ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM

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.

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates can

- Utilize their proficiencies in the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volumes of data.
- Advance their technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.
- Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
- Design and model AI based solutions to critical problem domains.
- Exhibit innovative thoughts and creative ideas for effective contribution towards economy building.

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 intelligence, 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.

PROGRAM SPECIFIC OUTCOMES (PSOs):
Graduates should be able to:

1. Apply the theoretical knowledge of AI and Data Science for effective decision making in business and governance domains.
2. Develop the skills in data analytics and data visualization, pertaining to knowledge acquisition, knowledge representation and knowledge engineering and hence capable of coordinating complex projects.
3. Accomplish research to cater the critical needs of the society through cutting edge technologies of AI.

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CURRICULA AND SYLLABI FOR I - VIII SEMESTER
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	3	0	0	3	3
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
6.	GE5154	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
7.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
8.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9.	GE5163	English Laboratory[$]	EEC	0	0	2	2	1
			TOTAL	**16**	**1**	**10**	**27**	**22**

[$]Skill Based Course

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5251	Professional Communication	HSMC	2	0	0	2	2
2.	MA5252	Engineering Mathematics II	BSC	3	1	0	4	4
3.	AZ5201	Object Oriented Programming and Data Structures	PCC	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
6.	GE5252	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	1	1
PRACTICALS								
7.	AZ5211	Data Structures Laboratory	PCC	0	0	4	4	2
8.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
9.	GE5262	Communication Laboratory / Foreign Language[#]	EEC	0	0	4	4	2
			TOTAL	**13**	**1**	**16**	**30**	**22**

[#]Value Added Courses

SEMESTER III

S. NO.	COURSE CODE	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	AZ5301	Digital Logic and Computer Organization	ESC	2	0	2	4	3
3	IT5402	Design and Analysis of Algorithms	PCC	3	0	0	3	3
4	IT5351	Database Management Systems	PCC	3	0	0	3	3
5	AZ5302	Fundamentals of Data Science	PCC	3	0	0	3	3
6		Electives – Humanities I	HSMC	3	0	0	3	3
PRACTICALS								
7	AZ5311	Data Science Laboratory	PCC	0	0	4	4	2
8	IT5312	Database Management Systems Lab	PCC	0	0	4	4	2
9	GE5361	Professional Development[$]	EEC	0	0	2	2	1
			TOTAL	**17**	**1**	**12**	**30**	**24**

[$]Skill Based Course

SEMESTER IV

S. NO.	COURSE CODE	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	AZ5402	Mathematical Foundations for Data Science	PCC	3	0	0	3	3
3	IT5403	Operating Systems	PCC	3	0	0	3	3
4	AZ5401	Artificial Intelligence	PCC	3	0	0	3	3
5	AZ5403	Data Exploration and Visualization	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	AZ5411	Artificial Intelligence Lab	PCC	0	0	4	4	2
9	AZ5412	Data Visualization Lab	PCC	0	0	4	4	2
			TOTAL	**21**	**0**	**8**	**29**	**22**

***Audit Course is optional**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AZ5501	Machine Learning Methods	PCC	3	0	0	3	3
2.	IT5551	Computer Networks	PCC	3	0	0	3	3
3.	AZ5502	Data Analytics	PCC	3	0	0	3	3
4.	AZ5503	Optimization Techniques	PCC	3	0	0	3	3
5.		Electives – Humanities I	HSMC	3	0	0	3	3
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Professional Elective II	PEC	3	0	0	3	3
8.		Audit Course – II *	AC	3	0	0	3	0
PRACTICALS								
9.	AZ5511	Machine learning lab	PCC	0	0	4	4	2
10.	AZ5512	Data Analytics lab	PCC	0	0	4	4	2
11.	AZ5513	Summer Internship / Summer Project (Minimum 4 Weeks)	EEC	-	-	-	-	2
			TOTAL	**24**	**0**	**8**	**32**	**27**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AZ5601	Deep Learning Techniques	PCC	3	0	0	3	3
2.	AZ5602	Computer Vision	PCC	3	0	0	3	3
3.	AZ5603	IoT and Cloud	PCC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
6.		Open Elective I	OEC	3	0	0	3	3
PRACTICALS								
7.	AZ5611	Deep Learning Lab	PCC	0	0	4	4	2
8.	AZ5612	IoT and Cloud Lab	PCC	0	0	4	4	2
9.	AZ5613	Socially Relevant Project Laboratory	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	AZ5701	Text and Speech Analytics	PCC	3	0	0	3	3
2	AZ5702	Information Security	PCC	3	0	0	3	3
3		Professional Elective V	PEC	3	0	0	3	3
4		Professional Elective VI	PEC	3	0	0	3	3
5		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
6	AZ5711	Information Security Laboratory	PCC	0	0	4	4	2
7	AZ5712	Project I	EEC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**23**	**19**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
		Professional Elective VII	PEC	3	0	0	3	3
	AZ5811	Project II	EEC	0	0	16	16	8
			TOTAL	**3**	**0**	**16**	**19**	**11**

TOTAL CREDITS :170

Summary of Credit Distribution for
Various Category of Courses by Semester wise

S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	3	3	3	3	0	0	0	16
2	BSC	12	4	4	3	0	0	0	0	23
3	ESC	5	8	3	0	0	0	0	0	16
4	PCC	0	5	13	16	16	13	8	0	71
5	PEC	0	0	0	0	6	6	6	3	21
6	OEC	0	0	0	0	0	3	3	0	6
7	EEC	1	2	1	0	2	1	2	8	17
8	Non-Credit /(Mandatory)					✓	✓			
Total		22	22	24	22	27	23	19	11	170

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Sl.No	Computational analytics Domain A	Data analytics Domain B	Media Processing Domain C	Network Security & Cloud Domain D	AI in Bio Informatics Domain E
1.	GPU architecture and programming V	Predictive Analytics VI	AI based Mobile application development VII	Applied Cryptography V	Bio-Informatics V
2.	Algorithmic Graph Theory V	Reinforcement Learning Techniques V	Applied AI VI	Cloud Security and Privacy VI	Modeling Bio-Informatics VI
3.	Quantum Computing VII	Full Stack Data Science V	Pattern Recognition V	Blockchain Technologies VI	AI for Genomics and Proteomics VII
4.	Computational Intelligence V	Machine Learning Operations VI	Conversational Analytics VII	Social Networks VI	Explainable AI VI
5.	Cognitive Models for computing VII	Digital Video Processing VI	Multimedia Technologies VII	Ethical Hacking VI	AI in Supply Chain V
6.	Service Oriented architecture V	Information Retrieval V	Mixed Reality VI	Artificial Intelligence in Cyber Security VII	Ethics for AI VII

LIST OF PROFESSIONAL ELECTIVES

Sl. No	COURSE CODE	COURSE TITLE	ELECTIVE DOMAIN	CATEGORY	L	T	P	CONTACT PERIODS	C
SEMESTER V ONWARDS									
1.	AZ5001	Service Oriented Architecture	A	PEC	3	0	0	3	3
2.	AZ5002	GPU Architecture and Programming	A	PEC	3	0	0	3	3
3.	AZ5003	Algorithmic Graph Theory	A	PEC	3	0	0	3	3
4.	AZ5004	Computational Intelligence	A	PEC	3	0	0	3	3
5.	AZ5005	Reinforcement Learning Techniques	B	PEC	3	0	0	3	3
6.	IT5022	Information Retrieval	B	PEC	3	0	0	3	3
7.	IT 5012	Pattern Recognition	C	PEC	3	0	0	3	3
8.	AZ5006	Bio-Informatics	E	PEC	3	0	0	3	3
9.	AZ5007	Full Stack Data Science	B	PEC	3	0	0	3	3
10.	AZ5008	Applied Cryptography	D	PEC	3	0	0	3	3
11.	AZ5009	AI in Supply chain	E	PEC	3	0	0	3	3
SEMESTER VI ONWARDS									
12.	AZ5010	Predictive Analytics	B	PEC	3	0	0	3	3
13.	AZ5011	Digital Video Processing	B	PEC	3	0	0	3	3
14.	IT5024	Mixed Reality	C	PEC	3	0	0	3	3
15.	AZ5012	Applied AI	C	PEC	3	0	0	3	3
16.	AZ5013	Social Networks	D	PEC	3	0	0	3	3
17.	IT5034	Blockchain Technologies	D	PEC	3	0	0	3	3
18.	AZ5014	Cloud Security and Privacy	D	PEC	3	0	0	3	3
19.	AZ5015	Explainable AI	E	PEC	3	0	0	3	3
20.	AZ5016	Modeling Bio-Informatics	E	PEC	3	0	0	3	3
21.	IT5043	Ethical Hacking	D	PEC	3	0	0	3	3
22.	AZ5017	Machine Learning Operations	B	PEC	3	0	0	3	3
SEMESTER VII ONWARDS									
23.	IT5018	Quantum Computing	A	PEC	3	0	0	3	3
24.	AZ5018	Cognitive Models For Computing	A	PEC	3	0	0	3	3
25.	AZ5019	AI Based Mobile Application Development	C	PEC	3	0	0	3	3
26.	AZ5020	Conversational Analytics	C	PEC	3	0	0	3	3
27.	IT5009	Multimedia Technologies	C	PEC	3	0	0	3	3
28.	AZ5021	Artificial Intelligence in Cyber Security	D	PEC	3	0	0	3	3
29.	AZ5022	AI for Genomics and Proteomics	E	PEC	3	0	0	3	3
30.	AZ5023	Ethics for AI	E	PEC	3	0	0	3	3

HSMC COURSES

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	CONTACT PERIODS
1.	HS5151	Technical English	HSMC	3	0	0	3
2.	HS5251	Professional Communication	HSMC	2	0	0	2
3.	GE5154	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1
4.	GE5252	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	1

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	CATE GORY	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	CATE GORY	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	CATE GORY	L	T	P	CONTACT PERIODS	C
1.	AZ5201	Object Oriented Programming and Data Structures	PCC	3	0	0	3	3
2.	AZ5211	Data Structures Laboratory	PCC	0	0	4	4	2
3.	IT5402	Design and Analysis of Algorithms	PCC	3	1	0	4	4
4.	IT5351	Database Management Systems	PCC	3	0	0	3	3
5.	AZ5302	Fundamentals of Data Science	PCC	3	0	0	3	3
6.	AZ5311	Data Science Laboratory	PCC	0	0	4	4	2
7.	IT5312	Database Management Systems Lab	PCC	0	0	4	4	2
8.	AZ5402	Mathematical Foundations for Data Science	PCC	3	0	0	3	3
9.	IT5403	Operating Systems	PCC	3	0	0	3	3
10.	AZ5401	Artificial Intelligence	PCC	3	0	0	3	3
11.	AZ5403	Data Exploration and Visualization	PCC	3	0	0	3	3
12.	AZ5411	Artificial Intelligence Lab	PCC	0	0	4	4	2
13.	AZ5412	Data Visualization Lab	PCC	0	0	4	4	2
14.	AZ5501	Machine Learning Methods	PCC	3	0	0	3	3
15.	IT5551	Computer Networks	PCC	3	0	0	3	3
16.	AZ5502	Data Analytics	PCC	3	0	0	3	3
17.	AZ5503	Optimization Techniques	PCC	3	0	0	3	3
18.	AZ5511	Machine learning lab	PCC	0	0	4	4	2
19.	AZ5512	Data Analytics lab	PCC	0	0	4	4	2
20.	AZ5601	Deep Learning Techniques	PCC	3	0	0	3	3
21.	AZ5602	Computer Vision	PCC	3	0	0	3	3
22.	AZ5603	IOT and Cloud	PCC	3	0	0	3	3
23.	AZ5611	Deep Learning Lab	PCC	0	0	4	4	2
24.	AZ5612	IOT and Cloud Lab	PCC	0	0	4	4	2
25	AZ5701	Text and Speech Analytics	PCC	3	0	0	3	3
26	AZ5702	Information Security	PCC	3	0	0	3	3
27	AZ5711	Information Security Laboratory	PCC	0	0	4	4	2

EEC COURSES

S.NO	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	CONTACT PERIODS	C
1.	GE5163	English Laboratory[$]	EEC	0	0	2	2	1
2.	GE5262	Communication Laboratory / Foreign Language[$]	EEC	0	0	4	4	2
3.	GE5361	Professional Development[$]	EEC	0	0	2	2	1
4.	AZ5513	Summer Internship /Summer Project (Minimum 4 Weeks)	EEC	0	0	0	0	2
5.	AZ5613	Socially Relevant Project Laboratory	EEC	0	0	2	2	1
6.	AZ5712	Project I	EEC	0	0	6	6	3
7.	AZ5811	Project II	EEC	0	0	16	16	8

[$] Skill Based Courses

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
Credits					**Total**	**24**	**0**

HS5151 TECHNICAL ENGLISH L T P C
3 0 0 3

OBJECTIVES

- To build lexical competency and accuracy that will help learners to use language effectively.
- To learn various reading strategies that will enable learners to comprehend the different modes of reading materials of varied levels of complexity.
- To comprehend the linguistic aspects of various rhetorical structures and functions of Technical English and use them effectively in writing.

UNIT I INTRODUCING ONESELF 9

Theory:

Reading: Descriptive passages (From Newspapers / Magazines) – Writing: Writing a coherent paragraph (Native Place, School Life) – Grammar: Simple present tense, Present continuous tense – Vocabulary development: One word substitution.

UNIT II DIALOGUE WRITING 9

Theory:

Reading: Reading a print interview (Comprehension and inference questions) - Writing: Writing a checklist - Dialogue writing – Grammar: Simple past tense – Question formation (Wh-Questions, 'Yes' or 'No' Questions, Tag Questions) – Vocabulary Development: Lexical items relevant to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 9

Theory:

Reading: Reading motivational essays on famous Engineers and Technologists (Answering Open – Ended and Closed Questions) – Writing: Writing formal letters/ emails – Grammar: Future tenses, Subject and verb agreement - Vocabulary Development: Collocations – Fixed expressions.

UNIT IV WRITING LETTERS OF COMPLAINT 9

Theory:

Reading: Reading Problem – Solution Articles/Essays Drawn From Various Sources – Writing: Making Recommendations – Writing a complaint Letter – Letter / email to the Editor – Note Making – Grammar: Use of modal verbs – Phrasal verbs – Cause-and-effect sentences – Vocabulary Development: Connectives, Use Of cohesive devices in writing, Technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9

Theory:

Reading: Reading graphical material for comparison (Advertisements & Infographics) – Writing: Writing Definitions - One-line & extended definition – Compare-and-contrast paragraphs - Grammar: Adjectives – Degrees of comparison – Compound nouns – Compound words - Vocabulary Development: Use of Discourse Markers – Suffixes (Adjectival endings).

TOTAL : 45 PEROIDS

LEARNING OUTCOMES:

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

- Use appropriate language structures and lexical items in authentic contexts.
- Read both general and technical texts and comprehend their denotative and connotative meanings.

- Write different kinds of formal documents with grammatical and lexical appropriacy.

Assessment Pattern

- Two written internal assessments to test learner's progress in grammar, vocabulary, reading and writing skills.
- End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills for two hours.

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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

GE5154 HERITAGE OF TAMILS L T P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

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

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

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

UNIT III FOLK AND MARTIAL ARTS 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports

of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE5154 தமிழர் மரபு L T P C
1 0 0 1

அலகு I <u>மொழி மற்றும் இலக்கியம்</u>: 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation,

Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

GE5163 **ENGLISH LABORATORY** **L T P C**
0 0 2 1

OBJECTIVES :

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions(filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V EXPRESSION 6

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN

- One online / app based assessment to test listening /speaking
- End Semester **ONLY** listening and speaking will be conducted online.

- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

HS5251 PROFESSIONAL COMMUNICATION L T P C
2 0 0 2

OBJECTIVES

- To comprehend various reading materials relevant to technical context and understand the main and supporting ideas of the reading materials.
- To write effective job applications along with detailed CV for internship or placements.
- To explore definitions, essay and report writing techniques and practice them in order to develop associated skills.

UNIT I TECHNICAL COMMUNICATION 6

Theory:

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

UNIT II SUMMARY WRITING 6

Theory:

Reading: Reading Technical Essays/ Articles and Answering Comprehension Questions – Writing: Summary Writing – Grammar: Participle Forms, Relative Clauses

UNIT III PROCESS DESCRIPTION 6

Theory:

Reading: Reading Instruction Manuals – Writing: Writing Process Descriptions – Writing Instructions – Grammar: Use of Imperatives, Active and Passive Voice, Sequence Words

UNIT IV REPORT WRITING 6

Theory:

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

UNIT V WRITING JOB APPLICATIONS 6

Theory:

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.

TOTAL : 30 PERIODS

LEARNING OUTCOMES

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

- Read and comprehend technical texts effortlessly.
- Write technical reports and job application for internship or placement.
- Learn to use language effectively in a professional context.

Assessment Pattern

- Two written internal assessments to test learner's progress in grammar, reading and writing skills.
- End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills along with vocabulary for two hours.

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.

AZ5201 OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

- To understand the Object Oriented Programming(OOP) language concepts.
- To learn and implement different data structures using OOP concepts.
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs in real world problems
- To familiarize the techniques of Sorting, Searching and Hashing.

UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 8

C++ - Data abstraction – encapsulation - Class – objects – Constructors - Static members - constant members - member functions – pointers - 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 8

Inheritance – Exception handling – Generic Programming - Templates - class templates- Virtual function - abstract class - 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 LINEAR DATA STRUCTURES – LIST, STACK, QUEUE 8

Array based & Linked list based implementation – Doubly & Circular Linked List - Applications of lists – Polynomial manipulation – Stack ADT – Queue ADT – Circular queue – Applications.

Suggested Activities:

- Flipped classroom on priority queue
- Converting an algorithm from recursive to non-recursive using stack.
- Demonstrating stack for Towers of Hanoi application
- Developing any application 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 – TREES AND GRAPH 12

Tree - Definitions - Binary and Binary search trees - Implementation – Tree Traversals – Insertion – Deletion - Balanced Tree: AVL tree – m-way tree- B tree – Heaps - Applications.- Graphs – Definitions – Representation of Graphs – Topological Sort - Graph Traversals – Shortest Paths - Minimum Spanning Tree.

Suggested Activities:

- Flipped classroom on binary search trees and graph traversal application
- External learning - Fibonacci heap
- Exploration of application of trees where trees can be applied for real time problems.
- Exploration of other single source shortest path 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

Suggested Evaluation Methods:

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

UNIT V SORTING, SEARCHING AND HASHING TECHNIQUES 9

Sorting algorithms: Insertion sort – shell sort –quick sort – heap sort- Merge sort -Searching: linear search – Binary search – Hashing: Hash functions – Separate chaining – open addressing – Rehashing – Extendible hashing.

Suggested Activities:

- Flipped classroom on selection sort.
- External learning - External sorting implementation.
- Implementation of all sorting techniques.
- Demonstration of searching techniques under best and worst case inputs.

S**uggested Evaluation Methods**:

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Implement advanced data structures through ADTs using OOP.
- Select and use appropriate linear/non–linear data structure for solving a given problem.
- Apply suitable hierarchical data structures to solve practical problems.
- Apply the graph data structures for a real world problem.
- Appropriately use sort, search, hash techniques for a given application.

TEXT BOOKS:

1. Herbert Schildt, “C++ The Complete Reference”, Fourth Edition, McGraw Hill Education, 2003.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, “C++ How to Program”, Tenth Edition, Pearson Education, 2017.
2. Michael T, Goodrich, Roberto Tamassia, David Mount, ““Data Structures and Algorithms in C++”, Seventh Edition, Wiley Publishers, 2004.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2006.

4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011.

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.

GE5252 TAMILS AND TECHNOLOGY L T P C
1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே·கே· பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும்

கல்வியியல் பணிகள் கழகம்).

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

GE5252 **தமிழரும் தொழில்நுட்பமும்** **L T P C**
1 0 0 1

அலகு I **நெசவு மற்றும் பானைத் தொழில்நுட்பம்**: **3**

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**: **3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III **உற்பத்தித் தொழில் நுட்பம்**: **3**

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV **<u>வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்</u>**: **3**

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V **<u>அறிவியல் தமிழ் மற்றும் கணித்தமிழ்</u>**: **3**

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும்
   கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

AZ5211 **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 the data structures using Object Oriented Programming (OOP) language.
- To explore linear and non-linear structures using OOP concepts.

- To understand various sorting, searching algorithms using OOP concepts.

LIST OF EXPERIMENTS: Implement the following exercises using C++:

1. Practice of C++ Programming on real world/technical applications using statements, expressions, decision making constructs, Iterative and branching constructs, structures, arrays, functions, pointers.
2. Implementation of Stack and queue using Arrays and Linked List.
3. Implementation of Binary Search Tree, AVL.
4. Implementation of Insertion sort, Quick Sort, Merge Sort.
5. Implementation of an Application (such as Library Management System) using Classes, Objects, Constructors, Destructors and String Handling.
6. Implementation of Programs using Function Overloading and Operator Overloading.
7. Implementation of an Application such as Student Information System using Inheritance, Virtual Functions and Abstract Classes.
8. Implementation of a Heap tree using Templates.
9. Implementation of Graph Traversals Algorithms: Breadth-First Search, Depth-First Search.
10. Implementation of List, Stack and Queue Data Structures using STL Concepts.
11. Mini Project

TOTAL:60 PERIODS

OUTCOMES:

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

- Implement the basic and advanced concepts of object-oriented programming.
- Solve the given problem using object oriented concepts.
- Implement linear and non-linear data structures through ADTs using OOP.
- Analyze and apply the sorting, searching and hashing techniques for a real world problem.
- Design and develop real time applications by applying suitable data structures and associated operations.

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.

GE5262 COMMUNICATION LABORATORY L T P C
0 0 4 2

OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I **12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II **12**

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

UNIT III **12**

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV **12**

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V **12**

Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern

- One online / app based assessment to test speaking and writing skills

Proficiency certification is given on successful completion of speaking and writing.

MA5302 DISCRETE MATHEMATICS L T P C
3 1 0 4

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.

AZ5301 DIGITAL LOGIC AND COMPUTER ORGANIZATION L T P C
2 0 2 3

UNIT I DIGITAL LOGIC FUNDAMENTALS 6

Digital Systems – Binary Numbers Representation of Positive and Negative Numbers – 1’s and 2’s Complements –– Boolean Algebra –Theorems and Postulates – Functions – Truth Table – Logic Gates – Universal gates– Minterms and Maxterms Canonical and Standard Forms –– Simplification using K-Maps. – Signed Binary Numbers. Commonly used weighted binary codes and its conversion

UNIT II COMBINATIONAL AND SEQUENTIAL LOGIC 6

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor - Decoder – Encoder – Multiplexers – Demultiplexers - Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables

UNIT III COMPUTER FUNDAMENTALS 6

Functional Units of a Digital Computer – Von Neumann Architecture - Operation and Operands of Computer Hardware – Software Interface –Instruction Set Architecture – RISC and CISC Architectures – Addressing Modes –Performance Metrics – Power Law – Amdahl’s Law.

