with different types of attacks such as sniffing, spoofing etc.
- Demonstrating the MITM attack using ARP Poisoning using Kali Linux.
- Teaching with case studies: SSL Stripping, SQL Injection, Brute Force attacks.

Suggested Evaluation Methods:

- Assignment on denial of service (DoS) attack and hijacking session with MITM attack.

- Quizzes on SSL stripping, ARP spoofing and weak authentication.

UNIT IV EXPLOITATION 9

Introduction to Metasploit – Reconnaissance with Metasploit – Port Scanning with Metasploit – Compromising a Windows Host with Metasploit – Client Side Exploitation Methods – E–Mails with Malicious Attachments – Creating a Custom Executable – Creating a Backdoor with SET – PDF Hacking – Social Engineering Toolkit – Browser Exploitation – Post–Exploitation – Acquiring Situation Awareness – Hashing Algorithms – Windows Hashing Methods – Cracking the Hashes – Brute force Dictionary Attacks – Password Salts – Rainbow Tables – John the Ripper – Gathering OS Information – Harvesting Stored Credentials.

Suggested Activities:

- Case studies: Understand the Metasploit and Exploitations.
- Demonstrating email with malicious attachment and cracking the hashes.
- Practical - Implementing hashing algorithms and cracking the hashes.

Suggested Evaluation Methods:

- Assignments on social engineering toolkit and browser exploitation.
- Quizzes on reconnaissance with Metasploit and client–side exploitation methods.

UNIT V WIRELESS AND WEB HACKING 9

Wireless Hacking – Introducing Aircrack– Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking – Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) – Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.

Suggested Activities:

- Cracking the WEP and WPA/WPA2 passphrase using Cracking tool in Kali Linux.
- Design a web application with different authentication mechanism.
- Understand the protection mechanism to prevent against various server attacks.

Suggested Evaluation Methods:

- Assignment on evil twin attack and denial of service attack on access point in WLAN.
- Quizzes on types of authentication and vulnerabilities in a web application.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Use the various security tools to assess the computing system.
2. Predict the vulnerabilities across any computing system using penetration testing.
3. Identify prediction mechanism to prevent any kind of attacks.
4. Protect the system from malicious software and worms.
5. Evaluate the wireless network flaws and able to apply security patches .
6. Analyze the risk and support the organization for effective security measures.

TEXT BOOK:

1. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014.

REFERENCES:

1. Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.
2. Jon Erickson , “Hacking: The Art of Exploitation”, Second Edition, Rogunix, 2007.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓						✓	✓		✓
CO3	✓	✓	✓			✓	✓		✓	✓		✓
CO4	✓	✓	✓		✓	✓	✓	✓				
CO5	✓	✓	✓	✓	✓				✓	✓		
CO6	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓

IT5044 NEXT GENERATION NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of 5G internet.
- To understand the concept of small cells in 5G mobile networks.
- To learn the mobile clouds in 5G network context.
- To understand the role of cognitive radios in 5G networks.
- To learn the security issues in 5G networks.

UNIT I PERVASIVE CONNECTED WORLD AND 5G INTERNET 9

Historical Trend of Wireless Communications – Evolution of LTE Technology to Beyond 4G – 5G Roadmap – Ten Pillars of 5G – Internet of Things and Context Awareness – Networking Reconfiguration and Virtualization Support – Mobility – Quality of Service Control – Emerging Approach for Resource over Provisioning.

Suggested Activities:

- Flipped classroom on Ten Pillars of 5G.
- Assignment on millimeter wave mobile communication.
- External learning - 5G in global level.

Suggested Evaluation Methods:

- Viva Voce on assignment topic.
- Group discussion on different generations of telecommunication networks.
- Quizzes on spectrum allocation strategies for 5G.

UNIT II SMALL CELLS FOR 5G MOBILE NETWORKS 9

Introduction to Small Cells – Capacity Limits and Achievable Gains with Densification – Mobile Data Demand – Demand vs. Capacity – Small Cell Challenges.

Suggested Activities:

- Flipped classroom on the types of small cells.
- Assignment on issues in femtocells.
- External learning – Small cell challenges.