UNIT IV PROCESSOR 6

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Structural Hazards - Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O 6

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O

TOTAL:30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture (MARS based basic exercises)

COURSE OUTCOMES:

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

CO1 : To learn Boolean algebra and simplification of Boolean functions.
CO2 : Design various combinational digital circuits using logic gates
CO3 : Design sequential circuits and analyze the design procedures
CO4 : State the fundamentals of computer systems and analyze the execution of an instruction
CO5 : Analyze different types of control design and identify hazards
CO6 : Identify the characteristics of various memory systems and I/O communication

TOTAL: 60 PERIODS

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.

REFERENCES:

1. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”,Tenth Edition, Pearson Education, 2016.
3. G. K. Kharate, “Digital Electronics”, Oxford University Press 2010.

MAPPING of COs with PO and PSOs

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	1	-	-	-	-	1	-	-	-	-	-	-
2	3	3	3	2	2	1	1	-	2	1	-	-	1	2	2
3	3	3	3	2	2	1	1	-	2	1	-	-	1	2	2
4	3	3	3	2	1	-	-	-	1	-	-	-	-	-	-
5	3	3	3	2	1	-	-	-	2	-	-	1	-	-	-
6	3	3	3	1	1	-	-	-	-	-		1	-	1	1
Avg.	3	3	3	2	2	1	1	-	2	1	-	1	1	2	2

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

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.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	2	2	-	1	2	-	-	2	2	2	2
2	3	3	3	2	2	2	1	-	2	-	-	2	2	2	2
3	3	3	3	3	2	2	-	1	2	1	1	2	2	2	2
4	3	3	3	3	2	2	1	1	2	1	1	2	2	2	2
5	3	3	3	3	1	1	-	-	2	1	1	2	2	2	2
6	3	3	3	3	2	-	-	-	2	-		2	2	2	2
Avg.	3	3	3	3	2	2	1	1	2	1	1	2	2	2	2

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

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.

COURSE OUTCOMES	Program Outcomes (POs) & Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	2	1	1	2	1	1	1	3	3	3
CO2	2	3	2	2	2	2	2	1	2	1	1	1	3	3	3
CO3	2	3	3	2	3	2	2	1	2	1	1	2	2	2	2
CO4	2	3	2	3	2	3	3	1	3	1	2	2	3	3	3
CO5	2	2	2	2	2	3	2	1	2	1	1	2	2	2	2
CO6	2	2	3	2	3	3	2	1	3	1	2	2	3	3	3

AZ5302 FUNDAMENTALS OF DATA SCIENCE L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction to Data Science - Overview of Data - Sources of Data - Types of Data - Small Data and Big Data - Data collection methods - Surveys - Interviews - Log and Diary data - User studies in Lab and Field - Web Scraping - Public datasets - Data cleaning - Tools for Data Science.

Suggested Activities:

- Survey of Python tools for data science
- External Learning: Web scraping

Suggested Evaluation Methods:

- Quiz on python tools
- Seminar on web scraping

UNIT II DESCRIPTIVE DATA ANALYSIS 9

Dataset Construction - Sampling of data - Stem and Leaf Plots - Frequency table - Time Series data - Central Tendency Measures of the location of data - Dispersion measures - Correlation analysis - Data reduction techniques - Principal Component analysis - Independent component analysis – Hypothesis testing – Statistical Tests

Suggested Activities:

- Flipped classroom on qualitative and quantitative datasets
- Tutorial on Sampling and Frequency
- Problem solving using central tendency measures
- Tutorial on Data reduction techniques

Suggested Evaluation Methods:

- Quiz on the type of datasets
- Assignment on determining central tendency measures
- Programming exercise on correlation analysis on a large set of data

UNIT III MODEL CONSTRUCTION 9

Overview of Machine learning concepts – Model construction using regression and Classification models - Linear regression and multiple regression models - KNN classification models - Comparison models - Training Data construction - Regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean

Suggested Activities:

- Implement linear regression models using python
- Implementation of KNN models

Suggested Evaluation Methods:

- Seminar on Regression models

UNIT IV DATA HANDLING AND MODEL EVALUATION 9

Data aggregation – Data Transformation: merging datasets, reshaping data – Data enrichment: missing values - Normalization - Cross-validation techniques - Accuracy metrics for evaluation of models – Contingency table, ROC curve, Precision-recall curves - A/B testing

Suggested Activities:

- Construct a contingency table for classifier evaluation

Suggested Evaluation Methods:

- Seminar on aggregation and grouping
- Quiz on evaluation measures

UNIT V DATA ANALYTICS 9

Introduction- Information based learning-Handling alternative feature selection and Impurity metrics -continuous descriptive features and Targets-Similarity based learning- Feature space- Predicting continuous targets-Error based learning- Measuring Error-Error surfaces.

Suggested activities

- Learning based exercises
- Flipped classroom in learning models

Suggested Evaluation Methods:

- Seminar on data analytics applications
- Seminar on Probability based learning

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course Students will be able to:

- Apply the skills of data inspecting and cleansing.
- Determine the relationship between data dependencies using statistics
- Can handle data using primary tools used for data science in Python
- Represent the useful information using mathematical skills
- Can apply the knowledge for data describing and visualization using tools.

TEXT BOOKS:

1. Grus, Joel, “Data science from scratch: first principles with python”, O'Reilly Media, 2019.
2. Chirag Shah, “A Hands-on Introduction to Data Science”, Cambridge University Press, UK, 2020.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.

REFERENCES:

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2. Aragues, A. “Visualizing Streaming Data: Interactive Analysis beyond Static Limits”, O’Reilly Media, Inc, 2018.
3. https://www.coursesidekick.com/statistics/study-guides/introstats1
4. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
5. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2	3	2	1	1	2	1	2	3	2	3	2
2	3	2	3	2	3	2	1	1	2	1	2	3	2	2	3
3	3	2	3	2	3	2	1	1	2	2	2	3	2	2	1
4	3	2	3	2	3	2	1	1	2	2	2	3	3	3	2
5	3	2	3	2	3	2	1	1	2	2	2	3	3	3	2
Avg.	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**3**	**3**	**2**

AZ5311 **DATA SCIENCE LABORATORY** **L T P C**
0 0 4 2

LIST OF EXPERIMENTS:

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

List of Equipments:

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

COURSE OUTCOMES:

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

1. Make use of the python libraries for data science
2. Make use of the basic Statistical and Probability measures for data science.
3. Perform descriptive analytics on the benchmark data sets.
4. Perform correlation and regression analytics on standard data sets
5. Present and interpret data using visualization packages in Python.

TOTAL: 60 PERIODS

MAPPING of COs with PO's and PSO's

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

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

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.

COURSE 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.

COURSE OUTCOMES	Program Outcomes (POs) & Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	2	2	1	1	2	1	1	1	3	3	3
CO2	2	3	2	2	2	2	2	1	2	1	1	1	3	3	3
CO3	2	3	3	3	3	2	2	1	2	1	1	2	2	2	2
CO4	2	2	3	2	3	3	2	1	3	1	2	2	3	3	3
CO5	2	2	3	2	3	3	2	1	2	1	2	2	3	3	3
CO6	2	3	3	3	3	3	2	1	3	1	2	2	3	3	3

GE5361 PROFESSIONAL DEVELOPMENT L T P C
0 0 2 1

OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts

Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: 10 Hours

Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion the students will be able to

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

GE5251 ENVIRONMENTAL SCIENCES L T P C
3 0 0 3

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

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 9

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 9

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 9

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 9

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 H u m an 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 analyze 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.

AZ5402 MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE L T P C
3 0 0 3

UNIT I VECTOR SPACES & LINEAR MAPS 9

Vector Spaces, Definition of Vector spaces, Subspaces, sums of Subspaces, Direct Sums, Span and Linear Independence, bases, dimension - Definition of Linear Maps - Algebraic Operations on L(V,W) - Null spaces and Ranges - Fundamental Theorems of Linear Maps - Representing a Linear Map by a Matrix- Invertible Linear Maps- Isomorphic Vector spaces-Linear Map as Matrix Multiplication-Operators-Products and Quotients of Vector Spaces.

Suggested Activities:

- Exploration on the usage of vector spaces and linear maps
- Solving a problem by choosing appropriate representation for the given data.

Suggested Evaluation Methods:

- Assignments on problem solving using vector space and linear maps
- Tutorials on vector space and linear maps

UNIT II EIGENVALUES, EIGENVECTORS, AND INNER PRODUCT SPACES 9

Eigenvalues and Eigenvectors - Eigenvectors and Upper Triangular matrices - Eigenspaces and Diagonal Matrices - Inner Products and Norms - Linear functionals on Inner Product spaces- Orthogonal Complements and Minimization Problems- Adjoints - Self-Adjoint Operators -Normal Operators.

Suggested Activities:

- Exploration on the usage of eigenvalues and eigenvectors
- External learning - different structures on norms and inner products
- Identifying the relationship between inner products and norms

Suggested Evaluation Methods:

- Assignments on problem solving using eigenvalues and eigenvectors
- Tutorials on inner products and norms

UNIT III PROBABILITY, RANDOM PROCESS AND STATISTICAL METHODS 10

Probability theory and axioms- Random variables- Discrete and Continuous Random Variables and Probability Distributions- Joint Probability Distributions- Random Process: Definitions – stationary in random processes – strict sense and wide sense stationary processes – autocorrelation and properties- Poisson and Gaussian processes and properties - Expectations and moments; Covariance and correlation - Statistics and sampling distributions - Method of Moments.

Suggested Activities:

- Demonstrating the probability distribution of different data sets.
- Exploring the correlations between the different features of data

- Identifying the use of statistical methods in data analysis

Suggested Evaluation Methods:
- Assignments on probability and random process
- Tutorials on statistical methods in data analysis

UNIT IV HIGH-DIMENSIONAL SPACE 9

The Law of Large Numbers - The Geometry of High Dimensions- Properties of the Unit Ball - Generating Points Uniformly at Random from a Ball - Gaussians in High Dimension - Random Projection and Johnson-Linden Strauss Lemma Dimension -Separating Gaussians- Fitting a Spherical Gaussian to Data.

Suggested Activities:
- Exploring the Geometry of High Dimensions
- Application of Random Projection and Johnson-Linden Strauss Lemma

Suggested Evaluation Methods
- Assignments on high dimensional data representation and analysis
- Tutorials on Random Projection

UNIT V SINGULAR VALUE DECOMPOSITION 8

Singular Vectors - Singular Value Decomposition (SVD)- Best Rank-k Approximations -Left Singular Vectors-Power Method for Singular Value Decomposition- Applications of Singular Value Decomposition

Suggested Activities
- Exploring the Singular Value Decomposition
- Application of Singular Value Decomposition

Suggested Evaluation Methods
- Assignments on Singular Value Decomposition
- Tutorials on Best Rank-k Approximations

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Find the basis and dimension of vector space and linear map
CO2: Obtain eigenvalues and eigenvectors of the data and represent them inner product space
CO3: Apply probability and random process concepts to in data analysis
CO4: Represent the large dimension data in high dimensional space and perform analysis
CO5: Apply Singular Value Decomposition on the data to simplify the problem
CO6: Demonstrate the use of mathematics in data science through a case study.

TEXT BOOKS:

1. S. Axler, Linear algebra done right, Springer,2017.
2. Peter Olofsson, Mikael Andersson, Probability, Statistics, and Stochastic Processes, 2nd Edition, Published by John Wiley & Sons, Inc., Hoboken, New Jersey 2012.
3. Avrim Blum, John Hopcroft, and Ravindran Kannan, Foundations of Data Science, Cambridge University Press; 1st edition 2020.

REFERENCES:

1. E. Davis, Linear algebra and probability for computer science applications, CRC Press, 2012.
2. J. V. Kepner and J. R. Gilbert, Graph algorithms in the language of linear algebra, Society for Industrial and Applied Mathematics,2011.

3. Elden Lars, Matrix methods in data-mining and pattern recognition, Society for Industrial and Applied Mathematics,2007.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	2	1	1	1	1	1	3	2	3	2
2	3	3	3	3	2	2	1	1	1	1	1	3	2	2	3
3	3	3	3	3	2	2	1	1	1	1	1	3	2	2	2
4	3	3	3	3	2	2	1	1	1	1	1	3	3	3	2
5	3	3	3	3	2	2	1	1	1	1	1	3	3	3	2
6	3	3	3	3	2	2	1	1	1	1	1	3	3	3	3
Avg.	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**3**	**3**	**3**	**3**

IT5403 OPERATING SYSTEMS L T P C
3 0 0 3

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 9

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 9

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

COURSE 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.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	1	1	1	1	-	2	-	-	2	1	2	-
2	3	3	2	2	1	1	1	-	2	2	-	2	1	2	-
3	3	3	2	2	1	2	1	3	1	3	2	2	2	-	1
4	3	3	2	2	1	-	1	-	2	-	-	2	1	1	-
5	2	3	2	2	2	2	1	3	2	3	2	2	1	1	-
Avg.	2.8	3	2	2	1	2	1	3	1.8	3	2	2	1.5	1.8	1

AZ5401 ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

UNIT I ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING 9

Foundations of AI: Importance of AI, Evolution of AI, Applications of AI, Classification of AI systems with respect to environment – Intelligent Agents – Structure of Agents, Multi Agents and Collaboration systems - Heuristic search strategies – Constraint Satisfaction Problem: Backtracking and Local Search - Optimization problems.

Suggested Activities:

- AI Quiz (Paper Pen/Online Quiz)
- Introducing the concept of Smart Cities, Smart Schools and Smart Homes
- Developing a framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using informed search techniques and uninformed search techniques
- Simple program on informed search algorithm

Suggested Evaluation Methods:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT II ADVERSARIAL SEARCH AND GAMES 9

Min-max Search, Heuristic Alpha-Bata Tree Search, Cutting of Search, Monte Carlo Tree Search - Optimal Decisions in Games: Alpha-Beta Pruning, Stochastic Games, Partially Observable Games, Card Game.

Suggested Activities:

- Developing a framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using simple game program
- Simple program on tic-tac-toe game
- Simple program on 8 queen puzzles

Suggested Evaluation Methods:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT III KNOWLEDGE, REASONING, AND PLANNING 9

Propositional Logic and Theorem - First- Order Logic: Knowledge Engineering, Effective Propositional Model Checking, Interference - Knowledge Representation Techniques - Reasoning Systems: Resolution and Theorem proving, Temporal, Spatial and Probabilistic Reasoning – Bayesian Networks - Planning in the Real World: Nondeterministic domains.

Suggested Activities:

- Developing a framework for real life activities such as propositional theorem
- Developing algorithms for basic mathematical expressions using simple reasoning systems
- Simple program on first order logic method

Suggested Evaluation Methods:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT IV AI PLANNING AND NLP 9

Natural language processing – Language understanding models – NLP Syntax and Semantics – Introduction to Statistical NLP – Classical Planning – Types – Graph Plan and SAT plan – Partial Order Planning

Suggested Activities:

- Developing a framework for real life activities such as monitoring and planning.
- Developing algorithms for basic Boolean satisfiability
- Simple program m – Graph Plan

Suggested Evaluation Methods:

- Quizzes on Knowledge in AI
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT V ADVANCEMENTS AND APPLICATIONS IN AI 9

HMM – language generation models – Applications of AI – Chatbot: types, architecture – Autonomous driving – AI assistants – Recommendation system – AI in security – Expert systems: medical, commerce, societal applications

Suggested Activities:

- Development of Chatbot
- Study of popular recommendation systems

Suggested Evaluation Methods:

- Evaluation of programming exercises
- Quiz on recent trends
- Assignment on HMM problems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception and knowledge representation.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world Problems.
4. Analyze and illustrate how search algorithms play vital role in problem solving
5. Illustrate the construction of learning and expert system.
6. Discuss current scope and limitations of AI and societal implications

TEXT BOOKS:

1. Russell, S. and Norvig, P. 2020. Artificial Intelligence - A Modern Approach, 4th edition, Prentice Hall.
2. Efraim Turban and Jay E. 2002. Aronson Decision Support Systems and Intelligent Systems, 6th edition, Pearson Education
3. Castillo, E., Gutiérrez, J. M., and Hadi, A. S. 2012. Expert Systems and Probabilistic Network Models, Springer-Verlag.

REFERENCES:

1. Ric, E., Knight, K and Shankar, B. 2017. Artificial Intelligence, 3rd edition, Tata McGraw Hill.

2. Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson.
3. Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
4. Alpaydin, E. 2015. Introduction to Machine Learning. 3rd edition.
5. Sutton R.S. and Barto, A.G. 2018. Reinforcement Learning: An Introduction, 2nd Edition MIT Press.
6. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	1	2	1	1	2	2	2	1	2	3	2	2
2	3	3	2	2	2	1	1	2	2	2	1	2	3	2	2
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5	2	2	2	2	3	1	1	2	2	2	1	2	3	3	2
6	3	3	3	2	3	1	1	2	2	2	1	2	3	2	2
Avg.	**2**	**2**	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**

AZ5403 DATA EXPLORATION AND VISUALIZATION L T P C
3 0 0 3

UNIT I THE FUNDAMENTALS OF EDA 9

The Fundamentals of EDA – Identifying Data quality – Missing values – Irregular Cardinality – Outliers – handling data Quality - Describing Data, Preparing Data Tables, Understanding Relationships - Identifying and Understanding Groups, Building Models from Data.

Suggested activities:

1. Explore your dataset
2. Extract important variables and leave useless variables
3. Identify outliers, missing values, or human error

Suggested Evaluation Methods:

1. Assignments on exploratory data analysis

UNIT II EXPLORATORY DATA ANALYSIS 9

Significance of EDA - Comparing EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids for EDA - EDA with Personal Email - Data Transformation - Descriptive Statistics - Grouping Datasets Correlation - Time Series Analysis.

Suggested activities:

1. Identify the relationship(s), or lack of, between variables
2. Discover patterns and Use correlation analysis to identify linear relationships between two variables.

Suggested Evaluation Methods:

1. Creating an application and exploring real time analysis

UNIT III UNIVARIATE, BIVARIATE, MULTIVARIATE DATA ANALYSIS 9

Univariate Data Analysis - Bivariate Association - Regression Analysis - Cluster Analysis - Visualization Design Principles – Tables - Univariate Data Visualization - Bivariate Data Visualization - Multivariate Data Visualization - Visualizing Groups - Dynamic Techniques.

Suggested activities:

1. Practice using the qnorm function.
   Given a normal distribution with mean 650 and standard deviation 125. There exist two quantiles, the lower quantile q1 and the upper quantile q2, that are equidistant from the mean 650, such that the area under the curve of the normal between q1 and q2 is 80%. Find q1 and q2.
   Calculate the mean, variance, and the lower quantile q1 and the upper quantile q2, that are equidistant and such that the range of probability between them is 80%.
2. Combine two of the techniques you've learned to visualise the combined distribution of cut, carat, and price.

Suggested Evaluation Methods:

1. Creating an application and understanding different data visualization.
2. Assignments of the problem

UNIT IV DATA VISUALIZATION (2D / 3D) 9

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Stylesheets - Three-Dimensional Plots - Geographic Data with Basemap - Visualization with Seaborn.

Suggested activities:

1. Scatter Plot with Matplotlib
2. Histogram with Plotnine (ggplot)
3. Boxplot with Seaborn

Suggested Evaluation Methods:

1. understanding 2D/3D data visualization with an application by a developmental model
2. Assignments of the problem

UNIT V INTERACTIVE DATA VISUALIZATION 9

Text and Document Visualization - Levels of Text Representations -Single Document Visualizations - Document Collection Visualizations- Interaction Concepts and Techniques - Designing Effective Visualizations - Comparing and Evaluating Visualization Techniques - Visualization Systems - Systems based on Data Type - Systems based on Analysis Type - Text Analysis and Visualization - Modern Integrated Visualization Systems

Suggested activities:

1. Emphasizing Fractions Using a Pie Chart
2. Plotting X/Y Data with a Scatter Chart
3. Add Magnitudes to X/Y Data with a Bubble Chart
4. Add Controls and Define data Structure for Interactive Charts
5. Integrate Charts to a web page and establish default style for the charts

6. Draw Composite charts and handle click events
7. Create Timeline chart
8. Visualize the Geographic data, incorporate label animation

Suggested Evaluation Methods:

1. Creating an interactive data visualization in a web page.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Understand the fundamentals of exploratory data analysis and its commonly used techniques.
- Apply statistical concepts to analyze data and explore the tools used for EDA.
- Perform multivariate data visualization and analysis.
- Interpret results of exploratory data analysis using stylesheets
- Implement visualization techniques in web for applications

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”,Packt Publishing, 2020.
2. Thomas Cleff , “Exploratory Data Analysis in Business and Economics”, Springer International, 2013.
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly Media, 1st Edition, December 2016.
4. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization:Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

REFERENCES:

1. Glenn J. Myatt, Wayne P. Johnson,” Making Sense Of Data I”, John Wiley & Sons, 2nd Edition, 2014.
2. Glenn J. Myatt, Wayne P. Johnson,” Making Sense Of Data Ii”, John Wiley & Sons, 2nd Edition, 2009.
3. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	3	2	1	1	1	-	1	3	2	3	2
2	3	3	3	3	3	2	1	1	1	-	1	3	2	2	3
3	3	3	3	3	3	2	1	1	1	-	1	3	2	2	2
4	2	2	2	2	3	2	1	1	1	-	1	3	3	3	2
5	2	2	2	2	3	2	1	1	1	1	1	3	3	3	2
Avg.	2	2	2	2	3	**2**	**1**	**1**	**1**	1	**1**	**3**	**3**	**3**	**3**

AZ5411 **ARTIFICIAL INTELLIGENCE LAB** **L T P C**
0 0 4 2

LIST OF EXPERIMENTS:

1. Study Experiment – AI tools: Working and Installation
2. Write a program to implement heuristic search procedure.
3. Design a program to implement depth limited search
4. Write a program to implement water jug problem.
5. Program to implement A* / AO* algorithm.
6. Write a program to implement Bidirectional Search
7. Implementation of n-Queen problem.
8. Write a program to optimize Travelling Sales Person problem.
9. Write a program to implement search problem of 3 x 3 puzzles.
10. Write a program to implement Hangman game using python.
11. Write a program to implement tic tac toe game for O and X.
12. Implement a program to perform abstractive text summarization
13. Implement a program to perform extractive text summarization.
14. Design and implement a Chat bot application.
15. Mini Project for societal application.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

1. Implement simple PEAS descriptions for given AI tasks
2. Implement a program that can summarize the given text document .
3. Demonstrate the ability to solve problems using searching and backtracking
4. Ability to implement simple reasoning systems using either backward or forward inference Mechanisms
5. Will be able to choose and implement suitable techniques for a given AI task

SOFTWARE:

Open-Source Software using Python

REFERENCES:

1. Richard Bosworth, 1995—A Practical Course in Functional Programming Using Standard MLǁ, McGraw-Hill
2. Rachel Harrison, 1993 —Abstract Data Types in Standard MLǁ, John Wiley & Sons.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	1	1	1	-	1	3	2	3	2
2	3	3	3	3	3	2	1	1	1	-	1	3	2	2	3
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5	3	3	3	3	3	2	1	1	1	-	1	3	3	3	2
Avg.	3	3	3	3	3	**2**	**1**	**1**	**1**	-	**1**	**3**	**3**	**3**	**3**

AZ5412 **DATA VISUALIZATION LAB** **L T P C**
0 0 4 2

LIST OF EXPERIMENTS:

1) Generate the data quality report in terms of identifying missing values, irregular cardinality and outliers for an insurance company.
2) Descriptive feature identification for predicting a target feature by visualizing relationships.
3) Data preparation for Exploration using normalization, binning and sampling methods.
4) Design and create data visualizations.
5) Conduct exploratory data analysis using visualization.
6) Craft visual presentations of data for effective communication.
7) Use knowledge of perception and cognition to evaluate visualization design alternatives.
8) Design and evaluate color palettes for visualization based on principles of perception.
9) Apply data transformations such as aggregation and filtering for visualization.
10) Develop data exploration and visualization for an application - Mini Project

SOFTWARE:

Python data exploration with Pandas
Data Exploration and visualization in R

COURSE OUTCOMES:

- Create data visualization by predicting relations among data
- Perform EDA using visualization techniques.
- Perform multivariate data visualization and analysis.
- Implement visualization using principles of perception.
- Implement visualization techniques in web for applications

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	2	2	3	2	1	1	1	-	1	3	2	3	2
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5	2	2	2	2	3	2	1	1	1	2	1	3	3	3	2
Avg.	2	2	2	3	3	**2**	**1**	**1**	**1**	2	**1**	**3**	**3**	**3**	**3**

AZ5501 MACHINE LEARNING METHODS L T P C
3 0 0 3

UNIT I MACHINE LEARNING BASICS 9

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of Machine learning methods – Early trends in Machine learning – Data understanding, representation and visualization – Hypothesis - Modelling in Machine learning - Classification: Probability theory and Bayes rule – Generative vs. discriminative training – Self-supervised Learning and Transfer learning.

Suggested Activities:

- Discussion on application domains of machine learning in data analytics.
- External Learning – Study of tools for data analytics.

Suggested Evaluation Methods:

- Quiz on machine learning techniques and applications.
- Implementation of machine learning techniques with Python libraries.

UNIT II REGRESSION & CLASSIFICATION 9

Linear Regression – Non-linear regression – Logistic regression – Regularization techniques - Decision Tree based Learning algorithms – Induction algorithms – Regression trees - Instance based Learning - K-Nearest Neighbor Algorithm - Support Vector Machines: Hard and soft margin – Functional and Geometric margin - Maximum margin linear separators – Kernels for learning non-linear functions.

Suggested Activities:

- Discussion on importance of supervised learning methods and applications.
- Seminar on Regression techniques (Lasso, Elastic Net, etc.) and Decision tree based design approaches.

Suggested Evaluation Methods:

- Quiz on applications of decision tree, and SVM algorithms.
- Implementation of ML techniques for classification problems.

UNIT III ENSEMBLE, CLUSTERING AND DIMENSIONALITY REDUCTION 9

Ensemble Learning: Using committees of multiple hypotheses. Bagging - Random Forest - Adaptive Boosting, Stacking and DECORATE - Active learning with ensembles – Clustering – K-means Clustering– Hierarchical Clustering - Expectation Maximization algorithm – Gaussian Mixture Model – Dimensionality Reduction – Principal Component Analysis – Linear Discriminant Analysis (LDA) - Latent Variable Models (LVM) – Latent Dirichlet Allocation (LDA) – Independent Component Analysis (ICA)

Suggested Activities:

- Group discussion on ensemble learning techniques and its limitations.
- Case study of evaluation metrics of learning algorithms.
- Implementation of clustering algorithms.

Suggested Evaluation Methods:

- Implementation of ensemble learning methods in Python.

UNIT IV PROBABILISTIC LEARNING MODEL

Bayesian Learning - Naive Bayes Algorithm - Introduction to Graphs – Bayesian Belief Networks - Inference in Graphical Models - Markov Chain – Markov Model - Hidden Markov Models – Inference – Learning - Generalization – Undirected Graphical Models -

Suggested Activities:

- Discussion on importance of graphical models
- Implementation of Naïve Bayes Algorithm

Suggested Evaluation Methods:

- Assignment on Inference
- Quiz on Bayesian Belief Network

9

UNIT V REINFORCEMENT LEARNING & ANN

Overview of Reinforcement Learning - Components of Reinforcement Learning - Markov decision process - Model Based Learning - Model Free Learning - Q Learning – Artificial Neural Networks – Structure and Activation functions – Perceptron – Multi Layer Perceptron - Back Propagation – Gradient descent training - Radial Basis function Neural Network

Suggested Activities:

- Case study on application of artificial neural networks in image/video data.
- Discussion on different ANN based ML methods.

Suggested Evaluation Methods:

- Implementation of basic ANN techniques
- Quiz on future applications of ANN.
- Assignments on reinforcement learning techniques for the real-time applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basics of machine learning.
2. Solve analytical problems with relevant mathematics background knowledge.
3. Explain testing and evaluation machine learning algorithms.
4. Understand ANN model apply knowledge in data analytics.
5. Explore the knowledge of unsupervised learning in data analysis.
6. Apply ML techniques to various real time applications.

TEXT BOOKS:

1. Ameet V Joshi, “Machine Learning and Artificial Intelligence”, Springer Publications, 2020.
2. Sridhar S. and Vijayalakshmi M., “Machine Learning”, Oxford University Press, 2021.

REFERENCES:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, “Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies”, MIT press, 2015
3. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997
4. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
5. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	1	2	1	1	2	2	2	1	2	2	1	1
2	3	3	2	2	2	2	1	2	2	2	1	2	1	1	1
3	2	2	2	2	2	1	1	2	2	2	1	2	1	1	1
4	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
5	2	2	2	2	3	1	1	2	2	2	1	2	2	3	1
6	3	3	3	2	3	2	1	2	2	2	1	2	3	2	2
Avg.	2	2	2	2	3	1	1	2	2	2	1	2	2	2	1

IT5551 COMPUTER NETWORKS L T P C
3 0 0 3

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. Reinforcement learning: Markov decision process, Q-learning

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 9

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 9

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

1: Highlight the significance of the functions of each layer in the network.
2: Identify the devices and protocols to design a network and implement it.
3: Build network applications using the right set of protocols and estimate their performances.
4: Trace packet flows and interpret packet formats.
5: Apply addressing principles such as subnetting and VLSM for efficient routing.
6: 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.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	-	-	-	-	-	-	-	1	-	-	1	1
2	3	3	3	3	2	2	2	-	2	-	1	-	1	2	1
3	3	3	2	3	2	-	-	-	-	-	-	2	1	2	1
4	3	3	3	3	3	1	2	1	2	-	1	1	1	2	1
5	3	2	2	3	2	1	2	1	1	-	1	2	-	2	1
6	3	2	2	3	2	1	2	1	1	-	-	2	1	2	1
Avg.	3	3	2	3	2	1	2	1	2	-	1	2	1	2	1

AZ5502 DATA ANALYTICS L T P C
3 0 0 3

UNIT I INTRODUCTION TO DATA ANALYTICS AND BIG DATA 9

Overview of Data Analytics: Types of Data Analysis – Steps in Data Analysis Process – Data Repositories – ETL process – Roles, Responsibilities and Skill Sets of Data Analysts – Data Analytic

Tools - – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Classification of big data analytics – Top Challenges of Big Data – Applications.

Suggested Activities:

- Case studies on big data applications.
- Challenges of big data in real-time and domain-specific problems.
- Demonstration on data analytics tools.

Suggested Evaluation Methods:

- Assignment on case studies related to applications of big data analytics.
- Group presentation on big data applications with societal need.
- Quizzes on big data and data analytics terminologies, data analytic tools and big data applications.

UNIT II DESCRIPTIVE AND INFERENTIAL STATISTICS 9

Types of Data – Mean, Median and Mode – Standard Deviation and Variance – Types of Data Distribution – Percentiles and Moments – Correlation and Covariance – Data Visualization: Tables, Charts, Plots - Modeling Uncertainty: Events and Probabilities – Conditional Probability – Bayesian Inferences - Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

Suggested Activities:

- Practicing numerical problems based on descriptive and inferential statistics.
- Demonstration of descriptive analysis using Python.
- Demonstration of data visualization in Python.

Suggested Evaluation Methods:

- Assignment on data distribution and description using open-source tools.
- Group Presentation on description and inference of data in real world applications.
- Quiz on descriptive and inferential statistics.

UNIT III EXPLORATORY DATA ANALYTICS 9

Data Analysis Foundations - Univariate, bivariate and multivariate analysis of Numeric and Categorical Attributes – Graph Data - Kernel Methods - Kernel Matrix, Vector Kernels, Basic Kernel Operations in Feature Space and Kernels for Complex Objects - High-dimensional Data – Data Cleaning – Dimensionality Reduction - Principal Component Analysis, Kernel Principal Component Analysis.

Suggested Activities:

- Solving problems in univariate, bivariate and multivariate analysis.
- Demonstration on Graph Data using python.
- Demonstrate PCA and KPCA using Iris data set in Python.

Suggested Evaluation Methods:

- Assignment on Multivariate analysis of numeric and categorical attributes.
- Group Presentation on Kernel methods.
- Quiz on High dimensional data.

UNIT IV DATA ANALYTICAL FRAMEWORKS **9**

Hadoop Overview – HDFS (Hadoop Distributed File System) – MapReduce – NoSQL: CAP theorem – HBase - MongoDB – CouchDB – Hive – Architecture – Hive Query Language (HQL) – Sqoop - Apache Drill**.**

Suggested Activities:

- Case studies on data analytical frameworks with real-time applications.
- Hands-on session for Installation and configuring Hadoop and MapReduce.
- Develop algorithms with Map Reduce framework.

Suggested Evaluation Methods:

- Practical – Programming assignments in Hbase, MongoDB and CouchDB.
- Quiz on Hive, Sqoop and Apache Drill.
- Mini Project (Group) – Collect the real-time data and store it in any one of the NoSQL databases. Implement analytical techniques using Map-Reduce Tasks and Visualize the results.

UNIT V BUSINESS ANALYTICS **9**

Introduction – Drivers for Business Analytics – Framework for Business Analytics – Life Cycle for Business Analytics Process – Applications of Business Analytics: Healthcare, Customer Service and Support, etc.

Suggested Activities:

- Case studies on real-time applications related to business analytics.
- Demonstration of business analytical tools.
- Demonstration of data analytics in business applications using python.

Suggested Evaluation Methods:

- Assignment on Framework for Business Analytics.
- Quiz on Business data analytics methods.
- Group presentation on the real-time applications.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the real-world business problems and model with analytical solutions.
2. Analyze an analytical problem with relevant statistical knowledge.
3. Apply all data preprocessing techniques on high dimensional data.
4. Explore different big data frameworks for programming, storage and statistical analysis.
5. Apply the appropriate analytical solutions for business applications.
6. Implement data analytics and data visualization using Python.

TEXT BOOKS :

1. Mohammed J. Zaki and Wagner Meira, Data Mining and Analysis - Fundamental Concepts and Algorithms, Cambridge University Press, 2014.
2. Rayan Wali&Quot;," A Practical Guide to AI and Data Analytics", Independently Published, 2022.

3. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, “Essentials of Business Analytics”, Cengage Learning, Second Edition, 2016.

REFERENCES:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
3. Wayne L. Winston, Brian Larson, “Data Analysis with Microsoft Power BI”, McGraw Hill Professional, 2020.
4. Ronen Feldman, James Sanger, “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Cambridge University Press, 2009.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	3	3	2	2	2	3	3	3	2
2	3	3	3	3	3	3	3	3	2	2	2	3	3	3	2
3	3	3	3	3	3	3	3	3	2	2	2	3	3	3	2
4	3	3	3	3	3	3	3	3	2	2	2	3	3	3	2
5	3	3	3	3	3	3	3	3	2	2	2	3	3	3	3
6	3	3	3	3	3	3	3	3	2	2	2	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	2	2	2	3	3	3	2.33

AZ5503 OPTIMIZATION TECHNIQUES. L T P C
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UNIT I CLASSICAL OPTIMISATION TECHNIQUES 9

Statement of an Optimization Problem-Design Vector -Design Constraints - Constraint Surface-Objective Function - Objective Function Surfaces - Classification of Optimization Problems - Single-Variable Optimization - Multivariable Optimization with no Constraints– equality constraints – inequality constraints - Kuhn-Tucker conditions.

Suggested Activities

- Exploration on the usage of optimization techniques
- Solving a problem by choosing appropriate representation for the given data.

Suggested Evaluation Methods

- Assignments on problem solving using constraints
- Tutorials on optimization problems and constraints

UNIT II LINEAR MODELS 9

Introduction of Operations Research - Mathematical formulation of LPP- Graphical Methods to solve LPP- Simplex Method- Big M method, Two-Phase Method-Integer programming: Branch and bound method- Transportation and Assignment problems -Travelling salesman problem.

Suggested Activities

- External learning – LPP based applications
- Solving problems in LPP

Suggested Evaluation Methods

- Assignments on problem solving using LPP methods
- Tutorials on Operations Research problems

UNIT III: NON LINEAR MODELS **9**

One dimensional Unrestricted Search- Dichotomous Search- Quadratic Interpolation Method- Newton's method and quasi-Newton methods Unconstrained Optimization Techniques**-** Direct Search Methods: Grid search methods, Powell's method, -Indirect methods**-** Steepest descent- Newton's method-constrained Optimization Techniques- Direct Random search method, Sequential linear programming - Indirect methods **-**Exterior penalty function method, Interior penalty function method

Suggested Activities

- Exploration on the usage of non-linear models
- Implementation of different direct and indirect methods of optimization

Suggested Evaluation Methods

- Assignments on non-linear models
- Tutorials on direct and indirect methods

UNIT IV OPTIMIZATION TECHNIQUES FOR DATA SCIENCE **9**

Gradient Descent (flow) -Projected Gradient (white-box adversarial attack) -Subgradient (svm) - Proximal Gradient (lasso) -Conditional Gradient (recommendation system) - Coordinate Gradient (graph clustering) -Lower Bound I - Acceleration (total variation denoising) - Mirror Descent (reinforcement learning) - Smoothing (robust svm) - Proximal Average (federated learning) -Splitting (robust PCA).

Suggested Activities

- Implementation of data science application using optimization techniques
- Analysis of algorithms based on optimization using suitable dataset

Suggested Evaluation Methods

- Assignments on optimization techniques for data science
- Tutorials on data science optimization techniques

UNIT V MODERN OPTIMIZATION ALGORITHMS **9**

Genetic Algorithms - Simulated Annealing- Particle Swarm Optimization- Ant Colony Optimization- Optimization of Fuzzy Systems- Representative Metaheuristic Algorithms- Firefly Optimization Algorithm- Honey Bee Swarm Optimization Algorithm.

Suggested Activities

- Implementation of modern optimization algorithms in real world problems
- Analysis of modern algorithms based on optimization using suitable dataset

Suggested Evaluation Methods

- Assignments on optimization algorithms
- Tutorials on analysis of modern optimization algorithm.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the use of optimization techniques
2. Solve problems using linear optimization techniques
3. Use appropriate non linear optimization techniques to solve the problem
4. Apply the optimization techniques for data science applications
5. Explore the contemporary optimization approaches

TEXT BOOKS:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson, 10th Edition, 2017.
2. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P),5thedition,2019
3. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.(Unit IV)

REFERENCES:

1. J.K. Sharma,"Operations Research Theory and Applications ", Trinity Press, Sixth Edition, New Delhi, 2016.
2. Sukanta Nayak, Fundamentals of Optimization Techniques with Algorithms, 1st Edition, Academic Press, Copyright © 2021 Elsevier Inc.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	-	-	1	-	1	-	1	-	2	3	1
2	3	3	3	2	2	3	1	2	2	-	1	-	2	3	2
3	3	3	3	2	2	3	1	2	2	-	1	-	2	3	2
4	3	3	3	3	2	3	1	2	1	1	2	1	3	3	3
5	3	3	3	3	2	1	1	-	1	-	2	2	3	3	3
AVg.	**3**	**3**	**3**	**2.4**	**2**	**2.5**	**1**	**2**	**1**	**1**	**1.4**	**1.5**	**2.4**	**3**	**2.2**

AZ5511 **MACHINE LEARNING LABORATORY** **L T P C**
0 0 4 2

LIST OF EXPERIMENTS:

1. Implement Naive Bayes learning algorithm for a sample training data set.
2. Implement a linear regression method.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4. Write a program to handle overfitting.
5. Implement SVM algorithm for a given data set.
6. Implement Bagging, boosting, and DECORATE algorithms with performance evaluation mechanisms.
7. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test

the same using appropriate data sets.

8. Implement facial recognition application with artificial neural network
9. Choose best machine learning algorithm to implement online fraud detection
10. Write a program to implement k-Nearest Neighbour algorithm.
11. Implement a k-means partitional clustering
12. Implement sentiment analysis using random forest optimization algorithm.

TOTAL : 60 PERIODS

OUTCOMES:

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

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Python/R/Java programs for various learning algorithms.
3. Implement ensemble and reinforcement learning techniques for a given data set and evaluate them.
4. Implement artificial neural network for a given application and dataset.
5. Identify and apply machine learning algorithms to solve real world problems.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	3	2	1	2	2	2	1	2	2	2	1
2	3	3	3	2	3	2	1	2	2	2	1	2	2	2	1
3	3	3	3	3	3	2	1	2	2	2	1	2	2	3	1
4	3	3	3	3	3	2	1	2	2	2	1	2	2	3	1
5	3	3	3	3	3	2	2	2	3	2	2	3	3	3	2
Avg.	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**1**

AZ5512 DATA ANALYTICS LABORATORY L T P C

0 0 4 2

LIST OF EXERCISES:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages. Read data from text file, excel and the web.
2. Choose a dataset from Kaggle and explore various commands for descriptive analytics.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis on the dataset.
4. Perform Z-test, T-test & ANOVA on the dataset.
5. Perform data pre-processing operations handling missing data and normalization on the dataset.
6. Perform univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis on the dataset.
7. Perform Bivariate analysis: Linear and logistic regression on the dataset.
8. Perform Multiple Regression analysis on the dataset.
9. Load a graph dataset and perform basic analysis such as calculating node degree centrality, identifying important nodes using between-ness centrality.

10. For the graph dataset chosen in previous question, find communities using graph clustering.
11. Implement page rank/HITS on large scale graph datasets.
12. Load a dataset and measure the regression performance using different kernel functions.
13. Perform kernel matrix operations on the dataset chosen
14. Implement PCA & KPCA - dimensionality reduction techniques on the dataset.
15. Choose any one business analytic tool (MS Excel/Power BI) and perform statistical descriptive and inference analytics.

TOTAL : 60 PERIODS

OUTCOMES:

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

1. Have skills in developing and executing analytical procedures in python.
2. Explore data and understand the distribution of data.
3. Develop, implement and deploy predictive models using regression.
4. Implement simple to complex data modeling with graph datasets.
5. Implement programs using kernel functions and tune models.
6. Have practical experience in carrying out descriptive and inferential statistics in a business analytical tool.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	3	3	2	2	3	2	2	2	3	2	2	2
2	2	3	3	3	3	2	2	3	2	2	2	3	2	3	2
3	3	3	3	3	3	2	3	3	2	2	2	3	2	3	2
4	3	3	3	3	3	2	3	3	2	2	2	3	2	2	2
5	3	3	3	3	3	2	3	3	2	2	2	3	2	2	2
6	3	3	2	3	3	2	3	3	2	2	2	3	2	3	3
Avg.	2.66	3	2.66	3	3	2	2.66	3	2	2	2	3	2	2.5	2.16

AZ5601 DEEP LEARNING TECHNIQUES L T P C

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UNIT I BASICS OF NEURAL NETWORK 9

Artificial Neuron - McCulloch Pitts units and Thresholding logic - Perceptron learning algorithm and Convergence - Linear separability - Feedforward Networks - Activation and Loss Functions.

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Suggested Activities

- Implement a perceptron learning algorithm
- Design an artificial neural using thresholding logic and other activation functions
- Analyze convergence of feed forward networks

Suggested Evaluation Methods

- Coding challenges to complete during class time

- Assignment to implement and train the network using appropriate technique and tools
- Quizzes and test

UNIT II INTRODUCTION OF DEEP NEURAL NETWORKS 9

Multilayer perceptron - Gradient Descent(GD) – Backpropagation - Vanishing and Exploding GD problem – Optimization Methods: Stochastic GD: Momentum based GD & Nesterov Accelerated GD, AdaGrad, RMSProp, Adam – Bias Variance tradeoff - Regularization – Dropout.

Suggested Activities:

- Implement a multilayer perceptron
- Experiment with different optimization methods
- Test with regularization techniques

Suggested Evaluation Methods:

- Coding Assignments – Vanishing and Exploding GD
- Tutorial on Multilayer perceptron and optimization methods
- Quizzes Regularization – Dropout

UNIT III CONVOLUTIONAL NEURAL NETWORKS 9

Motivation – Architectural Overview –Pooling – Parameter sharing - Regularization - Popular CNN Architectures: ResNet, AlexNet, VGGNet - Transfer learning –Image classification using Transfer learning.

Suggested Activities:

- Flipped classroom on CNN architectures
- External learning – concept of convolution and pooling layer
- Exploring on Transfer learning

Suggested Evaluation Methods:

- Quizzes on CNN architectures
- Hands-on coding Assignments on image classification using transfer learning

UNIT IV RECURRENT NEURAL NETWORKS 9

Sequence Modelling –Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - Deep Recurrent Networks, Recursive Neural Networks - Long Short-Term Memory Networks – Other Gated RNNs

Suggested Activities:

- Implement and train a simple RNN
- Build a sequence-to-sequence model
- Use a pretrain RNN model and analyse their performance on different sequence modelling task.
- Implement an LSTM network.

Suggested Evaluation Methods:

- Evaluate the accuracy of the RNN models prediction on a test dataset
- Comparison of architectures: LSTM, GRU, RNN on a test dataset

UNIT V AUTOENCODERS AND GENERATIVE MODELS **9**

Autoencoders – Regularized Autoencoders – stochastic Encoders and Decoders – Contractive Encoders - Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine – Directed Generative Nets - Generative Adversarial Networks

Suggested Activities:

- Discussion on Building and training autoencoders
- Understand the math behind the generative models

Suggested Evaluation Methods:

- Assignment problems on Directed Generative nets and Generative adversarial networks
- Quizzes on autoencoders

TOTAL: 45 PERIODS

OUTCOMES

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

1. Understand fundamental neural network concepts, including activation functions and loss functions.
2. Familiarize with different optimizers in machine learning and choose the appropriate one.
3. Design and implement deep learning architectures, such as CNNs, RNNs, autoencoders and Generative models.
4. Implement deep learning models using libraries like TensorFlow or PyTorch.
5. Apply deep learning techniques to real-world problems, with awareness of ethical considerations.

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.

REFERENCES

1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
2. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.
3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
4. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
5. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	3	3	1	-	-	-	-	1	1	2	3	3	3
2	3	3	3	3	1	-	-	-	-	1	1	2	3	3	3
3	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
4	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
5	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
AVg.	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	3	3	3

AZ5602 COMPUTER VISION L T P C
3 0 0 3

UNIT I DIGITAL IMAGE FUNDAMENTALS AND LOW-LEVEL PROCESSING 9

Basics of Image Formation, Colour Spaces - Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform - Linear Filtering - Image Enhancement – Restoration - Histogram Processing.