Suggested Evaluation Methods:

- Viva voce on assignment topic.
- Quiz on the drawbacks of dense deployment of Wi–Fi systems.

UNIT III COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS 9

Introduction – Cooperative Diversity and Relaying Strategies: Cooperation and Network Coding, Cooperative ARQ MAC Protocols – PHY Layer Impact on MAC Protocol Analysis: Impact of Fast Fading and Shadowing on Packet Reception for QoS Guarantee, Impact of Shadowing Spatial Correlation – Study: NCCARQ, PHY Layer Impact.

Suggested Activities:

- Flipped classroom on network coding.
- External learning – Cooperative MAC protocols.
- Assignment on packet exchange in PRCSMA.

Suggested Evaluation Methods:

- Viva voce on assignment topic.
- Quiz on NCCARQ operation under realistic channel conditions.
- Practical - Assessing the performance of NC-aided MAC protocolsin event-driven C++ simulator.

UNIT IV MOBILE CLOUDS AND COGNITIVE RADIO 9

Introduction – The Mobile Cloud – Mobile Cloud Enablers – Network Coding – Overview of Cognitive Radio Technology in 5G Wireless – Spectrum Optimization using Cognitive Radio – Relevant Spectrum Optimization Literature in 5G – Cognitive Radio and Carrier Aggregation – Energy Efficient Cognitive Radio Technology.

Suggested Activities:

- External learning - Network coding.
- Assignment on spectrum optimization using cognitive radio.
- External learning – Key requirements and challenges for 5G cognitive terminals.
- Assignment on component of a cognitive radio terminal.

Suggested Evaluation Methods:

- Viva voce on assignment topics.
- Quiz on carrier aggregation.

UNIT V SECURITY AND SELF ORGANISING NETWORKS 9

Overview of Potential 5G Communications System Architecture – Security Issues and Challenges in 5G Communications Systems – Self Organising Networks: Introduction, Self Organising Networks in UMTS and LTE, The Need for Self Organising Networks in 5G, Evolution towards Small Cell Dominant HetNets.

Suggested Activities:

- External learning - 5G communications system architecture.
- Flipped classroom on security issues and challenges in communication systems.
- Assignment on centralised 5G mobile botnet.

Suggested Evaluation Methods:

- Viva voce on assignment topics.
- Quiz on D-SON and C-SON architectures.
- Group discussion on Attacks on 4G Access Network.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Compare the 5G network with older generations of networks.
- Identify suitable small cells for different applications in 5G networks.
- Simulate 5G network scenarios.
- Connect applications to mobile cloud.
- Design applications with 5G network support.
- Analyze the security risks in 5G networks.

TEXT BOOK:

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.

REFERENCES:

1. Yin Zhang, Min Chen, “Cloud Based 5G Wireless Networks – Springer Briefs in Computer Science”, Springer, 2016.
2. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis) Mathiopoulos, “New Directions in Wireless Communications Systems: From Mobile to 5G”, CRC Press, 2017.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓		✓							
CO3	✓	✓	✓	✓	✓							
CO4	✓	✓	✓	✓	✓						✓	
CO5	✓	✓	✓	✓	✓				✓			
CO6	✓	✓	✓	✓	✓	✓	✓	✓		✓		

IT5045 COMPUTER FORENSICS **L T P C**
3 0 0 3

OBJECTIVES:

- To provide an understanding of computer forensics fundamentals.
- To analyze various computer forensics technologies.
- To identify methods for data recovery.
- To apply the methods for preservation of digital evidence.
- To learn about the types of attacks and remedial actions in the context of systems, networks, images and videos.

UNIT I INCIDENT AND INCIDENT RESPONSE **9**

Introduction to Security Threats: Introduction – Computer Crimes – Computer Threats and Intrusions – Phishing – Identity Theft – Cyber Terrorism and Cyber War – Need for Security: Information Security – OS Security – Database Security – Software Development Security – Introduction to Incident – Incident Response Methodology – Steps – Activities in Initial Response Phase After Detection of an Incident.

Suggested Activities:

- Survey of forensics tools such as WinHex, EnCase, FTK, or ProDiscover.
- External learning - Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.

Suggested Evaluation Methods:

- Demonstration on forensic tools
- Assignments on problem solving with sample cyber crime reports.