Suggested Activities:

- Discussion on different colour models and their applications.
- Study of OpenCV libraries for image/video applications.
- Demonstration of offline/online tools for image enhancement/restoration/histogram processing.

Suggested Evaluation Methods:

- Quizzes on various image capturing devices and related techniques.
- Practical – Programming assignments on basic image processing techniques.

UNIT II DEPTH ESTIMATION AND MULTI-CAMERA VIEWS 9

3-D Vision, Perspective - Binocular Stereopsis: Camera and Epipolar Geometry - Homography, Rectification - Direct Linear Transform, RANSAC - 3-D reconstruction framework - Auto-calibration.

Suggested Activities:

- Flipped classroom on camera vision and calibration in computer vision.
- Discussion on 3-D image/video capturing, analysis, and projection techniques.

Suggested Evaluation Methods:

- Quizzes on applications of stereovision and homography.
- Group discussion on handling outliers in image/video data.

UNIT III FEATURE EXTRACTION AND SEGMENTATION 9

Edges - Canny, LOG, DOG - Line detectors (Hough Transform) – Corners: Harris and Hessian Affine - Orientation Histogram, SIFT, SURF, HOG, GLOH - Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Markov Random Fields - Texture Segmentation

Suggested Activities:

- Implementation of line/corner detection techniques.
- Discussion on practical usage of SIFT and SURF based features.
- Flipped classroom on various feature reduction methods.

Suggested Evaluation Methods:

- Quizzes on feature engineering in video analytics.
- Group discussion on different fundamental transformation techniques in image/video data.
- Practical – Programming assignments on filtering techniques.

UNIT IV MOTION ANALYSIS AND TRACKING 9

Background Subtraction and Modelling - Optical Flow – Lucas–Kanade method, KLT - Spatio-Temporal Analysis - Dynamic Stereo - Motion parameter estimation - Tracking considerations – Action recognition

Suggested Activities:

- Python program to display optical flow of a given video data.
- Implementation of Kalman filter for object tracking in video data.
- External learning – Case study of developments in computer vision.

Suggested Evaluation Methods:

- Quizzes on various real time applications of computer vision.

- Group discussion on future apps. in computer vision to solve the real-world problems.

UNIT V OBJECT RECOGNITION AND SCENE ANALYSIS 9

Object detection and recognition, Bag-of-Visual-Words model, Object classification, Face detection and recognition, Deep learning in scene analysis, Applications of computer vision.

Suggested Activities:

- Discussion on applications of object detection and tracking.
- Flipped classroom on challenges and approaches in human face detection and recognition.

Suggested Evaluation Methods:

- Assignments on applications of deep learning in vision based applications.
- Practical – Programming assignments on object detection/recognition techniques.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Describe the concepts related to Image formation and processing.
2. Compare the concepts related to feature detection, matching and detection.
3. Understanding feature based alignment and motion estimation.
4. Study of 3D Reconstruction.
5. Perform image based rendering and recognition.

TEXT BOOKS:

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

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision,
2. Second Edition, Cambridge University Press, March 2004.
3. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
4. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.
5. R.C. Gonzalez and R.E. Woods, Digital Image Processing, 4th Edition,Pearson, 2022.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	3	2	1	2	2	2	1	3	2	1	1
2	3	3	2	2	3	2	1	2	2	2	1	3	2	3	1
3	3	2	2	2	3	2	1	2	2	2	1	3	2	3	1
4	3	2	2	2	3	2	1	2	2	2	1	3	1	3	2
5	3	3	3	2	3	2	1	2	2	2	1	3	2	3	3
Avg.	3	3	2	2	3	2	1	2	2	2	1	3	2	3	2

AZ5603 **IoT AND CLOUD** **L T P C**
3 0 0 3

UNIT 1 FOUNDATIONS OF IoT AND CLOUD 9

Introduction to IoT and its enabling technologies– Sensors, actuators, and smart objects– Wireless Sensor Networks– Cloud Computing and Data Analytics–IoT vs M2M: Understanding the differences– IoT Reference Models: Exploring domain-specific and generic models– Levels of IoT-based systems– IoT Security and Privacy– IoT Applications and Use Cases

Suggested Activities

- Interactive lectures and discussions on enabling technologies
- Group projects exploring IoT and M2M proprietary protocols
- Case study analysis on designing IoT-based ecosystems

Suggested Evaluation Methods

- Quizzes and discussions on IoT enabling technologies (WSN, Cloud and Big Data).
- Assignments on IoT and M2M proprietary protocols
- Group presentations on case study analysis and design

UNIT II DEVELOPING IoT END DEVICES 9

Microprocessors vs Microcontrollers–Open-source hardware movement–Software Development Lifecycle (SDLC) for embedded systems–Arduino IDE– Raspberry Pi– Python, and related packages–Edge Computing and IoT: Concepts and use cases–Integration of IoT devices with cloud platforms

Suggested Activities

- Interactive lectures on open-source hardware and SDLC for embedded systems
- Workshops exploring various IoT development platforms and tools
- Guided projects on developing IoT applications using Arduino and Python
-

Suggested Evaluation Methods

- Quizzes on open-source hardware and SDLC for embedded systems
- Assignments on IoT development platforms and tools such as Atmega Microcontrollers, Cypress Pioneer and NXP Freedom
- Practical exams on developing IoT applications

UNIT III IoT PROTOCOLS 9

MAC Layer Protocols: IEEE 802.15.4, IEEE 802.11ah, IEEE 1901.2a, LoRaWAN–IP-based Protocols: 6LoWPAN, NBIoT–Application Layer Protocols: REST, SCADA, CoAP, MQTT–IoT Networking Concepts: Routing, Topologies, and Addressing–IoT Standardization: Organizations and Initiatives–Interoperability and Integration of IoT Systems

Suggested Activities

- Lectures and discussions on the role of IPv6 in IoT-based systems
- Hands-on workshops exploring various IoT protocols and software tools such as Coap and MQTT.
- Case study analysis of IoT reference models (e.g., Cisco, IBM)

Suggested Evaluation Methods

- Assignments on IoT protocol implementation and software tools

- Quizzes on IPv6 and IoT protocols (CoAP and MQTT)
- Group presentations on IoT reference model analysis

UNIT IV CLOUD OFFERINGS **9**

Cloud storage models and communication APIs–IoT Cloud platforms: WAMP AutoBahn, Xively Cloud, IBM Watson, AWS for IoT–Python web application framework: Django–Serverless Computing and IoT–IoT and Fog Computing–IoT and Blockchain Technology–Case Studies: Smart Home, Smart Cities, Smart Agriculture, Weather Monitoring Systems, Industrial IoT, and Healthcare.

Suggested Activities

- Interactive lectures on cloud models and types of cloud services
- Flipped classroom on using Django and other IoT cloud platforms
- Group projects on implementing IoT solutions using cloud offerings

Suggested Evaluation Methods

- Quizzes on cloud models and IoT cloud platforms
- Assignments on implementing IoT solutions using cloud offerings

UNIT V DATA ANALYTICS FOR IoT **9**

Structured vs Unstructured Data–Data in motion and transit–Overview of Machine Learning techniques–Big Data tools and technologies for IoT analytics–Visualization and geospatial analytics–IoT Analytics platforms: ThingSpeak, Azure, ThingWorx–Edge Analytics and Real-Time Data Processing–Security and Privacy in IoT Data Analytics

Suggested Activities

- Lectures and discussions on popular machine learning algorithms (both supervised and unsupervised) and tools
- Flipped Classroom on data processing techniques (e.g., MapReduce)
- Guided projects on data analytics for IoT applications

Suggested Evaluation Methods

- Assignments on machine learning algorithms and tools
- Quizzes on data processing techniques and tools
- Group presentations on IoT analytics projects

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the enabling technologies and reference models of IoT.
2. Design portable IoT devices using Arduino IDE/ Raspberry Pi with Python.
3. Apply appropriate protocols in various parts of IoT based systems.
4. Understand Big Data tools and technologies and apply them in IoT based systems.
5. Design and deploy IoT based systems and connect
6. Design IoT systems for various real time applications.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A Hands-On Approach”, Universities Press, 2015.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.

3. David Hanes, Gonzalo Salguerio, Patrick Grossetete, Rob Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for Internet of Things”, Cisco Press, 2017.

REFERENCES:

1. Cuno Pfister, "Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud", O'Reilly Media, 2021.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley, 2012.
3. Samuel Greengard, "The Internet of Things", MIT Press, 2021.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	1	2	1	1	1	1	3	2	2	3
2	3	3	2	-	3	1	3	2	-	1	1	3	3	2	1
3	2	1	2	-	3	2	3	2	-	2	1	1	2	3	1
4	3	1	3	3	1	2	-	3	3	-	2	2	3	3	2
5	3	3	3	2	2	2	1	2	2	-	2	2	1	1	3
6	2	1	1	2	1	1	-	1	1	2	2	1	2	1	3
Avg.	2.67	2.00	2.33	2.4	2.17	1.50	2.25	1.83	1.75	1.5	1.50	2.00	2.17	2.00	2.17

AZ5611 DEEP LEARNING LAB L T P C
0 0 4 2

EXPERIMENTS

1. Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias and threshold.
    a. AND logic function
    b. OR logic function
    c. NOT logic function
    d. NOR logic function
    e. XOR logic function
2. Write a program to build a logistic regression classifier with a Neural Network mindset. Consider following guidelines.
    a. Consider any convenient dataset (Cats dataset etc.) and pre-process the dataset.
    b. Define the appropriate model structure.
    c. Evaluate the model performance.
    d. Analyse the obtained results
3. Design a neural network (NN) model with one hidden layer for classification problems. Use Planar data set or any other suitable data set
    a. Implement a 2-class classification neural network with a single hidden layer.
    b. Use units with a non-linear activation function, such as tanh.
    c. Compute the cross-entropy loss.
    d. Implement forward and backward propagation.
    e. Evaluate the model performance.
    f. Analyse the results.
4. Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable

dataset. Perform Exploratory Data Analysis

a. Prepare dataset
b. Build MLP model
c. Evaluate Model performance
d. Predict for test data

5. Implement the Face recognition using CNN
6. Implement a transfer learning concept for image classification
7. Implement an auto encoder for image denoising
8. Implement a dialogue generation using LSTM with attention mechanism
9. Implement an opinion mining in RNN
10. Machine Translation using Encoder-Decoder model.
11. Image augmentation using GANs
12. Mini project: Real world problems

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Perform different pre-processing operations on structured or unstructured data
2. Design neural network for various learning problems.
3. Demonstrate binary as well as multi- class classification problems.
4. To design and implement deep learning models for real time problems
5. Interpret the model results and analyse the performance of the models.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	-	-	-	-	1	1	2	3	3	3
2	3	3	3	3	1	-	-	-	-	1	1	2	3	3	3
3	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
4	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
5	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3
AVg.	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	3	3	3

AZ5612 **IoT AND CLOUD LAB** **L T P C**

0 0 4 2

EXPERIMENTS

1. Develop an Arduino sketch for a blinking LED.
2. Develop an Arduino sketch to control the LED brightness, including fading in and out.
3. Develop an Arduino sketch to calibrate a sensor by tracking the highest and lowest sensor readings during startup.
4. Develop an Arduino sketch to control the LED blink rate using a variable resistor as an analog input.
5. Develop an Arduino sketch to detect vibrations using a piezo element.
6. Develop a Python program to control an LED using Raspberry Pi.
7. Develop a Python program to interface an LED with a switch using Raspberry Pi.

8. Develop an application to store big data in HBase or MongoDB using Hadoop or R.
9. Explore IoT cloud platforms: Create and deploy an IoT application using platforms like IBM Watson, AWS IoT, or Azure IoT Hub.
10. Implement IoT protocols: Develop a Python program using CoAP or MQTT to send sensor data from Raspberry Pi to a cloud platform.
11. Perform data analytics on IoT data: Analyze and visualize IoT data using Python libraries or cloud-based tools like Google Data Studio.
12. Investigate IoT security: Explore encryption, authentication, and authorization techniques for IoT devices and applications.
13. Mini-project: Design, develop, and present an end-to-end IoT solution using the skills acquired from the lab sessions.

TOTAL: 60 PERIODS

Course Outcomes:

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

1. Use arduino/ raspberry pi and various sensors to build simple IoT experiments
2. Use wireless peripherals for exchange of data and use of Cloud platform to upload and analyse any sensor data
3. Use of Devices, Gateways and Data Management in IoT , to build a complete, working IoT system
4. Configure various virtualization tools such as Virtual Box, VMware workstation.
5. Design and deploy a web application in a cloud environment.
6. Manipulate large data sets in a parallel environment using Hadoop, Mongo DB

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	1	2	1	1	1	1	3	2	2	3
2	3	3	2	-	3	1	3	2	-	1	1	3	3	2	1
3	2	2	2	3	3	2	3	1	-	2	1	1	3	3	3
4	3	3	3	3	3	3	-	3	3	-	2	2	3	3	2
5	3	3	2	2	2	2	1	2	3	-	1	2	2	1	3
6	2	1	1	2	1	1	-	1	1	2	2	1	2	1	3
Avg.	2.67	2.50	2.17	2.60	2.50	1.67	2.25	1.67	2.00	1.5	1.33	2.00	2.50	2.00	2.50

AZ5613 SOCIALLY RELEVANT PROJECT LABORATORY

L	T	P	C
0	0	2	1

Students are expected to take up problems that would directly benefit 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, Banking, 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

DOCUMENTATION:

- Report Generation

TOTAL: 30 PERIODS

COURSE OUTCOMES (COs)

Upon successful completion of the course, the student will reliably demonstrate the ability to:

CO1. Analyze social problems and provide IT based technical solutions in order to benefit society.
CO2. Design, develop and implement solutions for social problems.
CO3. Develop innovative technical solutions of social relevance.
CO4. Design, develop and implement standard solutions to social problems.
CO5. Apply 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/.

MAPPING of CO's with PO's and PSO's

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

AZ5701 TEXT AND SPEECH ANALYTICS L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Overview of text mining- General Architecture – Algorithms – Preprocessing – basics of document classification - information retrieval - clustering and organizing documents - information extraction-prediction and evaluation - Textual information to numerical vectors - document standardization-tokenization - lemmatization vector generation for prediction - sentence boundary determination - evaluation performance-Probabilistic language models based on sequences of words: N-grams.

Suggested Activities:

- Discussion on applications of text mining.
- Case study on text preprocessing and feature extraction techniques.

Suggested Evaluation Methods:

- Quiz on text processing tools.
- Program assignment of feature extraction and analysis.

UNIT II TEXT CATEGORIZATION AND CLUSTERING 9

Text Categorization – Definition – Document Representation –Feature Selection - Decision Tree Classifiers - Rule-based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers Classification of Linked and Web Data - Meta-Algorithms– Clustering –Definition- Vector Space Models - Distance-based Algorithms- Word and Phrase-based Clustering - Semi-Supervised Clustering - Transfer Learning-Text Summarization techniques.

Suggested Activities:

- Flip classroom on text categorization.
- Case study on machine learning based chatbots.

Suggested Evaluation Methods:

- Quiz on probabilistic theory in text processing.
- Program assignment on text classification and clustering for real-time applications.

UNIT III BASIC CONCEPTS IN SPEECH PROCESSING 9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Suggested Activities:

- Discussion on speech production and classification.
- Case study on application of digital signal processing in speech production and classification.

Suggested Evaluation Methods:

- Assignment on design of filter bank.
- Program assignment STFT and LPC methods.

UNIT IV FEATURE EXTRACTION IN SPEECH 9

Features - Feature Extraction and Pattern Comparison Techniques - Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Suggested Activities:

- Discussion on fundamentals of feature extraction and analysis in speech data.
- Case study on applications of LPC, PLP, MFCC, etc. in speech processing.

Suggested Evaluation Methods:

- Quiz on speech processing tools.
- Program assignment on feature extraction and analysis in speech data.

UNIT V SPEECH MODELING AND RECOGNITION 9

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – Ngrams, context dependent sub-word units-Gaussian Mixture Models (GMMs) for acoustic modeling**.**

Suggested Activities:

- Flip classroom on speech modeling and recognition.
- Case study on speech recognition based on traditional and machine learning methods.

Suggested Evaluation Methods:

- Assignment on application of speech modeling techniques.
- A mini project on speech-to-text and text-to-speech conversion.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Identify the different features that can be mined from text and web documents.
2. Understand classification and clustering of text data.
3. Understand basics of digital speech processing.
4. Explore features in speech data for application development.
5. Apply concepts in speech recognition.
6. Perform speech analysis for different applications.

TEXT BOOKS:

1. Weiss S.M., Indurkhya N., Zhang T., Damerau F., “Text Mining: Predictive Methods for Analyzing Unstructured Information”, Springer, 2005
2. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES:

1. Ronen Feldman, James Sanger “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”-Cambridge University press, 2009.
2. Michael Berry, — “Survey of Text Mining: Clustering- Classification- and Retrieval”, Springer, 2004
3. Lawrence Rabinerand Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.

MAPPING of CO’s with PO’s and PSO’s

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	3	2	1	2	2	3	1	3	2	3	2
2	3	3	2	2	3	2	1	2	2	3	1	3	2	3	2

3	3	2	1	2	2	1	1	2	2	3	1	3	1	1	1
4	3	2	2	3	3	1	1	2	2	3	1	3	1	3	2
5	3	3	3	3	3	2	1	2	2	3	2	3	1	1	2
6	3	3	3	3	3	2	1	2	2	3	2	3	1	3	2
AVg.	3	3	2	3	3	2	1	2	2	3	1	3	1	2	2

AZ5702 **INFORMATION SECURITY** **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO SECURITY AND NUMBER THEORY **9**

Basics of Security – CIA Triad – Threats, Attacks and Services – Classical Cryptography – Substitution and Transposition ciphers – One-time Pad– Number Theory – Modular Arithmetic – Euclidean Theorem – Extended Euclidean Theorem – Algebraic Structures – Galois Field – Primality test –Pseudo randomness - Fermat's Theorem – Euler's Theorem – Chinese Remainder theorem – 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 –CPA, CCA– Advanced Encryption Standard (AES)– Analysis of AES.

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 – zero knowledge protocols - Introduction to Quantum Cryptography– 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)

Suggested Activities:

- Case studies on understand the components of X.509 Certificate
- 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
- Quizzes on Key Management, SSL, TLS

UNIT V SYSTEM SECURITY 9

Malwares – Password Management – Firewall – Intrusion Detection System and types – Intrusion Prevention System –– Penetration testing: concept, types, steps – OWASP top ten vulnerabilities – Secure Coding.

Suggested Activities:

- Teaching with case studies: access control and cloud security.
- Configure the Access Control List and use 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

COURSE OUTCOMES (COs)

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

CO1. Apply the basic security algorithms and policies required for a computing system.
CO2. Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.
CO3. Identify any network security issues and resolve the issues.
CO4. Manage the firewall and WLAN security.
CO5. Evaluate the system related vulnerabilities and mitigation.
CO6. Design secured web applications in real-time.

TEXTBOOKS:

1. William Stallings, “Cryptography and Network Security Principles and Practices”, Pearson/PHI, Seventh Edition, 2023.

REFERENCES:

1. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2004.
2. Pfleeger and Pfleeger, “Security in computing”, Third Edition, PHI/Pearson, 2018.
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.
5. Oded Goldreich, Foundations of Cryptography (two volumes) Cambridge university Press, 2004.
6. Patrick Engebretson, “The basics of Hacking and Penetration Testing”, Elsevier, 2011

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	3	-	-	-	2	-	-	3	2	2	2
2	3	3	3	3	3	-	-	-	2	-	-	3	3	2	2
3	3	3	3	3	3	3	-	3	2	-	-	3	3	2	2
4	3	1	3	1	3	3	-	3	2	-	-	3	3	3	2
5	3	3	3	3	3	3	-	3	2	-	-	3	3	3	2
6	3	3	3	1	3	3	-	3	2	-	3	3	3	3	2
AVg.	3	2.66	3	2.16	3	3	-	3	2	-	3	3	2.83	2.5	2

AZ5711 **INFORMATION SECURITY LABORATORY** **L T P C**

0 0 4 **2**

LIST OF EXPERIMENTS

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

1. Implement basic mathematical requirements for cryptography.
2. Write a program to perform encryption and decryption of classic cryptosystems. Perform cryptanalysis using Brute-force Attack.
3. Write a program to demonstrate symmetric key encryption process using DES and AES algorithm (academic versions). Also perform cryptanalysis using CCA, CPA.
4. Write a program to implement RSA algorithm and demonstrate the key generation and encryption process and analyze the same using factorization attack.
5. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.
6. 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.
7. Study and exploration of Wireshark tool
    a. To analyze network traffic for various protocols, e.g. ping, DNS and telnet.
    b. To learn about setting up ssh keys and configure the ssh client.

c. To verify whether the data is encrypted or not.

8. Study and exploration of Metasploit tool to learn about cracking hashed files in Windows environment.
9. Configure a firewall on Ubuntu platform.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

Upon successful completion of the course, the student will reliably demonstrate the ability to:

CO1. Attain mathematical knowledge required for cryptography.

CO2. Implement specific encryption/decryption algorithms meant for Confidentiality, Integrity, and Authentication and to perform security analysis of the same by implementing cryptanalysis.

CO3. Analyze the vulnerabilities in any application using penetration testing.

CO4. Explore and perform network analysis using various networking tools.

CO5. Configure a firewall.

CO6. Develop a Security system for an application

COURSE OUTCOMES	Program Outcomes (POs) & Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3	-		-	2	-	2	1	-	3	2
CO2	3	3	3	1	3	2	-	3	2	-	3	3	2	3	3
CO3	3	3	1	3	3	3	-	3	2	-	3	3	1	3	3
CO4	3	3	3	3	3	1	-	-	2	-	3	3	1	3	3
COte5	3	3	3	-	3	3	-	3	2	-	3	3	1	3	3
CO6	3	3	3	-	3	3	-	3	2	-	3	3	1	3	3

LIST OF PROFESSIONAL ELECTIVES

AZ5001 SERVICE ORIENTED ARCHITECTURE. **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO 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
- RESTful web services

Suggested Evaluation Methods

- Implementing XML, DOM and SAX
- Programming exercises

UNIT II SOA BASICS **9**

SOA Fundamentals – Defining SOA – Business Value of SOA – Architecture – Infrastructure Services Web Services Technologies: Web Services & SOA – WSDL, SOAP – UDDI – WS-Transaction, WS-Security – WS-Reliable Messaging. WS-Policy – WS-Attachments.

Suggested Activities

- Applications of SOA
- Identifying simple services based on SOA

Suggested Evaluation Methods

- Application based comparison

UNIT III SOA ANALYSIS AND DESIGN **9**

Need for models - Principles of service Design –Reuse, Integration, Agility Design of Activity Services (or Business Services) -Illustration Design of Data Services, Design of Client Services, Design of Business Process Services, Illustration – Loan Approval Business Process, Explanation of Loan Approval Process

Suggested Activities

- Study on various service design
- SOA best practices case studies

Suggested Evaluation Methods

- Quiz on service design principles

UNIT IV INTRODUCTION TO ENTERPRISE ARCHITECTURE (EA) **9**

Enterprise - Architecture - Enterprise Architecture - Layers of architecture - Need for EA, Benefits of EA - TOGAF – The Open Group Architecture Framework, TOGAF – EA Domains - SOA vs EA - Perspectives of SOA - Need for SOA in Enterprise Architecture - SOA – Enterprise Architecture Integration, Enterprise Architecture Development Methods - SOI Concerns - SOA Tools.

Suggested Activities

- Case study on SOA EA integration

Suggested Evaluation Methods

- Assignment on SOA tools

UNIT V APPLICATION OF SOA **9**

Big Data and SOA: Concepts, Big Data and its characteristics, Technologies for Big Data, Service-orientation for Big Data Solutions - AI in service-oriented software design

Suggested Activities

- External learning on AI and SOA
- Analysis on SOA for Big Data

Suggested Evaluation Methods

- Assignments on applications of SOA

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Design a web service application
2. Articulate the main concepts, key technologies, strengths and limitations of SOA
3. Develop the ability to understand and use the SOA Technologies and delivery
4. Develop and design Enterprise architecture
5. Perform SOA based analytics and relate with AI.

TEXT BOOK:

1. Shankar Kambhampaty, “Service-oriented Architecture & Microservice Architecture: For Enterprise, Cloud, Big Data and Mobile”, Third Edition, Wiley, 2018.
2. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.
3. Service Oriented Architecture by IBM ICE Publications
4. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.

REFERENCES:

1. Ron Schmelzer et.al, “XML and Web Services”, Pearson education, 2002.
2. Leonard Richardson, Sam Ruby, “RESTful Web Services”, O'REILLY publication, 2007.
3. Nicolai M. Josuttis, “SOA in Design – The Art of Distributed System Design”, O'REILLY publication, 2007.
4. Raj Balasubramanian, Benjamin Carlyle, Thomas Erl, Cesare Pautasso, “SOA with REST – Principles, Patterns & Constraints for Building Enterprise Solutions with REST”, Prentice Hall, 2013.

MAPPING of COs with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	1	1	-	1	1	1	-	2	3	1
2	3	2	2	3	1	1	-	-	1	-	1	-	2	3	2
3	3	3	2	2	1	1	2	2	1	1	1	-	2	3	2
4	3	3	3	3	2	2	1	2	1	1	2	1	3	3	3
5	2	3	3	3	2	2	1	2	1	2	2	2	3	3	3
Avg.	**2.4**	**3**	**3**	**2.4**	**1.8**	**2**	**1**	**-**	**1**	**-**	**1.4**	**1.5**	**2.4**	**3**	**2.2**

AZ5002 GPU ARCHITECTURE AND PROGRAMMING L T P C

3 0 0 3

UNIT I GPU ARCHITECTURE 9

Introduction - Heterogeneous parallel computing - Need for parallelism –Challenges in parallel programming – Evolution of GPU architectures – Understanding Parallelism with GPU – Architecture of a modern GPU - Block scheduling - Synchronization and transparent scalability - Warps and SIMD hardware.

Suggested Activities:

- Flipped class on evolution of GPU.

- External learning – GPU architecture.

Suggested Evaluation Methods:

- Quizzes on GPU.
- Group discussion on GPU vs. SIMD

UNIT II GPU PROGRAMMING: CUDA 10

CUDA's programming model: threads, blocks, and grids - CUDA's execution model: streaming multiprocessors and warps - CUDA compilation process - Memory hierarchy - Optimization of CUDA applications - Graphs - Warp functions - Dynamic parallelism - Debugging CUDA programs.

Suggested Activities:

- Flipped class on parallel programming.
- Practical – Download the CUDA toolkit and setup the CUDA environment.
- Practical – Write simple CUDA code and vary the parameters to understand the concept of threads, blocks and grids

Suggested Evaluation Methods:

- Evaluation of the assignment by checking the configuration.
- Demonstrate the CUDA setup by running simple and sample programs.

UNIT III GPU AND ACCELERATOR PROGRAMMING: OpenCL 9

The OpenCL architecture - The platform model - The execution model - The programming model - The memory model - Shared virtual memory - Atomics and synchronization - Events and profiling OpenCL programs - OpenCL and other parallel software platforms

Suggested Activities:

- Flipped class on basics OpenCL.
- Practical – Execute sample OpenCL programs with different memory options

Suggested Evaluation Methods:

- Assignment on GPU programming using OpenCL
- Demonstrate the OpenCL setup by running sample programs.

UNIT IV GPU PROGRAMMING: PyCUDA 8

GPU programming using PyCUDA: kernals, threads, blocks, and grids – thread synchronization and intercommunication – Parallel prefix algorithm – Streams, events, contexts, and concurrency.

Suggested Activities:

- Flipped class on Python tool kit for CUDA.
- Practical – Write simple PyCUDA code with threads, blocks and grids

Suggested Evaluation Methods:

- Quiz on PyCUDA programmng.
- Demonstrate the PyCUDA setup and execution of sample programs.

UNIT V ALGORITHMS ON GPU 9

Parallel Patterns: Parallel convolution: a basic algorithm, Constant memory and caching, Tiled convolution using caches for halo cells - Prefix scan: Parallel scan with the Brent-Kung algorithm, Segmented parallel scan for arbitrary-length inputs - Sparse Matrix computation: A simple SpMV

kernel with the COO format - Grouping row nonzeros with the CSR format - Improving memory coalescing with the ELL format.

Suggested Activities:

- Flipped class on Parallel patterns.
- Discussion on different parallel programming applications.

Suggested Evaluation Methods:

- Assignment on parallel programming algorithms.
- Demonstration of sparse matrix computation.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the need for parallel programming
2. Describe the GPU Architecture
3. Program GPU using CUDA and PyCUDA
4. Program GPU using OpenCL
5. Compare the CUDA and OpenCL programming
6. Identify efficient parallel programming patterns to solve problems

TEXT BOOKS:

1. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Fourth Edition, Morgan Kaufmann, 2022.
2. Gerassimos Barlas, Multicore and GPU Programming: An Integrated Approach, Second Edition, Morgan Kaufmann, 2022
3. Brian Tuomanen, Hands-On Gpu Programming with Python and CUDA: Explore high-performance parallel computing with CUDA, Packt Publishing Limited, 2018

REFERENCES:

1. Shane Cook, CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, —Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.
3. Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013.
4. Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	2	1	2	1	1	1	2	2	1	2	-	1	-
2	2	2	2	1	2	1	1	1	2	2	1	2	-	1	-
3	2	2	2	2	3	1	1	1	2	2	1	2	-	1	-
4	2	2	2	2	3	1	1	1	2	2	1	2	-	1	-
5	2	2	2	2	3	1	1	1	2	2	1	2	-	1	-
6	2	2	2	2	3	1	1	1	2	2	1	2	-	2	-
Avg.	**2**	**2**	**2**	**1.67**	**2.67**	**1**	**1**	**1**	**2**	**2**	**1**	**2**	**-**	**1.17**	**-**

AZ5003 ALGORITHMIC GRAPH THEORY L T P C
3 0 0 3

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.

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.

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 GRAPH THEORETIC ALGORITHMS 9

Algorithms –Connectedness and Components – Spanning Tree - A set of Fundamental Circuits- Cut - Vertices and Separability – Directed Circuits - Shortest-Path Algorithms - Depth first search on a graph: Planarity Testing – Isomorphism –

Suggested Activities:

- External learning - Cut-Vertices and Separability.
- Practical -
  - Implementation of graph algorithms.
  - Finding a set of fundamental circuits in a graph.
- Flipped classroom on isomorphism.
- Applications in real life problems.

Suggested Evaluation Methods:

- Tutorials on connected components .
- Assignment on Planarity testing.

UNIT V MACHINE LEARNING WITH GRAPHS 9

Introduction – Background and traditional approaches – Graph Neural Networks – Neural Message passing – Generalized neighborhood Aggregation – Generalized update methods – Edge features and multi-relational GNNs – Graph pooling – Generalized message passing.

Suggested Activities:

- Practical -
  - Implementation of graph neural networks.
- Applications in real life problems.

Suggested Evaluation Methods:

- Quiz on traditional approaches to machine learning using graphs.

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.

TEXTBOOKS:

1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Dover Publications Inc., 2016.
2. Hamilton, William L., “Graph Representation Learning”, Morgan and Claypool, 2020.

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.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	3	1	-	-	-	-	-	2	-	1	2	2
2	2	2	2	3	1	-	-	-	-	-	1	1	1	2	2
3	2	1	2	3	3	2	-	2	2	-	2	-	1	2	2
4	2	1	2	3	2	-	1	-	-	-	3	1	2	2	2
5	2	-	2	3	2	2	-	2	2	3	1	1	3	2	2
AVg.	2	1.5	2	3	1.8	2	1	2	2	3	1.8	1	1.3	2	2

AZ5004 COMPUTATIONAL INTELLIGENCE L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Background and history of evolutionary computation - Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption - Self organization and Evolution - Historical Views of Computational Intelligence - Adaption and Self organization for Computational Intelligence - Ability to Generalize - Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

Suggested Activities:

- Flipped classroom on Applications areas of Computational Intelligence.

Suggested Evaluation Methods:

- Quiz on Aadaption and Self organization for Computational Intelligence.
- Assignment on Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

UNIT II NEURAL NETWORK CONCEPTS AND PARADIGMS 9

Neural Network History - What Neural Networks are and Why they are useful - Neural Networks Components and Terminology - Neural Networks Topology - Neural Network Adaption - Comparing Neural Networks and Other information Processing Methods - Preprocessing and Post Processing.

Suggested Activities:

- Create and view custom neural networks using MatLab.
- Implementation of XOR with backpropagation algorithm

Suggested Evaluation Methods:

- Quiz on neural networks.

- Assignment on comparison of Neural Networks and Other Information Processing Methods.

UNIT III EVOLUTIONARY COMPUTATION THEORY AND CONCEPTS 9

History of Evolutionary Computation, Evolution Computation Overview, Genetic algorithms, Evolutionary programming, Evolution strategies, genetic programming, and particle swarm optimization.

Suggested Activities:

- Flipped classroom on Evolution strategies.
- Programming exercises on maximizing a function using Genetic algorithm.

Suggested Evaluation Methods:

- Quiz on Genetic algorithms.
- Assignment on Evolutionary programming.

UNIT IV SWARM INTELLIGENCE 9

Particle Swarm Optimization: Particle Swarm Optimization Algorithm - PSO System Parameters - Modifications to PSO - Cooperative PSO - Particle Swarm Optimization versus Evolutionary Computing and Cultural Evolution – Applications. Ant Colony Optimization.

Suggested Activities:

- Flipped classroom on Modifications to Ant Colony Optimization.
- Implementation of Particle Swarm Optimisation algorithm for solving a problem.

Suggested Evaluation Methods:

- Quiz on Particle Swarm Optimization Algorithm.

UNIT V FUZZY SYSTEMS 9

Fuzzy systems: Fuzzy Sets - Membership Functions - Fuzzy Operators - Fuzzy Set Characteristics - Linguistics Variables and Hedges - Fuzziness and Probability - Fuzzy Inferencing systems: Fuzzification: Inferencing – Defuzzification - Fuzzy Controllers: Components of Fuzzy Controllers - Fuzzy Controller Types.

Suggested Activities:

- Flipped classroom on Fuzzy Controllers.
- Install MatLab Fuzzy Logic Toolbox and ANN toolbox to design and simulate systems.
- Implementation of fuzzy control/ inference system

Suggested Evaluation Methods:

- Quiz on Fuzzy sets and membership functions.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Provide a basic exposition to the goals and methods of Computational Intelligence.
2. Understand and implement basic neural networks for solving problems.
3. Study of the design of Evolutionary Computation Theory.
4. Apply genetic algorithms to optimization problems..
5. Improve problem solving skills using the acquired knowledge in the areas of swarm intelligence,

6. Apply fuzzy logic and build fuzzy systems to handle uncertainty and solve engineering problems.

TEXT BOOKS:

1. Eberhart, E. and Y. Shi., "Computational Intelligence: Concepts and Implementations", Morgan Kauffmann, San Diego, 2007.
2. Engelbrecht, A.P. Computational Intelligence: An Introduction, Second Edition, John Wiley and Sons, 2007.

REFERENCES:

1. Stuart Russell, Peter Norvig, —Artificial Intelligence: A Modern Approach, Third Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich and Kevin Knight, —Artificial Intelligence, Third Edition, Tata McGraw- Hill, 2010.
3. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
4. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.

MitchellMelanie, An Introduction to Genetic Algorithms, The MIT Press, 1998.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	3	1	1	1	1	1	-	1	-	-	-	2	1	2
2	2	2	1	2	1	1	1	-	1	-	-	1	2	2	2
3	1	3	2	3	3	1	1	-	1	-	-	2	2	1	3
4	2	1	1	2	2	2	1	2	2	2	2	2	2	2	3
5	2	2	2	2	3	2	1	2	2	1	1	2	2	3	3
6	3	3	3	3	2	2	1	2	2	2	2	2	2	3	3
AVg.	2	3	2	2	2	2	1	2	2	2	2	2	2	2	3

AZ5005 REINFORCEMENT LEARNING TECHNIQUES L T P C
3 0 0 3

UNIT I INTRODUCTION OF REINFORCEMENT LEARNING 9

Overview of reinforcement learning (RL) - Tabular Solution Methods - Multi Armed Bandits - k-Armed Bandits - Action Value Methods - Gradient Bandit Algorithm - Finite Markov Decision Process - Optimality and Approximation - Policy Evaluation - Policy Improvement - Policy Iteration - Monte Carlo Methods- Temporal Difference Learning

Suggested Activities:

- Group discussions to share their understanding and insights into reinforcement learning concepts and brainstorm ideas
- Coding exercises to implement and experiment with algorithms using any programming language or a reinforcement-learning framework.

Suggested Evaluation methods:

- Quizzes to assess students' understanding of the key concepts namely reinforcement learning, tabular solution methods, policy evaluation, policy improvement, and finite Markov decision processes.
- Reports on case studies they have worked on, highlighting their analysis of the problem,

application of tabular solution methods, and their findings and conclusions.

UNIT II DYNAMIC PROGRAMMING APPROXIMATION 9

Deterministic Dynamic Programming - Stochastic Dynamic Programming - Deterministic Shortest Path Problem - Discrete Deterministic Optimization - Approximation Approaches in Reinforcement Learning, Multi Step Lookahead, Problem Approximation, Rollout and Policy Improvement Principle - Parametric Approximation - Approximation Architectures - Sequential Dynamic Programming Approximation - Q Factor Parametric Approximation

Suggested Activities:

- Provide problem-solving exercises that involve deterministic shortest path problems and discrete deterministic optimization.
- Design and implement algorithms for sequential dynamic programming approximation and Q-factor parametric approximation using programming languages or reinforcement learning libraries to develop and test their solutions.

Suggested Evaluation methods:

- Group discussions or project presentations highlighting their understanding and application of sequential dynamic programming.

UNIT III INFINITE HORIZON OVERVIEW 9

Infinite Horizon Dynamic Programming - Infinite Horizon Problems, Stochastic Shortest Path Problems, Discounted Problems, Semi- Markov Discounted Problems, Asynchronous Distributed Value Iteration, Policy Iteration - Infinite Horizon Reinforcement Learning - Approximation in Value Space, Fitted Value Iteration, Q Learning, Temporal Differences

Suggested Activities:

- Use simulation environments to observe the behavior and performance of different algorithms in infinite horizon reinforcement learning.

Suggested Evaluation methods:

- Assessments that require them to apply infinite horizon dynamic programming techniques to solve given problems, such as calculating the optimal value function for a discounted problem or finding the optimal policy for a stochastic shortest path problem

UNIT IV AGGREGATION AND LEARNING IMPLEMENTATION 9

Aggregation - Aggregation with Representative States, Continuous Control Space Discretization, POMDP Aggregation, Aggregation with Representative Features, Hard Aggregation – Implementation Resources - Q Learning - Q Learning with Code - Deep Q Network (DQN) - Double DQN - Dueling DQN - Policy Based Reinforcement Learning - Actor-Arctic Models and A3C - Deterministic Policy Gradient and the DDPG

Suggested Activities:

- Literature review on recent advancements and research papers related to aggregation in reinforcement learning.

Suggested Evaluation methods:

- Group projects- by evaluating the ability to apply aggregation techniques effectively and critically assess their performance in real-world scenarios.

UNIT V PRACTICAL AND OPERATIONAL APPROACHES 9

Practical Reinforcement Learning – RL Project Life Cycle, RL Project, RL Engineering and Refinement – Operational Reinforcement Learning – Implementation, Deployment.

Suggested Activities:

- Invite guest speakers or industry professionals who have experience with RL projects to share their insights and real-world examples.
- Hands-on workshops to explore RL toolkits and frameworks, such as OpenAI Gym, TensorFlow, or PyTorch

Suggested Evaluation Methods:

- Reflective journals or write reflection papers throughout the RL project life cycle to critically reflect experiences, challenges faced, lessons learned, and potential improvements for future RL projects.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. To recall the fundamental concepts of reinforcement learning and describe the basic principles and algorithms used in tabular solution methods.
2. Apply dynamic programming approximation techniques to solve deterministic and stochastic dynamic programming problems.
3. Analyze infinite horizon problems in reinforcement learning.
4. To evaluate the effectiveness of aggregation techniques, including aggregation with representative states and features.
5. To design and implement reinforcement learning systems using Q-learning and DQN algorithms.
6. To develop and refine RL projects, considering real-world implementation and deployment challenges.

TEXT BOOKS

1. Richard S. Sutton and Andrew G. Barto; Reinforcement Learning: An Introduction; 2nd Edition, MIT Press, 2022
2. Dimitri P. Bertsekas; Reinforcement Learning and Optimal Control; 1st Edition, Athena Scientific, 2019.
3. D., Phil Winder Ph.. Reinforcement Learning. United States, O'Reilly Media, 2020.

REFERENCES

1. Deep Reinforcement Learning Frontiers of Artificial Intelligence By Mohit Sewak · 2019
2. Thomas G. Dietterich; Hierarchical Reinforcement Learning with the MAXQ Value Function Decomposition; Journal of Artificial Intelligence Research, vol. 13, pp. 227-303, 2000.
3. Vincent Francois-Lavet, Peter Henderson, Riashat Islam, Marc G. Bellemare and Joelle Pineau; An Introduction to Deep Reinforcement Learning; ArXiv ePrint, 2018.
4. Remi Munos, Reinforcement Learning and Stochastic Optimization: A Unified Frameword for sequential Decisions, CRC Press, 2019.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	1	1	1	2	2	1	2	1	1	1
2	3	3	3	2	3	2	2	2	2	2	2	3	2	3	2
3	2	3	2	3	2	2	2	2	2	2	2	3	2	3	2
4	2	2	3	3	2	2	2	2	3	1	3	2	2	3	2
5	3	3	3	2	3	2	2	2	3	3	2	3	2	3	3
6	3	2	3	2	3	2	1	2	2	2	2	3	3	2	3
Avg.	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**3**	**2**

IT5022 INFORMATION RETRIEVAL L T P C
3 0 0 3

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.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	-	1	-	3	3	2	2	2	2	2
2	3	3	3	3	3	-	-	-	3	3	2	2	2	3	2
3	3	3	3	2	3	-	-	3	2	-	1	3	2	2	2
4	3	3	3	3	3	-	2	-	2	-	2	3	3	3	3
5	3	3	3	3	2	3	3	3	1	-	2	3	2	2	2
6	3	3	3	3	3	-	-	3	3	3	2	3	2	3	2
Avg.	3	3	3	3	3	3	2	3	2	3	2	3	2	3	2

IT5012 PATTERN RECOGNITION L T P C
3 0 0 3

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:

- In-class activity - Problems based on Z transform Circular and linear convolution.
- Testing of frequency transformation and convolution problems 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 BOOKS:

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.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	2	2	-	-	3	3	3	3	2	3	2
2	3	3	3	-	-	3	3	3	-	-	3	3	2	3	2
3	3	3	3	-	-	-	-	3	-	-	3	3	2	3	2
4	3	3	3	-	-	3	3	3	-	-	3	3	2	2	2
5	3	3	3	3	3	3	3	-	-	-	3	3	2	3	2
6	3	3	3	3	3	-	-	3	3	3	3	3	2	3	2
Avg.	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**

AZ5006 BIO-INFORMATICS L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Overview of Bioinformatics Technologies – Structural Bioinformatics – Data Format and Processing – Secondary Resources and Applications – Role of Structural Bioinformatics – Biological Data Integration System

Suggested Activities

- Exploring about Biological Data Integration System
- Understanding different data formats.

Suggested Evaluation Methods

- Quizzes on need of bioinformatics for real world scenario.
- Practical – Programming assignments on methods used for integrating biological data.

UNIT II BIOINFORMATICS TOOL BOX **9**

Sequence Analysis – NGS – Graph Theory – Gene Ontology – Importing Data and Deploying.

Suggested Activities

- Analyzing biomedical data using data mining tool in MatLab

Suggested Evaluation Methods

- Quizzes on various bioinformatics tools and its usage.
- Programming assignments on methods to analyze bio data using any one data mining tool

UNIT III BIOLOGICAL DATA ANALYSIS **9**

Microarray Data Analysis – Mass Spectrometry Data Analysis – Statistical Classification of Biological Data.

Suggested Activities:

- Flipped classroom on statistical classification of biological data.

Suggested Evaluation Methods:

- Quizzes on various data analysis methods.
- Programming assignments on various classification methods

UNIT IV IMAGE PROCESSING **9**

Key Features of Image Processing – Importing and Exporting Images – Image File Formats and Format Conversion – Pre and Post Processing Images – Spatial Transformations and Image Registration – Microarray Image Analysis.

Suggested Activities:

- Extract the key features for biological image in MatLab.
- Implementing Spatial Transformations for imageinMatLab.

Suggested Evaluation Methods:

- Quizzes on transformations used in bio-images.
- Programming assignments on applying various image processing methods on a simple bio application

UNIT V SYSTEMS BIOLOGY **9**

Basics of Enzyme Kinetics – Kinetic Laws – Modeling Biological System: Simulation, Sensitivity Analysis, Parameter Estimation using Simbiology – Pharmacokinetic Modeling: Simulation, Population Study – Model of the Yeast Heterotrimeric G Protein Cycle and Glycolysis.

Suggested Activities

- Implementing sensitivity analysis for biology data in MatLab.

Suggested Evaluation Methods

- Quizzes on system biology.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Develop models for Biological Data.
2. Implement image processing Techniques to Bioinformatics Data.

3. Implement Micro Array analysis over Genome Expression.
4. Understand the study of simbiology.
5. Understand the pharmacokinetic modeling.
6. Understand the working model of biological data in Matlab.

TEXT BOOKS

1. Yi-Ping Phoebe Chen(Ed),"Bioinformatics Technologies", Springer Publications, 2005
2. G. Alterovitz, M. F. Ramoni, "Systems Bioinformatics: An Engineering Case-Based Approach", Artech House, 2007.