UNIT II FILE STORAGE AND DATA RECOVERY 9

File Systems – FAT, NTFS, NTFS Encrypting File System – Forensic Analysis of File Systems – Storage Fundamentals – Initial Response & Volatile Data Collection from Windows System – Initial Response & Volatile Data Collection from Unix system – Forensic Duplication – Tools – Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events – Networks.

Suggested Activities:

- Practical - Experiments with USB disk and hard disk using FTK or other tool.
- External learning - Tools for data storage and access, bypassing filtered [blocked] ports, reviewing Internet activity, open source forensic tools for file storage and data recovery will be introduced.

Suggested Evaluation Methods:

- Evaluate the experiment by checking the total quantity of files recovered from the disk for reconstruction.
- Quiz on forensic analysis of file system.

UNIT III NETWORK AND EMAIL FORENSICS 9

Network Evidence – Types of Network Monitoring – Setting Up a Network Monitoring System – Network Data Analysis – Email Clients – Email Tracing – Internet Fraud – Spam Investigations – Mobile Forensics – Subscriber Identity Module (SIM) Investigations – Wireless Device Investigations – PDA Investigations.

Suggested Activities:

- External learning - Familiarizing with port redirection tools: Quick 'n Easy FTP Server, FPIPE and FPORT.
- Practical - Study of the forensics tools.

Suggested Evaluation Methods:

- Demonstration on port redirection tools.
- Real-time problems like email analysis for tracing.

UNIT IV SYSTEM FORENSICS 9

Data Analysis: Analysis Methodology – Investigating Live Systems (Windows & Mac OS) – Hacking: Investigating Hacker Tools – Ethical Issues – Cybercrime. Forensic and Investigative tools – Forensic Equipments for evidence collection – Post exploitation.

Suggested Activities:

- Demonstration on MD5Hash tool.
- Practical - IE activity analysis.

Suggested Evaluation Methods:

- Assignment problems- Live windows and Linux investigation.
- Quiz on ethical hacking.

UNIT V IMAGE AND VIDEO FORENSICS 9

Recognizing a Graphics File – Data Compression – Locating and Recovering Graphics Files – Identifying Unknown File Formats – Copyright Issues with Graphics – Fraud using image and video – Detection of Fraud in images and video.

Suggested Activities:

- External learning - Survey on image file formats steganography tools.
- Practical - JPHS tool for steganography

Suggested Evaluation Methods:

- Assignment problems on forgery detection in images.
- Quiz on locating and recovering graphics files.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Recognize attacks on systems.
2. Design a counter attack incident response and incident response methodology.
3. Illustrate the methods for data recovery, evidence collection and data seizure.
4. Understand network and email attacks and forensic investigation with tools.
5. Use forensic tools and collect evidences of a computer crime.
6. Analyze various image encryption/decryption, steganography and fraud in image.

TEXT BOOK:

1. Kevin Mandia, Jason T. Luttgens, Matthew Pepe, “Incident Response and Computer Forensics”, Tata McGraw-Hill, 2014.

REFERENCES:

1. Bill Nelson, Amelia Philips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Cengage Learning, 2018.
2. John R. Vacca, “Computer Forensics”, Firewall Media, 2009.
3. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, Auerbach Publications, First Edition, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	
CO2	✓	✓	✓	✓	✓	✓						
CO3	✓	✓	✓		✓				✓			
CO4	✓	✓	✓	✓				✓		✓	✓	✓
CO5	✓	✓	✓		✓	✓	✓	✓				
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

AD5091 **CONSTITUTION OF INDIA** **L T P C**
3 0 0 0

OBJECTIVES:

- To teach history and philosophy of Indian Constitution.
- To describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To summarize powers and functions of Indian government.
- To explain emergency rule.
- To explain structure and functions of local administration.

UNIT I INTRODUCTION **9**

History of Making of The Indian Constitution – Drafting Committee – (Composition & Working) – Philosophy of The Indian Constitution – Preamble – Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES **9**

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 III ORGANS OF GOVERNANCE **9**

Parliament – Composition – Qualifications and Disqualifications-Powers and Functions – Executive President – Governor – Council of Ministers – Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

UNIT IV EMERGENCY PROVISIONS **9**

Emergency Provisions – National Emergency, President Rule, Financial Emergency.