REFERENCES

1. Michael R. King, Nipa A. Mody, "Numerical and Statistical Methods for Bioengineering: Applications in MATLAB", Cambridge University Press, 2011.
2. John L. Semmlow, "Bio signal and Medical Image Processing", CRC Press, 2004.
3. Frank C. Hoppensteadt, Charles S. Peskin, "Modeling and Simulation in Medicine and Life Sciences", Springer, 2010.
4. C. Gibas, Per Jambeck, "Developing bio- informatics computer skills", O'Reilly Media, 2001

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	1	1	1	1	1	1	3	2	1	2	2
2	2	2	3	-	1	1	1	1	1	1	3	2	2	2	2
3	2	2	2	-	1	1	1	1	1	1	3	2	1	2	2
4	3	-	2	-	1	1	1	1	1	1	3	-	1	2	2
5	3	-	1	-	1	1	1	1	1	1	3	-	1	2	2
6	2	2	1	1	2	1	1	1	1	1	3		1	2	2
AVg.	2.5	2	1.8	1	1	1	1	1	1	1	3	2	1	2	2

AZ5007 FULL STACK DATA SCIENCE L T P C
3 0 0 3

UNIT I DATA SCIENCE ESSENTIALS 9

Data Types-Operators-Variables--Control Flow Statements-Functions-User Defined Functions-Lambda Function; Data Structures-List-Tuples-Set-Dictionary; String Handling-Exception Handling.

Suggested Activities:

- Flipped classroom on python essentials for data science.
- Practical - Programming exercises involving the python basics and data structures.

Suggested Evaluation Methods:

- Quiz on core python concepts
- Assignments on python data structures.

UNIT II FULL STACK FOR APPICATION DEVELOPMENT 9

Introduction to PyQt6-Installation-UI Widgets-Layout Management-Dialogs-Events-Example Applications-Packaging PyQt6 Applications for Windows-Deployment of PyQt6 Software in

Windows / Linux. Introduction to SQLite. Working with SQLite Database with PyQt6.

Suggested Activities:

- Flipped classroom on windows graphical user interface application.
- Practical – Develop GUI applications using various PyQt6 widgets.

Suggested Evaluation Methods:

- Practical – Working with SQLite Database using PyQt6
- Programming Assignments on PyQt6, SQLite database.
- Practical – Deploy PyQt6 Application in Windows / Linux.

UNIT III FULL STACK FOR WEB DEVELOPMENT 9

Introduction to Flask-Routes-Templates-Forms-Creating Web Applications using Flask-Examples.Introduction to MongoDB-Working with MongoDB with Flask-Simple Application Examples.

Suggested Activities:

- Flipped classroom on HTML, Web Development using Flask Python.
- Practical – Develop web application using HTML form with Flask

Suggested Evaluation Methods:

- Quiz on Flask Python and Mongo DB
- Programming Assignments on Flask Python.
- Practical – Develop CRUD based Web Application using Flask with Mongo DB.

UNIT IV MACHINE LEARNING CONCEPTS 9

Introduction to Data Science-Essential Libraries for Data Science; Python for Data Processing and Modeling-Top Libraries-Working with TensorFlow-Numpy-SciPy-Pandas- Examples; Python for Machine Learning – Working with Keras - SciKit-Learn-Examples.

Suggested Activities:

- Flipped classroom on Data Science for Data Processing and Machine Learning.
- Build Data Science Applications using Data Processing, Machine Learning using python APIs

Suggested Evaluation Methods:

- Quiz on Basics of Data Science, Machine Learning
- Assignments on Data Processing and Modelling, Machine Learning
- Practical – Develop full stack application for data science techniques such as data processing and machine learning.

UNIT V DATA SCIENCE FOR NLP, DATA MINING, DATA VISUALIZATION 9

Natural Language Processing-Working with NLTK-SpaCy-Gensim-Examples. Data Mining and Data Scrapping- Working with Scrapy-BeautifulSoup; Data Visualization- Top Libraries-Working with Matplot-Seaborn-Plotly-Example Applications.

Suggested Activities:

- Flipped classroom on Data Science for NLP, Data Mining and Data Visualization.
- Practical – Build Data Science Applications using NLP, Data Mining and Data Visualization using Python APIs.

Suggested Evaluation Methods:

- Quiz and Assignments on NLP, Data Mining and Data Visualization
- Practical – Develop full stack application for data science techniques such as NLP, Data Mining and Data Visualization.

TOTAL:45 PERIODS

OUTCOMES:

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

1. Understand the essential concepts of python for data science
2. Develop and Package Desktop GUI applications using PyQt6 python.
3. Learn and Develop Web Applications with Database using Flask
4. To practice the data science techniques using data processing and modeling, machine learning
5. To practice the data science techniques using data visualization, data mining and natural language processing.

TEXT BOOKS:

1. Jake VanderPlas "Python Data Science Handbook" Shroff/O'Reilly; First edition, 2016
2. Reema Thareja "Python Programming: Using Problem Solving Approach Python Programming". Oxford University Press, First Edition 2017.
3. Wes McKinney "Python for Data Analysis". O′Reilly; 2nd edition, 2017.
4. Yuli Vasiliev "Python for Data Science: A Hands-On Introduction". No Starch Press, 2022.
5. Jack Chan, Ray Chung, & Jack Huang "Python API Development Fundamentals" Packt Publishing, 2019.
6. Miquel Grinberg “Flask Web Development 2e: Developing Web Applications with Python”. O′Reilly, 2nd edition, 2018.
7. S.Sridhar, J.Indumathi, V.M.Hariharan, Apr 2023, “Python Programming”, Pearson

REFERENCES:

1. Gareth Dwyer, “Flask by Example”, Packet Publishers, 2016.
2. “Hands-On Data Structures and Algorithms with Python” — By Dr. Basant Agarwal, 2018.
3. “The Art of Data Science” — by Roger D. Peng and Elizabeth Matsui, 2016.
4. “Hands-On Data Visualization: Interactive Storytelling From Spreadsheets to Code” by Jack Dougherty, Ilya Ilyankou O’Reilly Media (1st edition) 2021.
5. “Data Mining and Machine Learning: Fundamental Concepts and Algorithms” — by Mohammed J. Zaki, Wagner Meira, Jr. Cambridge University Press; 2nd Edition, 2020.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	2	-	-	-	-	-	2	1	-	3	1	1	1
2	1	3	3	1	3	1	1	-	3	1	2	2	1	1	2
3	1	3	3	1	3	1	1	-	3	1	2	2	3	1	2
4	1	3	3	2	2	2	1	-	3	1	2	2	2	3	3
5	1	3	3	2	2	2	1	-	3	1	2	2	2	2	3
Avg.	1	2.6	2.8	1.5	2.5	1.5	1	-	2.8	1	2	2.2	1.8	1.6	2.2

AZ5008 APPLIED CRYPTOGRAPHY L T P C
3 0 0 3

UNIT I INTRODUCTION TO APPLIED CRYPTOGRAPHY 9

Basics of Security – CIA Triad – Threats, Attacks and Services- Trust Models.- Basics of Modular Arithmetic - Classical Cryptography – Substitution – Transposition - Cryptanalysis of substitution ciphers – Basics of Cryptographic systems – symmetric key – asymmetric key– hash functions – cryptographic algorithms - Block – Stream Ciphers – Public key algorithms

Suggested Activities:

- Implement Classical cryptographic algorithms using any Cryptographic tool.
- Practice cryptanalysis of classical cryptography and break them.
- Practice exponentiation and multiplicative inverses in modular arithmetic

Suggested Evaluation Methods:

- Quiz and assignments on classical cryptography
- Assignments on cryptanalysis of classical cryptography

UNIT II CRYPTOGRAPHIC SYSTEMS 9

DES – Block Cipher modes of operation – Linear cryptanalysis – Differential Cryptanalysis – Triple DES - AES - Public Key Cryptosystems – Number Theory Concepts - RSA – ELGamal Cryptosystem, Diffie-Hellman Key Exchange, Fields, Elliptic Curve Arithmetic - Elliptic Curve Cryptography – Attacks - Side channel attack - Merkle-Hellman knapsack attack - Hellman's time-memory tradeoff (TMTO) attack.

Suggested Activities:

- Demonstrate the working of DES, AES and ECC algorithms using CrypTool.
- Simulate and demonstrate various cryptographic attacks on DES, AES and ECC.

Suggested Evaluation Methods:

- Assignments on key generation and key expansions of DES, AES, ECC.
- Quiz on the mathematics behind the public key algorithms

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 9

Message Authentication and Hash Functions - Secure Hash Algorithms – SHA 512 - Message Authentication Codes – Weak and Strong MACs – HMAC - Digital Signature Schemes - RSA – Elgamal – Digital Signature Standard - Attacks on Digital Signature - Digital Signatures and Authentication Protocols.

Suggested Activities:

- Use open source or free tools to calculate hash values using SHA 512
- Simulate the working of Digital signature schemes.

Suggested Evaluation Methods:

- Assignments on Digital Signature Standard
- Quiz on MAC and Hash functions

UNIT IV KEY AGREEMENT AND DISTRIBUTION 9

Identification Scheme and Entity Attenuation-Challenge and Response in the Secret-key setting-Challenge and Response in the Public key Setting - Schnorr Identification Scheme - Key Pre-distribution - Unconditionally Secure key Pre-distribution - Key Agreement Scheme - Diffie-Hellman Key agreement - Public key infrastructure-PKI - Certificates - Zero Knowledge Proofs and Protocols

Suggested Activities:

- Debate on the challenges faced by secret key and public key crypto systems
- Simulate key agreement scheme using any open source tool

Suggested Evaluation Methods:

- Group presentation on the challenges faced
- Quiz on key distribution and key agreement

UNIT V SECUIRTY APPLICATIONS 9

Database Security- Cloud Security – XML security – OS security - Web security- Cross Site Scripting, Cross Site Request Forgery, SQL Injection – Firewalls – VPN Security- Application layer Security – PGP, Transport layer Security – SSL, Network layer Security – IPSec.

Suggested Activities:

- Debate on database and cloud security
- Deploy firewall in a system and analyze it's characteristics

Suggested Evaluation Methods

- Quiz on web security, transport layer security and network security applications

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. Develop skills to use both symmetric and asymmetric key cryptography to ensure confidentiality.
3. Utilize specific hash functions and Mac algorithms for security applications.
4. Evaluate the application of different digital signature schemes in solving real world problems.
5. Critically analyze the challenges in symmetric and asymmetric key distribution.

TEXT BOOKS:

1. William Stallings, “Cryptography and Network security Principles and Practices”, Pearson/PHI, Seventh Edition, 2017.
2. Douglas R. Stinson ,“Cryptography Theory and Practice ”, Fourth Edition, Chapman & Hall/CRC,2019

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. Behrouz 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.
5. Menges A. J , Oorschot P, Vanstone S.A,“Handbook of Appliled Cryptography” CRC Press, 2001 Reprint

MAPPING of Course Outcomes with Program Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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3	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
4	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
5	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
Avg	3	3	3	3	2	2	2	1	2.6	3	1	3	3	3	3

AZ5009 AI IN SUPPLY CHAIN L T P C
3 0 0 3

UNIT I SUPPLY CHAIN FUNDAMENTALS 9

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

Suggested Activities

- Flipped classroom on supply chain performance
- Discussion on the need of supply chain

Suggested Evaluation Methods

- Assignment on Digital transformation in Supply chain

UNIT II SUPPLY CHAIN NETWORK 9

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

Suggested Activities

- Tutorial on network design and location intelligence.
- External learning on framework for Network design decisions in supply chain

Suggested Evaluation Methods

- Assignment on various software for network design

UNIT III PLANNING DEMAND, INVENTORY AND SUPPLY 9

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

Suggested Activities

- .Discussion on choosing the right ERP software.

Suggested Evaluation Methods

- Quiz on Inventory management system.

UNIT IV APPLICATION OF AI IN SUPPLY CHAIN MANAGEMENT 9

Adopting AI for Supply Chain: Understanding Supply chain structure – Establishing business KPIs and ROI –Benefits of AI for SCM- Applications of AI: Supplier Selection Problem – Predicting Customer behavior – Managing Supply Chain Risks – Demand/ Sales Estimation – Inventory and Storage Management – Transportation and Distribution - Production – Sustainable Development.

Suggested Activities

- Demonstrate Predictive customer behavior using Python.
- Demonstration of Demand and Sales Estimation using Python
- Read a latest survey in AI for supply chain management

Suggested Evaluation Methods

- Programming assignment applications of AI in Transportation and Distribution.
- Assignment on Sustainable development.

UNIT V CASE STUDIES 9

Case studies on Supply chain: Inventory management - Automation and Digitization – Real-time visibility & predictive analytics – Supply chain connectivity – Last-mile logistics- Identifying Vulnerabilities in the Machine Learning Model Supply Chain

Suggested Activities

- Exploring the dataset for AI in supply chain

Suggested Evaluation Methods

- Mini project with benchmark dataset

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to (5-6 outcomes)

1. Understand the need of supply chain management
2. Design a supply chain network
3. Plan based on inventory and supply
4. Use AI to solve supply chain problems
5. Write python programs with benchmark datasets and evaluation metrics.

TEXT BOOKS

1. Sunil Chopra, Peter Meindl and DharamVirKalra, Supply Chain Management-Strategy Planning and Operation, Pearson Education, Seventh Edition, 2021
2. Kurt Y. Liu, " Supply Chain Analytics : Concepts, Techniques and Applications, Palgrave Macmillan Cham, 1st Edition, ISBN : 978-3-030-92223-8

REFERENCES

1. Atour Taghipour, "Demand Forecasting and order planning in supply chains and

Humanitarian Logistics", IGI Global publications, ISBN : 9781799838067, 1799838064.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2007.
3. Nada R. Sanders, Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence, Pearson Education, 2014.
4. Research Papers on AI for supply chain.

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	2	3	2	2	2	1	2	2	3	2	2
2	2	2	3	2	2	3	2	2	2	2	3	2	2	2	2
3	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2
4	1	3	3	2	3	2	2	2	2	2	3	2	2	3	3
5	2	3	2	2	3	3	2	2	2	2	2	2	1	3	3
Avg	2	2.5	2.5	2	2	3	2	2	2	2	3	2	2	2	2

AZ5010 PREDICTIVE ANALYTICS L T P C
3 0 0 3

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics - The CRISP-DM Process Model for Predictive Analysis - The role of data in Predictive Analysis - Data Understanding - Data Visualization - The Value of Statistical Significance - Statistical concepts and tools for Predictive Analysis.

Suggested Activities:

- Case studies on applications for predictive analytics.
- Understanding of Challenges and issues of predictive analytics.
- Implementation of statistical concepts using tools.

Suggested Evaluation Methods:

- Assignment on applications of predictive analytics.
- Group presentation on statistical tools for analysis.
- Quiz on predictive analytics terminologies, tools and applications.

UNIT II DATA PREPARATION AND FEATURE SELECTION 9

Understanding the importance of data quality for Predictive Analysis - Data Preparation - Data pre-processing - Dealing with missing data and outliers - Feature selection/creation techniques - Exploratory data analysis for predictive modelling.

Suggested Activities:

- Solving problems related to Exploratory Data Analysis.
- Demonstration of tools for Data Pre-processing.
- Implementation of Feature selection algorithms.

Suggested Evaluation Methods:

- Assignment on Data Understanding and Data Preparation.
- Group presentation on tool exploration of data preparation.
- Quiz on concepts related to data preparation and feature selection.

UNIT III PREDICTIVE MODELING TECHNIQUES 9

Introduction to Modeling - Descriptive Modeling- Data Preparation Issues with Descriptive Modeling - Predictive modeling techniques - Decision Trees - Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms - Parameter tuning and hyperparameter optimization - Evaluating model performance and metrics – Model Ensembles.

Suggested Activities:

- Case studies on Predictive modeling techniques.
- Practicing problems for decision tree, neural network, KNN, NB.
- Practicing problems for linear regression, multi-linear regression, etc.

Suggested Evaluation Methods:

- Assignment on Model Evaluation and Metrics for each technique.
- Demonstration on various techniques implemented with dataset.
- Quiz on predictive modeling techniques.

UNIT IV TIME SERIES ANALYSIS AND FORECASTING 9

Introduction to Time Series Analysis and Forecasting - Components of time series - Trend and Seasonality analysis – ARIMA, LSTM modeling and forecasting - Exponential smoothing techniques – Model Evaluation - Applications.

Suggested Activities:

- Case studies on applications of Time series data analysis.
- Implement the ARIMA model.
- Develop a LSTM forecasting model for an application.

Suggested Evaluation Methods:

- Assignment on Trend and Seasonality analysis.
- Group presentation on real-time applications.
- Quiz on Model Evaluation and Performance.

UNIT V ADVANCED TOPICS IN PREDICTIVE ANALYSIS 9

Deep Learning and its applications in Predictive Analysis - Unsupervised Learning techniques - Clustering and Association Rule Mining - Ensemble Learning and Model Stacking techniques - Ethical and legal considerations in Predictive Analysis – Case studies.

Suggested Activities:

- Case studies on deep learning applications for predictive analytics.
- Demonstrate Clustering model using tool.
- Implement Association rule mining using any analytical software.

Suggested Evaluation Methods:

- Assignment on Ensemble learning and model stacking.

- Demonstration of deep learning models for predictive analytics.
- Quiz on tools and applications.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Grasp the fundamental concepts of predictive analytics and its applications.
2. Understand the pre-processing of the data and importance of feature selection.
3. Perform exploratory data analysis to gain insights into data patterns.
4. Get hands-on practice with various predictive modeling techniques.
5. Acquire skills in model evaluation, model selection and model validation.
6. Apply predictive analytics to real-world problems using analytics software.

TEXT BOOKS

1. Dean Abbott, “Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst”, Wiley, 2014.
2. Daniel T. Larose, Chantal D. Larose, “Data Mining and Predictive Analytics”, Wiley, 2015.

REFERENCES

1. Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017.
2. Alberto Cordoba, “Understanding the Predictive Analytics Lifecycle”, Wiley, 2014
3. Jiawei Han and Micheline Kamber, Data Minin g Concepts and Techniques, Third Edition, Elsevier, 2012.
4. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	2	2	2	2	3	3	3	3	2
2	3	3	3	3	3	3	2	2	2	2	3	3	3	3	2
3	3	2	2	3	3	2	2	2	2	2	2	2	3	3	2
4	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
5	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
6	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3
AVg.	**3**	**3**	**3**	**3**	**3**	**3**	**2.5**	**2.5**	**2.5**	**2**	**3**	**3**	**2.5**	**3**	**2.5**

AZ5011 **DIGITAL VIDEO PROCESSING** **L T P C**
3 0 0 3

UNIT I BASICS OF IMAGE 9

Image representation and image analysis tasks - Image representations – digitization – properties – color images – Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Canny edge detection - Line detection by local pre-processing operators

Suggested Activities:

- Discussion on digital image and color models.
- Study of OpenCV libraries for image/video processing.
- Demonstration of offline/online tools for basic processing applications.

Suggested Evaluation Methods:

- Quizzes on different concepts for line and edge detection.
- Practical – Python programming assignments on image/video processing.

UNIT II FUNDAMENTALS OF VIDEO 9

Digital Video Basics – Color Representation and Chroma Sub Sampling – Video Sampling Rate and Standards Conversion – Digital Video Formats –Video Features – Colour, Shape and Textural Features - 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 – Video Segmentation.

Suggested Activities:

- Discussion on challenges in video processing and analytics.
- Study of standard video formats and applications.

Suggested Evaluation Methods:

- Quizzes on different motion estimation and tracking methods.
- Practical – Programming assignments on optical flow feature extraction.

UNIT III OBJECT DETECTION USING MACHINE LEARNING 9

Object detection methods – R-CNN - You Only Look Once (YOLO) - YOLO architectures - Deep Learning framework for Object detection – Deep Learning Architectures - Faster R-CNN - bounding box approach – Optimization techniques - Intersection over Union (IoU) - Loss Functions – Real-Time object detection – multiple object detection and tracking

Suggested Activities:

- Group discussion on the latest YOLO architecture and other techniques for object detection.
- Demonstration of offline/online tools for deep learning techniques in video analysis.

Suggested Evaluation Methods:

- Assignment on real-time object detection techniques.
- Practical – Programming assignments on YOLO techniques.

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face detection - Haar cascades – HOG – Face Extraction – Eigen faces and Fisher faces – Euclidean distance and cosine similarity - Applications of Face Recognition - DeepFace solution by Facebook - FaceNet for Face Recognition - Gesture Classification – HMM and SVM – Gesture recognition.

Suggested Activities:

- Discussion on different features and dimensionality reduction techniques in image/video processing.
- Study of state of art face and gesture recognition techniques.

Suggested Evaluation Methods:

- Quizzes on different techniques used for face recognition in real-time.
- Practical – Programming assignments on feature extraction and object detection.

UNIT V VIDEO ANALYTICS USING DIFFERENT CNN 9

Video Processing – use cases of video analytics - Vanishing Gradient and exploding gradient problem - RestNet architecture - RestNet and skip connections - Inception Network - GoogleNet architecture - Improvement in Inception v2 - Video analytics: RestNet and Inception v3 / v4.

Suggested Activities:

- Discussion on different video surveillance techniques.
- Case study of RestNet and related techniques used in video analytics.

Suggested Evaluation Methods:

- Quizzes on real-time applications of video processing and analytics.
- Practical – Programming assignments on RestNet/GoogleNet.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Understand the basics of image and video processing techniques
2. Explain the techniques used for image pre-processing.
3. Develop various object detection techniques.
4. Understand the various face recognition mechanisms.
5. Elaborate on deep learning-based video analytics.

TEXT BOOK:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021
3. S.Sridhar, 2016, “Digital Image Processing”, Second Edition, Oxford University Press

REFERENCES

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. D. A. Forsyth, J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
4. Murat Tekalp, “Digital Video Processing” Second Edition, Prentice Hall, 2015.

MAPPING OF CO’S WITH PO’S AND PSO’S

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

3	3	3	3	2	3	2	1	2	3	2	2	3	1	2	2
4	3	3	2	2	2	2	1	2	2	2	1	2	1	2	2
5	2	2	3	2	3	2	1	2	2	2	1	3	2	2	3
Avg	3	3	3	2	3	2	1	2	2	2	1	3	1	2	2

IT5024 **MIXED REALITY** **L T P C**
3 0 0 3

UNIT I INTRODUCTION **9**

Introduction to Virtual Reality – Components of VR System – Introduction to AR – System structure of Augmented Reality – 3D Vision – Augmented Reality – Alternative interface paradigms – Spatial AR – Input devices – 3D Position trackers – Performance parameters – Navigation and manipulation interfaces – Gesture interfaces – Human visual system – Personal graphics displays – Large volume displays – Human factor involving auditory system.

Suggested Activities:

- Flipped classroom on different MR systems.
- Demonstration of the virtual reality effect.
- 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**

Programming framework of VR systems – 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 – Architecture AR systems.

Suggested Activities:

- Flipped classroom on rendering requirements.
- External learning – Different types of graphics architectures and workstations.
- Demonstration of GPU programming.

Suggested Evaluation Methods:

- Tutorials on graphics pipeline.
- Brainstorming session – Graphics architectures.
- Practical - GPU programs for AR/VR Applications.

UNIT III MR MODELING **9**

Geometric modelling – Virtual object shape – Object visual appearance – Kinematics modelling – Transformation matrices – Object position – Transformation invariants – Object hierarchies – The 3D world – Physical modelling – Collision detection – Surface deformation – Force computation – Force smoothing and mapping – Behaviour modelling.