UNIT V LOCAL ADMINISTRATION **9**

District's Administration head – Role and Importance – Municipalities – Introduction – Mayor and Role of Elected Representative – CEO of Municipal Corporation – Pachayati Raj – Introduction – PRI – Zila Pachayat – Elected officials and their roles – CEO ZilaPachayat-Position and role – Block level – Organizational Hierarchy (Different departments) – Village Level – Role of Elected And Appointed Officials – Importance of Grass Root Democracy.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand history and philosophy of Indian Constitution.
2. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
3. Understand powers and functions of Indian government.
4. Understand emergency rule.
5. Understand structure and functions of local administration.

TEXTBOOKS:

1. Basu D D, "Introduction to the Constitution of India", Lexis Nexis, 2015.
2. Busi S N, "Ambedkar B R framing of Indian Constitution", First Edition, 2015.
3. Jain M P, "Indian Constitution Law", Seventh Edition, Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

AD5092 VALUE EDUCATION L T P C
3 0 0 0

OBJECTIVES:

- To develop knowledge of self-development.
- To explain the importance of Human values.
- To develop the overall personality through value education.
- To overcome the self destructive habits with value education.
- To interpret social empowerment with value education.

UNIT I INTRODUCTION TO VALUE EDUCATION 9

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 VALUES 9

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 INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour Development - Soul and Scientific Attitude. Positive Thinking, Integrity and Discipline, Punctuality, Love And Kindness, Avoid Fault Thinking, Free From Anger, Dignity of Labour, Universal Brotherhood and Religious Tolerance, True Friendship Happiness vs. Suffering, Love for Truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of Self-Destructive Habits, Association and Cooperation, Doing Best for Saving Nature Character and Competence – Holy Books Vs Blind Faith, Self-Management and Good Health, Science of Reincarnation.

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Non Violence, Humility, Role of Women, All Religions and Same Message, Mind Your Mind, Self-Control, Honesty, Studying Effectively.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Gain knowledge of self-development.
2. Learn the importance of Human values.
3. Develop the overall personality through value education.
4. Overcome the self destructive habits with value education.
5. Interpret social empowerment with value education.

REFERENCES:

1. Chakroborty, S.K., “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							√	√				√
CO2							√	√	√			√
CO3							√	√	√			√
CO4							√	√				√
CO5							√	√				√

AD5093 PEDAGOGY STUDIES L T P C
3 0 0 0

OBJECTIVES:

- To understand the methodology of pedagogy.
- To compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- To infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- To illustrate the factors necessary for professional development.
- To identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY 9

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 9

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 9

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 9

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 9

Research Design – Contexts – Pedagogy – Teacher Education – Curriculum and Assessment – Dissemination and Research Impact.

TOTAL: 45PERIODS

OUTCOMES:

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

1. Understand the methodology of pedagogy.
2. Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
3. Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
4. Know the factors necessary for professional development.
5. Identify the Research gaps in pedagogy.

REFERENCES:

1. Ackers J, Hardman F, “Classroom interaction in Kenyan primary schools, Compare”, 31 (2): 245-261, 2001.
2. Agrawal M, “Curricular reform in schools: The importance of evaluation”, Journal of Curriculum Studies, 36 (3): 361-379, 2004.
3. Akyeampong K, “Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1”, London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, “Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?”, International Journal Educational Development, 33 (3): 272–282, 2013.
5. Alexander RJ, “Culture and pedagogy: International comparisons in primary education”, Oxford and Boston: Blackwell, 2001.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												√
CO2												√
CO3												√
CO4												√
CO5												√

AD5094 STRESS MANAGEMENT BY YOGA L T P C
3 0 0 0

OBJECTIVES:

- To develop healthy mind in a healthy body thus improving social health also improve efficiency.
- To invent Do’s and Don’t’s in life through Yam.
- To categorize Do’s and Don’t’s in life through Niyam.
- To develop a healthy mind and body through Yog Asans.
- To invent breathing techniques through Pranayam.