Suggested Activities:

- Flipped classroom on modelling and rendering of 3D objects.
- External learning – Collision detection algorithms.
- Practical – Programs for 3D models.

Suggested Evaluation Methods:

- Tutorials on 3D modelling techniques.
- Group discussion on model management.
- Demonstration of three dimensional models.

UNIT IV MR PROGRAMMING 9

Programming for VR system – Toolkits and scene graphs – World Toolkit – Java 3D – Human factors in VR – VR Health and safety issues – VR and society – MR programming framework – Trajectories through MR Performance – Mobile interface design – Quantitative evaluation – Qualitative evaluation.

Suggested Activities:

- Case study – Different types of programming toolkits.
- Practical – Create VR scenes using toolkits like World ToolKit, Java 3D, Ghost, PeopleShop, Unity.

Suggested Evaluation Methods:

- Tutorial on programming toolkits for MR.
- Practical - Programming for scene creation in MR.

UNIT V APPLICATIONS 9

Implementation support: Unity and ARCore framework - AR Foundation – AR on Android devices – Emerging applications of MR – Information visualization – Wearable computing.

Suggested Activities:

- External learning – Different types of MR applications.
- Practical – Development of MR applications in medicine, entertainment, etc.
- Tutorials on MR applications

Suggested Evaluation Methods:

- A mini project on MR applications.
- Demonstration of MR application development and evaluation.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basic concepts of mixed reality.
2. Design and develop the mixed reality applications in different domains.
3. Design various models for MR systems.
4. Implement mixed reality programming with toolkits.
5. Understand the working principles of MR.
6. Develop new mixed reality 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.

MAPPING of CO’s with PO’s and PSO’s

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3	2	2	2	2	3	1	-	-	1	-	-	1	2	2	2
4	2	2	2	2	3	1	-	-	1	-	-	1	2	3	2
5	3	2	3	2	2	1	-	-	-	-	-	1	2	2	2
6	3	2	3	2	2	1	-	-	1	-	-	1	2	2	2
Avg	3	2	3	2	3	1	1	1	1	2	2	1	2	2	2

AZ5012 APPLIED AI L T P C
3 0 0 3

UNIT I INTRODUCTION TO APPLIED AI 9

Basics of Artificial Intelligence – Turing Test - Applied Neural Networks – AI categories – Narrow, strong, super - AI Techniques - AGI, Deep learning, Reinforcement learning - Transfer learning

Suggested Activities:

- Transfer learning simple implementation
- Quiz on AI categories

Evaluation methods:

- Assignment on AI techniques

UNIT II IMAGE RECOGNITION WITH DEEP LEARNING AND NEURAL NETWORKS 9

Object recognition - Object detection – Face recognition - Image Classification - Neural Networks and Deep Learning for Image Classification - Image segmentation – Applications of Image Segmentation and Object Recognition

Suggested Activities:

- Discussion on Applications of Object detection and analysis
- Flipped class room on Deep learning models for image classification

Evaluation methods:

- Assignment / implementation of image recognition techniques

UNIT III APPLIED AI IN NATURAL LANGUAGE PROCESSING 9

Applied Machine Learning for Natural Language Processing – Text Classification -Sentiment

recognition – Information Retrieval – Name entity recognition – Machine Translation – Speech Recognition - Parsing – Part-of-Speech tagging

Suggested Activities:

- Discussion on Speech Emotion recognition
- Flipped Classroom activity on NLP

Evaluation methods:

- Quiz on Information retrieval techniques

UNIT IV AUTONOMOUS DRIVING AND GAN 9

Introduction to Driverless Vehicles - Autonomous driving – Algorithms, approaches, and obstacles – Knowledge Graph - Generative Adversarial Network – Generator, Discriminator – Applications of GAN

Suggested Activities:

- Flipped class room on Autonomous lane detection techniques

Evaluation methods:

- Assignment on applications of GAN
- Assignment on future of autonomous driving

UNIT V AI IN SMART SYSTEMS AND ITS IMPACT 9

Applied Artificial Intelligence in Smart Systems: AI- powered Assistants, Fraud prevention, Smart Homes - Future of AI - AI and Social impact: AI and Ethics, AI in Society, Singularity – Bias in AI

Suggested Activities:

- Tutorials on AI in Cyber Security

Evaluation methods:

- Assignment on AI-powered assistants
- Quiz on Impact of AI

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the influence of AI in different domains
2. Identify the selection of image and neural algorithms for various image recognition tasks
3. Design and implement NLP based text and speech systems
4. Design and implement Autonomous driving Algorithms for various real time applications
5. Identify the scope of AI in smart systems

TEXT BOOK:

1. Yao, M., Zhou, A., & Jia, M. (2018). Applied Artificial Intelligence: A Handbook for Business Leaders. Wiley.
2. Heaton, J. (2015). Artificial Intelligence for Humans: Fundamentals and Practical Examples. Heaton Research, Inc.

REFERENCES

1. Simoudis, E., Patsalos-Fox, M., & Lotz, E. (2019). Autonomous Vehicles: Opportunities, Strategies, and Disruptions. John Wiley & Sons.
2. Russell, S., & Norvig, P. (2010). Artificial Intelligence: A Modern Approach. Prentice Hall.
3. Raschka, S., & Mirjalili, V. (2017). Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow. Packt Publishing.

MAPPING of CO's with PO's and PSO's

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	2	2	1	2	2	2	1	3	3	2	2
2	2	2	3	2	3	2	1	2	2	2	1	3	1	2	1
3	2	2	3	2	3	2	1	2	2	2	1	3	1	2	1
4	3	3	3	2	3	2	2	2	3	3	2	3	2	3	2
5	3	3	3	2	3	2	2	2	3	3	2	3	2	3	2
Avg	2	2	3	2	3	2	2	2	2	2	1	3	2	2	2

AZ5013 SOCIAL NETWORKS L T P C
3 0 0 3

UNIT I INTRODUCTION TO SOCIAL NETWORKS 9

Complex Networks, Overview of Social Network Analysis, Social Media Content, Levels of Network Analysis, Network Statistics, Representation of the Networks, Network Models, Network Centrality, Security and Privacy in Social Networks.

Suggested Activities:

- Practical – Study of existing social networks
- 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.
- Assignments on calculation of ties, density, path, length, distance, betweenness,centrality, clique.
- Group discussion on data privacy and security social networks

UNIT II LINK PREDICTION 9

Link Analysis. Link Prediction, Link Prediction Methods, Metrics for Link prediction, prediction of Performance Metrics, Community Detection, Taxonomy of community criteria, Community evaluation, Ego Networks - Characteristics of Ego Networks, Ego Network Measures, Network Cohesion.

Suggested Activities:

- Practical – Discovering communities in social networks and techniques.
- External learning – Hands-on problems related to evaluating community metrics

Suggested Evaluation Methods:

- Demonstration – Link prediction and community identification
- Assignments on community detection approaches.

UNIT III INFORMATION DIFFUSION 9

Game Theoretic models, User behavior in social networks, Strategic Interaction in networks,

Information Networs, Information Cascades, Cascading behavior in Networks, Diffusion in Network, Modeling, Cascades and Clusters, Diffusion, Thresholds, Six degrees of separation Decentralized search, Epidemics, Influence maximization, Outbreak detection, Markets and Information, Voting, Property Rights, Social Network Analysis Tools.

Suggested Activities:

- Practical – Analyzing user behavior in social networks.
- External learning – Exploring the use of different social network analysis tools

Suggested Evaluation Methods:

- Demonstration – Opinion analysis on social networks
- Assignments on Information diffusion in graphs.

UNIT IV SOCIAL SEMANTIC AND RECOMMENDER SYSTEM 9

Modeling and aggregating Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Developing social-semantic applications - Recommendation in Communities -Social Collaboration Platforms-Recommendation Types- Partner Recommendation -Social Network-Based Collaboration .-Reputation Model - Structural Importance Model - Framework and Ranking Algorithm - Social Broker Recommendation - Virtual Organizations -Expert Communities - Broker Ranking .

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 V VISUALIZING, MINING SOCIAL NETWORKS 9

Taxonomy of Visualizations - Structural Visualization, Semantic and Temporal Visualization, Statistical Visualization, The Convergence of Visualization, Interaction and Analytics - Structural and Semantic Filtering with Ontologies, Centrality-based Visual Discovery and exploration, Mining Social Network Graphs - Clustering, Discovery of Communities, Partitioning, overlapping Communities, Simrank, Triangles in social networks, Neighborhoods, Transitive closure.

Suggested Activities:

- Practical – Exploring social networks and implementing innovative social network visualizations using tools such as Gephi, Cytoscape.
- Exploring applications in social networks.
- External learning – Investigating the role of visualization in real-world applications.

Suggested Evaluation Methods:

- Demonstration of immersive social network visualizations.
- Tutorials on innovative applications of social networks.
- Quizzes on state-of-the-art visualization techniques for social networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Grasp the fundamental principles of networks and social network analysis
2. Discover different community and analyzing information diffusion in social networks
3. Employ data mining and techniques for social network analysis.
4. Utilize advanced extraction and mining tools for social network analysis.
5. Develop personalized and immersive visualizations for social networks.
6. Design secure and ethical AI-powered social network applications.

TEXT BOOKS:

1. Social Network Modelling and Analysis, Niyati Aggrawal, Adarsh Anand, Taylor and Francis, 2022
2. Social Networks and the Semantic Web, Peter Mika, Springer 2007
3. Mining of Massive Datasets by Cambridge University Press, Jure Leskovec, Anand Rajaraman, Jeff Ullman, 2011
4. Social Network data Analytics, Charu C Aggarwal, Springer, 2011

REFERENCES:

1. Networks, Crowds, and Markets reasoning about a highly connected world
2. David Easley and Jon Kleinberg, Cambridge University Press, 2010
3. Social Network Analysis and Education, Theory Methods & Applications by Brain V, Carolan, Sage Publications, 2014
4. Understanding Social Networks Theories, Concepts and Findings, Oxford University Press, 2012, Charles and Kadushin
5. Analyzing Social Networks, Stephan P Borgatti, Martin G Everett, Jeffrey C Johnson, Sage Publications, 2017
6. Social Recommender Systems, Daniel Schall, Springer, 2015

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	1	1	-	-	2	2	-	2	-	-	-	2	2	2	2
2	2	2	2	-	2	-	-	2	-	-	2	2	2	2	2
3	3	2	2	2	3	1	1	2	1	1	3	2	2	2	2
4	3	2	2	3	3	2	1	1	1	2	3	2	3	3	3
5	2	2	3	3	3	2	-	2	2	2	3	3	2	2	2
6	2	3	3	3	3	2	-	2	2	2	3	3	2	2	2
AVg.	2.17	1.83	2.4	2.75	2.67	1.8	1	1.83	1.5	1.75	2.8	2.33	2.17	2.17	2.17

IT5034 **BLOCKCHAIN TECHNOLOGIES** **L T P C**
3 0 0 3

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.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	1	2	1	1	2	1	-	3	2	2	2
2	2	2	2	2	1	2	1	1	2	1	-	3	2	2	2
3	3	3	3	3	3	2	2	2	3	2	2	3	2	2	2
4	3	3	3	3	3	2	2	2	3	2	2	3	2	2	2
5	3	3	3	3	3	2	2	2	3	2	2	3	2	2	2
6	3	3	3	3	3	3	2	2	3	2	2	3	2	2	2
Avg	2.6	2.6	2.6	2.6	2.33	2.16	1.6	1.6	2.6	1.6	2	3	2	2	2

AZ5014 **CLOUD SECURITY AND PRIVACY** **L T P C**
3 0 0 3

UNIT I INTRODUCTION OF CLOUD SECURITY 9

The SPI Framework for Cloud Computing- Relevant Technologies in Cloud Computing-.Cloud access devices.-Browsers and thin clients-.High-speed broadband access- Data centers and server farms.-Storage devices-Virtualization technologies-APIs-Barriers to Cloud Computing- Adoption in the enterprise Security- Privacy-Connectivity and Open Access-Reliability-Interoperability

Suggested Activities

- Exploration on different recent cloud technologies
- Understanding cloud security at enterprise level

Suggested Evaluation Methods

- Assignments on distinction between security and privacy
- Practice on virtualization mechanism

UNIT II INFRASTRUCTURE SECURITY 9

Host level- Network Level-Host level-Data Security and Storage- Aspects of Data Security-Data Security Mitigation-Provider Data and Its Security- Identity and Access Management- Relevant IAM Standards and Protocols for Cloud Services- IAM Practices in the Cloud- Cloud Authorization Management

Suggested Activities

- External learning – Data security schemes in cloud
- Implement IAM application

Suggested Evaluation Methods

- Assignments on Cloud authorization.

Unit III SECURITY MANAGEMENT IN THE CLOUD 9

Security Management Standards- Availability Management- SaaS , IaaS,, PaaS- Availability - Access control Management- Security Vulnerability, Patch, and Configuration Management- Intrusion Detection and Incident Response- Caveats

Suggested Activities

- Exploration on the various vulnerability tools
- Implementation of intrusion detection in real time scenarios.

Suggested Evaluation Methods

- Assignments on the design of access structure
- Tutorials on vulnerability tools

UNIT IV PRIVACY 9

Key Privacy concerns in cloud-Data Life cycle-Changes to Risk and compliance to cloud- Legal and Regulatory Implications-International laws and regulations- Key management- Audit and compliance- Incremental CSP-COBIT-HIPAA - Cloud Security Alliance

Suggested Activities

- Implementation of a privacy application by adopting cloud data life cycle
- Analysis of privacy concerns in CSP

Suggested Evaluation Methods

- Assignment on key management infrastructure
- Assignment on risk and compliance to cloud.

UNIT V SECURITY AS A SERVICE 9

The Impact of Cloud security on the Role of Corporate IT- Potential Threats of Using CSPs- Program Guidance for CSP Customers- SAS 70 Report Content Example- SysTrust Report Content Example- Open Security Architecture for Cloud.

Suggested Activities

- External learning on SAS report and analysis
- Formulation of attack vectors of various

Suggested Evaluation Methods

- Assignments on security levels in a corporate scenario

Total Periods:45

COURSE OUTCOMES:

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

1. Appreciate cloud resource management.
2. Articulate the main concepts, key technologies, strengths and limitations of Cloud Security
3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
4. Explain the core issues of cloud computing such as resource management and security.
5. Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud vulnerability tools

TEXT BOOKS:

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, John Wiley, 2011.

2. John W. Rittinghouse, James F. Ransome, “Cloud Computing: Implementation “Management and Security”, CRC Press, 2010.

REFERENCES:

1. Reese, G. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. 2009
2. Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013.
3. 3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011

MAPPING of COs with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	1	1	-	1	1	1	-	2	3	1
2	3	3	3	3	1	-	-	-	-	-	1	-	2	3	2
3	3	3	3	2	1	1	1	1	1	1	1	-	2	3	2
4	3	3	3	3	2	2	1	2	1	1	2	1	3	3	3
5	3	3	3	3	2	2	1	2	1	2	2	2	3	3	3
Avg.	3	3	3	2.4	3.2	2	1	-	1	-	1.4	1.5	2.4	3	2.2

AZ5015 **EXPLAINABLE AI** **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO XAI 9

Introduction to Explainable AI: Motivation, Importance - Challenges and limitations of black box models - Types of Explainability – taxonomy of explanations - Interpretability – Importance of Interpretability - Taxonomy of Interpretability Methods - Scope of Interpretability - Evaluation of Interpretability - Properties of Explanations - Human-friendly Explanations

Suggested Activities

- Debate on Challenges and Limitations of Black-Box Models
- Group discussion about Interpretability of the models

Suggested Evaluation Methods

- Quiz on Properties of Explanations
- Assignment on Taxonomy of Explanations

UNIT II INTERPRETABLE MACHINE LEARNING MODELS 9

Overview of Interpretable Machine Learning – Decision Trees, Random Forests – principles, interpretation techniques, Rule based Models – Rule induction, Decision list, rule-based classifiers, Linear models – Interpreting Coefficients, regularization techniques, feature selection.

Suggested Activities

- Choose a dataset and build a decision tree model, visualize and interpret decision tree's structure
- Build a random forest model and explore feature importance
- Develop rule- based models for prediction
- Build a linear regression model using and explore feature importance

Suggested Evaluation Methods

- Tool based assignments on decision tree, random forest and regression using real world case studies.

UNIT III MODEL AGNOSTIC XAI TECHNIQUES 9

Overview of model Agnostic systems – LIME – local feature importance explanations – SHAP – individual predictions and feature importance – Partial Dependence Plot – Individual Conditional Expectation Plot - Counterfactual explanations

Suggested Activities

- Apply Lime to a pre-trained model and generate local explanations
- Apply SHAP to a pre-trained model and generate explanations for individual predictions
- Visualize and interpret the relationships between features and predictions using PDP and ICE Plots

Suggested Evaluation Methods

- Programming assignments to demonstrate LIME and SHAP

UNIT IV XAI FOR DEEP LEARNING 9

XAI for deep learning models - Gradient-based methods: Grad-CAM, Integrated gradients, Saliency Maps – Layer wise relevance propagation (LRP)– feature visualization- Deep Dream – Activation Maximization

Suggested Activities

- Build a deep learning model and analyze the importance of features in model's predictions.
- Implement Grad cam visualization.
- Explore LRP techniques to assign relevance scores to individual input features.

- Explore existing XAI tools and frameworks that can be applied to deep learning models.

Suggested Evaluation Methods

- Group Presentation on Gradient based methods.
- Mini Project on Explainable Deep Learning

UNIT V EVALUATION AND ETHICAL CONSIDERATIONS 9

Evaluating XAI Methods - Metrics and criteria for evaluating explanation - Human-in-the-loop evaluation - User studies and feedback - Ethical Considerations in XAI - Bias, fairness, and transparency - Privacy and security concerns - Social and legal aspects of XAI – Applications

Suggested Activities

- Explore different evaluation metrics and criteria for evaluating explanation.
- Analyze the presence of bias and fairness issues in a chosen dataset.
- Debate on ethical dilemmas related to AI

Suggested Evaluation Methods

- Group discussion on Future Directions and Emerging Trends
- Practical Implementation of Interpretability in Deep Reinforcement Learning:
- Evaluate the mini project (given at the end of 4th unit) using different metrics.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Recall Taxonomy of explanations.
2. Understand interpretable machine learning principles of decision tree, rule based and linear models.
3. Apply Model Agnostic XAI techniques, interpret and explain predictions of machine learning models.
4. Develop XAI techniques for deep learning models.
5. Evaluate XAI methods and Propose innovative solutions to address ethical considerations
6. Apply XAI techniques in practical scenarios, for real-world datasets and problems.

TEXT BOOKS:

1. Christoph Molnar, “Interpretable Machine Learning: A Guide for Making Black Box Models Explainable”, 2022. (This is a comprehensive book available as a free online resource: https://christophm.github.io/interpretable-ml-book/)”, Springer, 2019.
2. Uday Kamath, John Liu, “Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning”, 2021.

REFERENCES:

1. Leonida Gianfagna, Antonio Di Cecco, Explainable AI with Python, Springer, 2021.
2. Denis Rothman, “Hands-On Explainable AI (XAI) with Python: Interpret, Visualize, Explain, and Integrate Reliable AI for Fair, Secure, and Trustworthy AI Apps”, Packt Publishing Ltd, 2020

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	1	1	2	2	1	3	2	2	1
2	3	3	3	2	2	2	1	2	2	3	1	3	3	3	3

3	3	3	3	3	3	2	1	2	2	3	1	3	3	3	3
4	3	3	3	3	3	2	1	2	2	3	1	3	3	3	3
5	3	3	3	3	3	3	1	3	3	3	2	3	2	3	3
6	3	3	3	3	3	2	1	2	3	3	1	3	3	3	3
AVg.	**3**	**3**	**3**	**2.83**	**2.83**	**2.16**	**1**	**2**	**2.33**	**2.8**	**1.16**	**3**	**2.66**	**2.8**	**2.66**

AZ5016 MODELING BIOINFORMATICS L T P C
3 0 0 3

UNIT I PROBABILISTIC AND MODEL-BASED LEARNING 9

Introduction: Probabilistic Learning - Basics of Probability - Random Variables and Probabilistic Distributions - Basics of Information Theory - Basics of Stochastic Processes - Hidden Markov Models - Frequentist Statistical Inference - Some Computational Issues - Bayesian Inference

Suggested Activities:

- Implement a simulation of a hidden Markov model using programming languages such as Python
- Hands-on experiment to demonstrate the concept of probability distribution.

Suggested Evaluation methods:

- Programming tasks or projects to implement probabilistic algorithms or models.
- Research paper or report exploring a specific topic related to probabilistic and model-based learning.

UNIT II COMPUTATIONAL INTELLIGENCE IN BIOINFORMATICS 9

Introduction - Fuzzy Sets (FS) - Artificial Neural Networks (ANN) - Evolutionary Computing (EC) - Rough Sets (RS) – Hybridization - Application to Bioinformatics, Machine learning- Overfitting and under fitting- Types of machine learning, The math behind Deep learning- Tensors, mathematical operations, Clustering in Bioinformatics-Distance based Clustering in Bioinformatics, Graph based clustering in Bioinformatics, Biclustering , Multi-Objective Biclustering, Fuzzy Possibilistic Biclustering.

Suggested Activities:

- Creating Fuzzy inference system for bioinformatics data analysis.
- Explore biclustering methods for identifying co-expressed genes in microarray data.

Suggested Evaluation methods:

- Quizzes to assess the understanding of the mathematical concepts behind deep learning, tensors, and clustering algorithms.
- Assign a bioinformatics project/related case study that requires applying machine learning techniques.

UNIT III DATA MINING FOR BIOINFORMATICS 9

Biological Databases and Integration- Introduction: Scientific Work Flows and Knowledge Discovery, Biological Data Storage and Analysis, Dimensionality, data cleaning and Integration- Feature selection and Extraction strategies in data mining-Filter and wrapper approaches- focus algorithm, relief method-Gram, Schmidt forward feature selection, Feature construction and extraction.

Suggested Activities:

- Learning how to handle missing data, outliers, and inconsistencies in biological datasets.
- Explore real-world bioinformatics problem and analyze the workflow of knowledge discovery.

Suggested Evaluation methods:

- Case studies involving real biological datasets are presented and following process to be carried out: analyze the data, perform feature selection, and provide insights.

UNIT IV DEEP LEARNING IN BIOINFORMATICS 9

Introduction to Deep Learning and bioinformatics- Convolutional Neural Networks (CNNs) for Bioinformatics-Convolutional neural network architecture: Convolution Layer, Pooling layer, Stride and padding-Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) Networks in Bioinformatics: Introduction-The problem, short-term memory -Protein sequence classification: Protein structure, Protein function, Prediction of protein function-LSTM with dropout- LSTM with bidirectional and CNN.

Suggested Activities:

- Coding exercises to implement and experiment with Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) in bioinformatics tasks.
- Industry experts or researchers working in the field of deep learning and bioinformatics to deliver guest lectures.

Suggested Evaluation methods:

- Quizzes and tests to assess the understanding of the concepts, architectures, and techniques related to CNNs and RNNs in bioinformatics.
- Practical exams - given a bioinformatics dataset and required to develop and train CNN and RNN models within a given timeframe.