UNIT I INTRODUCTION TO YOGA **9**

Definitions of Eight Parts of Yog. (Ashtanga).

UNIT II YAM **9**

Do`s and Don't's in Life.
Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan.

UNIT III NIYAM **9**

Ahinsa, Satya, Astheya, Bramhacharya And Aparigraha.

UNIT IV ASAN **9**

Various Yog Poses and Their Benefits for Mind and Body.

UNIT V PRANAYAM **9**

Regularization of Breathing Techniques and Its Effects-Types of Pranayam.

TOTAL: 45PERIODS

OUTCOMES:

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

1. Develop healthy mind in a healthy body thus improving social health also improve efficiency.
2. Learn Do's and Don't's in life through Yam.
3. Learn Do's and Don't's in life through Niyam.
4. Develop a healthy mind and body through Yog Asans.
5. Learn breathing techniques through Pranayam.

REFERENCES:

1. Swami Vivekananda, Advaita Ashrama, "Rajayoga or conquering the Internal Nature", Publication Department, Kolkata.
2. Janardan Swami Yogabhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							√	√				√
CO2							√	√				√
CO3							√	√				√
CO4							√	√				√
CO5							√	√				√

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS **L T P C 3 0 0 0**

OBJECTIVES:

- To develop basic personality skills holistically.
- To develop deep personality skills holistically to achieve happy goals.

- To rewrite the responsibilities.
- To reframe a person with stable mind, pleasing personality and determination.
- To discover wisdom in students.

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (Wisdom) - Verses- 29,31,32 (Pride & Heroism) – Verses- 26,28,63,65 (Virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

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 IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of Basic Knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Develop basic personality skills holistically.
2. Develop deep personality skills holistically to achieve happy goals.
3. Rewrite the responsibilities.
4. Reframe a person with stable mind, pleasing personality and determination.
5. Awaken wisdom in students.

REFERENCES:

1. Gopinath, Rashtriya Sanskrit Sansthanam P, "Bhartrihari's ThreeSatakam, Niti".
2. Sringar-vairagya, New Delhi, 2010,
3. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata,2016.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION L T P C

3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

COURSE OUTCOMES

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

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X,

200

4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:

1. Introduction to Sanga Tamil Literature.

2.‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.

3.‘Attruppadai’ in Sanga Tamil Literature.

4.‘Puranaanuru’ in Sanga Tamil Literature.

5.‘Pathitru paththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9

Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature’s Grammar- Tamil Sangam Literature’sparables.

UNIT II ‘AGATHINAI’ AND ‘PURATHINAI’ 9

Tholkappiyar’s Meaningful Verses–Three literature materials–Agathinai’s message-History of Culture from Agathinai–Purathinai–Classification–Mesaage to Society from Purathinai.

UNITIII ‘ATTRUPPADAI’. 9

Attruppadai Literature–Attruppadai in‘Puranaanuru’-Attruppadaiin ‘Pathitru paththu’-Attruppadai in ‘Paththu aattu’.

UNITIV ‘PURANAANURU’ 9

Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.

UNITV ‘PATHITRU PATHTHU’ 9

Pathitrupaththu in‘Ettuthogai’–Pathitru paththu’s Parables–Tamil dynasty:Valor, Administration, Charity in Pathitru paththu- Mesaage to Society from Pathitru paththu.

TOTAL (L:45) = 45 PERIODS

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

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.

2. Differentiate 'Agathinai' and'Purathinai'in their personal and societal life.

3. Appreciate and apply the messages in 'Attruppadai' in their personal and societal life.

4. Appreciate and apply the messages in 'Puranaanuru' in their personal and societal life.

5. Appreciate and apply the messages in 'Pathitru paththu' in their personal and societal life.

REFERENCES:

1. Sivaraja Pillai,The Chronology of the Early Tamils,Sagwan Press,2018.

2. Hank Heifetz and George L. Hart, The Purananuru, Penguin Books,2002.

3. Kamil Zvelebil,The Smile of Murugan:On Tamil Literature of South India, Brill Academic Pub,1997.

4. George L. Hart, Poets of theTamil Anthologies: Ancient Poems of Love and War, Princeton University Press,2015.

5. Xavier S.Thani Nayagam, Land scape and poetry:a study of nature in classical Tamil poetry, Asia Pub.House, 1967.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4									0.9						0.6
5									0.9						0.6

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION L T P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.
2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.
3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.

6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172 VALUES AND ETHICS L T P C
3 0 0 3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous-Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXTBOOKS:

1. AwadeshPradhan :MahamanakeVichara. (B.H.U., Vanarasi-2007)

2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

HU5173 HUMAN RELATIONS AT WORK L T P C
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓			✓
CO2									✓	✓		✓
CO3						✓		✓	✓			✓
CO4								✓				✓
CO5								✓	✓	✓		✓

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

HU5174 PSYCHOLOGICAL PROCESSES L T P C
3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT 2: SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT 5: PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns -

Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., & Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske & M. Zeidner (Eds.). International handbook of personality and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.

- De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C

3 0 0 3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)

(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)

(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)

(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)

(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY L T P C
3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.

- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE 9

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN 9

Origin of Universe And Creation – 'Nasidiya Sukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD 9

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari's Vakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION 9

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN 9

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of Bhartrhari Brahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga.
7. Bacon, Francis: Power as Knowledge
8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE L T P C
3 0 0 3

UNIT I INTRODUCTION 7
Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS 9
Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH 11
Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING 7
Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR 11
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall
2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271 GENDER, CULTURE AND DEVELOPMENT L T P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives

- ✓ To familiarize students with the concepts of sex and gender through literary and media texts.
- ✓ To help students ask critical questions regarding gender roles in society.
- ✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- ✓ To help students think critically about gender based problems and solutions.

Learning Outcomes

- ➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- ➢ Students will be able to analyse current social events in the light of gender perspectives.
- ➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender

- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:

1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations

- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:

1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
2. Video: Witness: Freeing Women From Cleaning Human Waste (2014, HRW, Manual Scavenging, India)

UNIT III: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:

1. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001)
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:

1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:

1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:

Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 **ETHICS AND HOLISTIC LIFE** **L T P C**
3 0 0 3

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE

The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT

Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:

Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

Science, Technology, Consumerism, Relation with Nature and Environment, New dimension of Global Harmony: Democracy, Equality, Social Justice

TOTAL:45 PERIODS

OUTCOMES:

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

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING L T P C
3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal

courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS 9

Sole traders (Business has no separate identity from you, all business property belongs to you).

Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

UNIT IV LAW AND SOCIETY 9

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence**.**

UNIT V CASE STUDIES 9

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION L T P C
3 0 0 3

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS 9

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM 9

History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement – Film Theories – Realist, Auteurists, Feminist, Psychonalyic, Idealogical Theories.

UNIT III FILMS ACROSS THE WORLD 9

European Films – Russian Films – Japanese Films – Korean Films – Hollywood Film – Studio Culture – All Time Great Movies.

UNIT IV INDIAN FILMS 9

The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V INTERPRETING FILMS 9

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

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

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.

- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS : -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive,universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems –inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS- THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :
Lectures, discussion.

Evaluation Internal and External :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

1.Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition
2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C 3 0 0 3

OBJECTIVES

- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I INTRODUCTION

Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral - Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II READING CULTURE

Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel's ' The night of the Scorpion' . 'Nothing's Changed'- Tatamkhulu Afrika- Apartheid. Ruskin Bond- 'Night train at Deoli'- How real life is different from movies.

UNIT III IDENTIFYING MEANING

Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar's 'Jagat Mithya'- the world as an illusion. The Indian version as 'meaninglesss meaning'.

UNIT IV POST MODERNISM

'If on a winter's night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V RETURNING TO PICTURES

Lierature of the present- Emphasis on the visual world. Twitterature. SMS. Whatsapp language. Consumer culture. Change in fixed gender notions. Interactive sessions. Introspection.

Reading list

1. Bond, Ruskin: 'Night train at Deoli'
2. Ezekiel, Nissim: ' The Night of the Scorpion'
3. Afrika,Tatamkhulu: 'Nothing's Changed'
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert- *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*
8. Farrell, Edmund J: 'Listen, my children, and you shall read'

OUTCOME

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.