UNIT V PROGRAMMING IN BIOINFORMATICS 9

Introduction to Python Libraries for Implementing and experimenting Machine Learning and Deep Learning Approaches – Numpy and SciPy, Image manipulation, The Akando and Dancer Modules, Parsing DNA data files, Sequence Alignment, Dynamic Programming.

Suggested Activities:

- Coding exercises to parse DNA data files and perform basic operations such as reading, writing, and extracting relevant information.

Suggested Evaluation methods:

- Quizzes or tests to assess theoretical knowledge related to the Python libraries

TOTAL: 45 PERIODS

OUTCOMES

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

1. Recall the fundamental concepts of probabilistic learning, computational issues related to probabilistic learning algorithms and propose solutions.
2. Apply frequentist statistical inference techniques to analyze data and make probabilistic predictions.
3. Implement computational intelligence methods for solving bioinformatics problems.
4. Analyze biological datasets using data mining techniques, evaluate the performance of machine learning models, and interpret the results.
5. Develop deep learning models for protein sequence classification and analysis.
6. Understand the functionalities of libraries such as Numpy, SciPy, and Akando in bioinformatics data processing and analysis.

TEXT BOOKS

1. “Introduction to Machine Learning and Bioinformatics”, CRC Computer Science & Data Analysis, 2019, by Sushmita Mitra, Sujay Datta, Theodore Perkins), George Michailidis

2. Deep Learning in Bioinformatics: Techniques and Applications in practice", 1st Edition - January 8, 2022, Habib Izadkhah
3. "Data Mining for Bioinformatics", Sumeet Dua, Pradeep Chowriappa, CRC Press Taylor & Francis Group, 2013

REFERENCES

1. Python for Bio Informatics, Jason Kinser, Jones and Bartlett Publishers, 2009
2. "Introduction to Machine Learning and Bioinformatics", CRC Computer Science & Data Analysis, 2019, by Sushmita Mitra, Sujay Datta, Theodore Perkins), George Michailidis

MAPPING of CO's with PO's and PSO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	1	1	2	2	2	1	3	2	1	1
2	3	3	2	3	2	2	1	2	2	2	2	3	2	1	1
3	3	3	3	2	3	2	1	2	2	2	2	3	2	1	2
4	3	3	3	3	3	2	1	2	2	2	2	3	2	1	1
5	3	3	3	3	3	2	1	2	2	2	2	3	2	3	1
6	2	2	1	2	3	1	1	2	2	2	1	3	1	3	2
Avg.	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**1**

IT5043 ETHICAL HACKING L T P C
3 0 0 3

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 BOOKS:

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.

MAPPING of Course Outcomes with Program Outcomes

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

AZ5017 **MACHINE LEARNING OPERATIONS** **L T P C**
3 0 0 3

UNIT 1: INTRODUCTION TO MLOPs **9**

MLOps Introduction-The need of MLOps-Benefits-Components-Different Roles of MLOps-Machine Learning Life Cycle (MLLC)-open source MLOps Tools for MLLC- MLOps Vs DevOps; Types of ML Software -Data: Data Engineering pipelines, Model: Machine Learning Pipelines-Code: Deployment Pipelines.

Suggested Activities:

- Flipped classroom on MLOps.
- Learning – MLOps Tools, Types of ML Software.

Suggested Evaluation Methods

- Quiz on MLOps
- Tutorials on MLOps Essentials

UNIT 2: DATABASE FOR MLOPs **9**

SQL vs NoSQL-Differences-Pros and cons; Working with MySQL Database using Python-CRUD-Examples-Introduction to MongoDB- MongoDB using Python-CRUD-Examples.

Suggested Activities:

- Flipped classroom on SQLite and MongoDB
- Practical - Working with SQLite CRUD Examples using Python
- Practical - Working with MongoDB CRUD Examples using Python

Suggested Evaluation Methods

- Quiz on SQLite, MongoDB
- Tutorials on Python Databases.
- Demonstration of Programs using SQLite and MongoDB.

UNIT 3: MACHINE LEARNING MODELS **9**

Introduction to Machine Learning-Data Preprocessing-Types -Supervised Learning – Algorithms; Unsupervised Learning-Algorithms; Reinforcement Learning-Algorithms; Python Libraries for Machine Learning – Scikit Learn, TensorFlow, Keras, PyTorch, Pandas-Matplotlib-Examples.

Suggested Activities:

- Flipped classroom on Machine Learning Models
- Implementation of Supervised Machine Learning Algorithms using Python
- Implementation of Unsupervised Machine Learning Algorithms using Python

Suggested Evaluation Methods

- Quiz on Machine Learning Models
- Tutorials on Python Data Structures and Machine Learning Libraries.

UNIT 4: TRACKING ML PROJECTS **9**

Docker Introduction – Pros and Cons –Features – Architecture – Installing Docker on Windows / Linux - Docker Image, Containers – Dockerfile – Deploying Simple Java / Python Application on Windows / Linux; Introduction to MLflow – Components – Key Concepts in MLflow – Installing

MLflow – Tracking ML Experiments using MLflow.

Suggested Activities:

- Flipped classroom on Docker Container and MLflow
- Java Application Deployment using Docker on Windows / Linux
- Python Application Deployment using Docker on Windows / Linux
- Tracking ML projects using MLflow.

Suggested Evaluation Methods

- Quiz on Docker and MLflow
- Demonstration of Deployed Applications using Docker
- Tutorials on MLflow with Python.

UNIT 5: MLOPs IN CLOUD **9**

Introduction to Cloud – Services – DevOps for Machine Learning – Machine Learning Operations with Microsoft Azure Cloud (MLOps with Azure) / Amazon Web Services (MLOps with AWS) / Google Cloud Platform (MLOps with GCP); Deployment – Simple ML project on Azure DevOps / AWS SageMaker / GCP.

Suggested Activities:

- Flipped classroom on Cloud Machine Learning
- Flipped classroom on deployment of ML models using cloud tools
- Practical – Deployment of ML Models into Cloud Azure / AWS / GCP

Suggested Evaluation Methods

- Quiz on Cloud Service Providers – Azure / AWS SageMaker / GCP
- Tutorials on Machine Learning Operations with Cloud
- Demonstration of Deployed ML Models using Cloud Tools.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the essential concepts of MLOps
2. Develop Database Applications using SQLite and MongoDB with Python
3. Learn and Implement the Machine Learning Models
4. Deploy applications using Docker and Track ML projects using MLFlow
5. Deploy MLOps in Cloud Platforms – AWS / Azure / GCP.

TEXTBOOKS:

1. Mark Treveil and the Dataiku team “Introducing MLOps: How to Scale Machine Learning in the Enterprise” Shroff/O'Reilly, First edition, 2020.
2. Oliver Theobald "Machine Learning for Absolute Beginners", Scatterplot Press, 2nd edition, 2017.
3. Reema Thareja "Python Programming: Using Problem Solving Approach Python Programming".Oxford University Press, First Edition 2017.
4. Martin C. Brown “Python: The Complete Reference” McGraw Hill Education, Forth edition, 2018.
5. Yuxi (Hayden) Liu "Python Machine Learning By Example". Ingram short title, 2017.
6. M. N. Rao "Cloud Computing", PHI Learning, 2015.
7. Timothy Chou “Cloud Computing: Fundamentals”. Cloudbook, First Edition, 2015.

8. Andreas Muller “Introduction to Machine Learning with Python: A Guide for Data Scientists” Shroff/O'Reilly, First Edition, 2016.

REFERENCES:

1. “ML Ops: Operationalizing Data Science” by David Sweenor, Steven Hillion, Dan Rope, Dev Kannabiran, Thomas Hill, Michael O’Connell.
2. “Accelerated DevOps with AI, ML & RPA: Non-Programmer’s Guide to AIOPS & MLOPS” by Stephen Fleming.
3. Francois Duval “Python Machine Learning-Practical Guide for Beginners”, 2017.
4. “Mastering Azure Infrastructure Servicesp” (1st edition), by John Savill, 2015.
5. "MongoDB in Action" (1st Edition), by Kyle Banker 2011.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	1	-	1	1	-	-	-	1	-	1	1	1	2
2	1	3	2	2	2	1	1	-	2	1	3	2	1	1	2
3	1	3	3	3	3	2	1	1	2	1	3	2	2	3	3
4	1	3	3	3	3	2	1	1	2	1	3	1	2	3	3
5	1	3	3	3	3	2	1	1	2	1	3	1	3	3	3
Avg	1	2.8	2.4	2.75	2.4	1.6	1	1	2	1	3	1.4	1.8	2.2	2.6

IT5018 QUANTUM COMPUTING L T P C
3 0 0 3

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:

1. Quiz on postulates and computational models.
2. Problem solving assignment on application of quantum mechanics.
3. 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 MACHINE LEARNING 9

Quantum Clustering - Quantum K-Means and K-Medians- Quantum Classifiers - Nearest neighbours - Support Vector Machine (SVM) in quantum space - Quantum Principal Component Analysis - Feature Maps - Linear Models - Probabilistic Models - Quantum Neural Networks

Suggested Activities:

- Flipped classroom on quantum machine learning.
- Extra reading and discussion from reference books.

Suggested Evaluation Methods:

- Quiz on quantum machine learning.
- Problem solving assignment on text book exercise questions

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students 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 machine learning.

TEXT BOOK:

1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
2. Santanu Ganguly, “Quantum Machine Learning: an Applied Approach : The Theory and Application of Quantum Machine Learning in Science and Industry”, Publisher Apress L. P., 2021

REFERENCES:

1. Jack D. Hidary, “Quantum Computing: An Applied Approach” 1st edition, Springer, 2019
2. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
3. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	-	-	-	-	-	-	-	-	-	-	1	1
2	3	3	3	-	-	-	-	-	-	-	-	-	-	1	1
3	3	3	3	3	2	-	-	-	-	-	3	1	2	2	2
4	3	3	3	3	2	1	-	1	-	-	3	1	2	2	2
5	3	3	3	3	2	-	-	-	-	-	-	-	1	1	1
6	3	3	3	3	2	-	-	-	-	-	-	2	3	3	3
AVg.	3	3	2.83	3	2	1	-	1	-	-	3	1.33	2	1.67	1.67

AZ5018 COGNITIVE MODELS FOR COMPUTING L T P C
3 0 0 3

UNIT 1: INTRODUCTION TO COGNITIVE MODELLING 9

Definition - Goals - Approaches – Benefits – Developing Cognitive Models – Theoretical Frameworks – Cognitive Architectures and Models – Role in understanding human cognition

Suggested Activities

- Divide the students into groups and instruct them to review literatures related to cognitive architectures
  - Group Presentation on the review carried out.

Suggested Evaluation Method

- Quiz on Cognitive Architectures and Models

UNIT 2: COGNITIVE MODEL TYPES 9

Rule Based Models - Production Rules –Conditions – Actions - Build Rule based Model – Connectionist Models – Basic Concepts - Building and validating a connectionist model - Hybrid Model - ACT-R – SOAR – Production Systems and Cognitive Architectures – Building and validating a hybrid model

Suggested Activities

- Choose a simple cognitive task and implement a rule based model to simulate this.
- Choose a simple cognitive task and construct a connectionist neural network model using TensorFlow or PyTorch.

Suggested Evaluation Methods

- Group discussion on the advantages and limitations of all three models

UNIT 3: MODELLING COGNITIVE PROCESSES – I 9

Perceptual organization - Attention – Perception – Models - Learning and Memory – Memory systems and Models – Encoding, Storage, Retrieval Processes – Reinforcement learning – Working Memory and Cognitive Control- Long Term Memory models

Suggested Activities

- Design an attention experiment and investigate the effects of different factors on attentional processes.
- Form groups and analyze different learning strategies.
- Choose a memory experiment and investigate factors such as encoding processes or interference effects.

Suggested Evaluation Methods

- Written assessments or quiz on modelling cognitive processes
- Develop research proposals addressing attention, perception, learning or memory

UNIT 4: MODELLING COGNITIVE PROCESSES – II 9

Language Processing – Communication - Decision Making & problem Solving –Cognitive Processes in Decision making –Rational and Heuristic Decision Making Models - Decision making under uncertainty - Dynamical and Complex Systems – Large Scale Modelling

Suggested Activities

- Explore various cognitive biases influencing decision making such as confirmation bias, availability heuristic etc.

Suggested Evaluation Methods

- Present a language experiment report after investigating word recognition and sentence parsing.

UNIT 5: APPLICATIONS OF COGNITIVE MODELLING 9

Cognitive Modelling in Engineering - Education – Human Computer interaction – User Experience Design – Cognitive Workload and Humana factors Engineering - Systems Design and Evaluation - Robotics - Linguistic applications of cognitive modelling – Future Trends

Suggested Activities

- Explore the intersection of cognitive modeling and artificial intelligence.

Suggested Evaluation Methods

- Case study Presentation

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Explore the fundamental concepts and principles of cognitive modeling and its role in understanding human cognition.
2. Explain the differences between symbolic and connectionist approaches in cognitive modeling.
3. Apply cognitive modeling techniques to analyze and simulate cognitive processes related to perception, attention, memory and long term memory.
4. Apply techniques to simulate and interpret cognitive processes related to decision-making, problem-solving in large scale systems.
5. Utilize cognitive modeling techniques to address and solve problems in various domains, such as language processing and decision-making

TEXT BOOKS:

1. Jerome R Busemeyer and Adele Diederich, “Cognitive Modeling: A Computational Approach” SAGE publications, 2009.
2. Thad Polk and Colleen Seifert , “Cognitive Modeling”, The MIT Press 2002

REFERENCES:

1. Jerome R. Busemeyer, Zheng Wang, James The Oxford Handbook of Computational and Mathematical Psychology,Townsend, Ami Eidels (ed.), Oxford University Press (2015).
2. Emmanuel M. Pothos and Andy J. Wills, “Formal Approaches in Categorization” Cambridge University Press,2011.
3. Jerome R. Busemeyer and Peter D. Bruza, Quantum Models of Cognition and Decision, Cambridge University Press, 2014.
4. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
5. Bernard J. Bears and Nicole M. Gage, “Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience”, Academic Press 2010.
6. O’Reilly, R. C., Munakata, Y., Frank, M. J and Hazy, T. E. Computational Cognitive Neuroscience. Wiki Book, 4th Edition (2020). URL: https://CompCogNeuro.org

MAPPING of Course Outcomes with Program Outcomes

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
2	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
3	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
4	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
5	3	3	3	3	2	2	2	1	3	3	1	3	3	3	3
Avg	3	3	3	3	2	2	2	1	2.6	3	1	3	3	3	3

AZ5019 AI BASED MOBILE APPLICATION DEVELOPMENT L T P C
3 0 0 3

UNIT 1 INTRODUCTION 9

Mobile Applications – Types of Mobile Applications – Mobile Web, Native Applications, Hybrid Applications - Characteristics and Benefits - Mobile Frameworks and Tools – Web Based Cross Frameworks-Native Based Cross Frameworks-Xamarin-Codename One-Flutter-React Native-Native Script-Pros and Cons; Mobile Platforms – Types: Mobile App UI/UX Design Tools.

Suggested Activities:

- Flipped classroom on mobile applications and types of frameworks.
- Theory – study about different types of mobile applications, frameworks, platforms and tools.

Suggested Evaluation Methods

- Quiz on types of mobile applications and frameworks.
- Assignments on mobile frameworks, UI/UX design tools.

UNIT 2 ANDROID APPLICATION DEVELOPMENT 9

Introduction to Android – Architecture – SDK Tools – Languages for Android - XML – Java / Kotlin - UI Widgets – Layouts – Event Handling - Overview of Application Components - Android Intents, Types - SQLite Database – CRUD.

Suggested Activities:

- Flipped classroom on android architecture and tools.
- Practical – Develop Native Android Smartphone Applications using Java / Kotlin.
- Practical – Develop Android Application for Intents.
- Practical – Working with SQLite CRUD examples using Android Application.

Suggested Evaluation Methods

- Quiz on android app development, and components.
- Program on SQLite Database with android.
- Assignment on application components, types of intents.

UNIT 3 IOS APPLICATION DEVELOPMENT 9

Introduction to iOS- architecture – features – XCode and SDK tools – Objective C / Swift – UI Controls – Container Views – Event Handling - Overview of iOS Data Persistence – Connectivity: SQLite Database with iOS application.

Suggested Activities:

- Flipped classroom on iOS app development and tools.
- Practical – Develop native iOS smartphone application using Objective-C / Swift
- Practical – Working with various UI Controls using iOS application.
- Practical – Working with SQLite database using iOS application.

Suggested Evaluation Methods

- Quiz on iOS app development.
- Assignment on iOS data persistence.
- Program on iOS application for SQLite database.

UNIT 4 AI IN MOBILE APPLICATION DEVELOPMENT 9

AI technologies for mobile applications - A simple AI based Chatbot using Android / iOS; AI powered mobile apps – Architecture: Google Assistant, Siri, Replika, Cortona, Elsa – FaceApp, Amazon Alexa.

Suggested Activities:

- Flipped classroom on AI in mobile application development & key elements.
- Case study of AI powered mobile apps.
- Demonstration of Developed AI based chatbot using android / iOS.

Suggested Evaluation Methods

- Quiz on key concepts of AI in mobile application development.
- Practical – Build AI based chatbot using Android / iOS application.

UNIT 5 AI TOOLS FOR MOBILE APPLICATION DEVELOPMENT 9

Usage of AI in mobile apps; Build AI mobile apps – Implementation considerations; AI tools: CoreML-TensorFlow – ML Kit -OpenCV – Caffe2 – Emerging AI applications in smartphones.

Suggested Activities:

- Flipped classroom on AI application development and tools.
- Demonstration of popular existing mobile applications using AI tools.

Suggested Evaluation Methods

- Quiz and assignments on AI tools in mobile application development
- Practical – Develop Android / iOS mobile application using AI tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

1. Understand the frameworks, platforms and tools of mobile application development.
2. Learn native Android application development using Java / kotlin.
3. Understand native iOS application development using Objective-C / Swift.
4. Learn implementation aspects of AI in mobile application development.
5. Develop AI based mobile application using Android / iOS.

TEXTBOOKS:

1. Laurence Moroney, “AI and Machine Learning for On-Device Development: A Programmer's Guide”, O'Reilly Media, 1st Edition, 2021.
2. Dawn Griffiths and David Griffiths, “Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin”, Shroff/O'Reilly, 3rd edition, 2021.
3. Ahmad Sahar and Craig Clayton, “iOS 15 Programming for Beginners: Kickstart your mobile app development journey by building iOS apps with Swift 5.5 and Xcode 13”, Packt Publishing, 6th edition, 2021.

REFERENCES:

1. Jakob Iversen, Michael Eierman, “Mobile App Development for iOS and Android”, Prospect Press, 2nd edition, 2017.
2. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012
3. Professional mobile Application Development paperback,2012 Jeff Mcherter (Author),Scott Gowell (Author), Wiley India Private Limited
4. https://www.apptunix.com/blog/artificial-intelligence-tools-for-mobile-app-development/
5. https://www.tensorflow.org/lite/examples
6. https://www.leewayhertz.com/how-to-build-ai-powered-mobile-apps/

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

1	1	1	1	-	1	-	-	-	1	1	-	1	1	1	1
2	1	3	3	2	3	1	1	2	3	1	3	2	3	3	3
3	1	3	3	2	3	1	1	2	3	1	3	2	3	3	3
4	1	2	3	2	3	1	1	2	1	1	1	2	1	1	1
5	1	3	3	3	3	1	1	3	3	1	3	2	2	3	3
AVG	**1**	**2.4**	**2.6**	**2.25**	**2.6**	**1**	**1**	**2**	**2.2**	**1**	**2.5**	**1.8**	**2**	**2**	**2**

AZ5020 CONVERSATIONAL ANALYTICS. L T P C
3 0 0 3

UNIT I INTRODUCTION OF CONVERSATIONAL ANALYTICS 9

Studying Social Interaction from a CA Perspective- Intellectual Roots and Contexts for Conversation Analysis- The Conversation Analytic Approach to Data Collection- The Conversation Analytic Approach to Transcription- Basic Conversation Analytic Methods.

Suggested Activities

- Exploration on different parts of a conversation with examples
- External learning on conversational analytics techniques.

Suggested Evaluation Methods

- Assignments on Conversational analytic methods
- Tutorials on approaches on conversational analytics

UNIT II FUNDAMENTAL STRUCTURES OF CONVERSATION 9

Action Formation and Ascription - Turn Design- Turn-Constructional Units and the Transition-Relevance Place-Turn Allocation and Turn Sharing-Sequence-Repair-Preference Organization-Overall Structural Organization

Suggested Activities

- External learning – Turn design and allocation in conversation
- Implement IAM application

Suggested Evaluation Methods

- Assignments on constructional units and transition

Unit III KEY TOPICS IN CA 9

Embodied Action and Organizational Activity- Gaze in Conversation- Emotion, Affect and Conversation- Affiliation in Conversation- Epistemics in Conversation- Question Design and Reference in Conversation- Phonetics and Prosody- Grammar in conversation

Suggested Activities

- Exploration on conversational emotion and effect.
- Implementation of action in conversation

Suggested Evaluation Methods

- Assignments on the design of embodied action
- Tutorials on grammar.

UNIT IV KEY CONTEXTS OF STUDY IN CA: POPULATIONS AND SETTINGS 9

Interaction among Children-Conversation Analysis and the Study of Atypical Populations-Conversation Analysis in Psychotherapy- Conversation Analysis in Medicine, Newsroom and Interview- Conversation Analysis and Linguistics

Suggested Activities

- Implementation of a conversational AI application by adopting cloud data life cycle
- Analysis of conversation in different scenarios

Suggested Evaluation Methods

- Assignment on conversational analytics in classroom

UNIT V CHATGPT 9

Introduction to CHATGPT and AI Chatbots- Strategy for asking prompts-Advanced techniques for prompts- Real world applications for asking prompts.

Suggested Activities

- External learning on CHATGPT design
- Formulation of prompts for any conversation in an application.

Suggested Evaluation Methods

- Assignments on AI chatbots

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Develop a conversational structure.
2. Articulate the main concepts, key technologies, strengths and limitations of Conversational analytics
3. Develop the ability to understand and use the structure of conversation and delivery methods
4. Explain the formulation of prompts and deployment
5. Choose the appropriate technologies, algorithms and approaches for implementation of AI chatbots

TEXT BOOK:

1. Jack Sidnell and Tanya Stivers, “The Handbook of Conversation Analysis”, John Wiley, 2012.
2. A.A.Kabir, “ChatGPT Handbook: Asking The Right questions”(https://www.amazon.com/ChatGPT-Handbook-Asking-Right-Questions)

REFERENCES:

1. Jack Sidnell, Tanya Stivers “The Handbook of Conversation Analysis”, Blackwell Publishing Ltd., 2012
2. Alexa Hepburn and Jonathan Potter,” Essentials of Conversation Analysis”, American Psychological Association, 2021

MAPPING of COs with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	1	1	-	1	1	1	-	2	3	1
2	3	2	2	3	1	1	-	-	1	-	1	-	2	3	2
3	3	3	2	2	1	1	2	2	1	1	1	-	2	3	2
4	3	3	3	3	2	2	1	2	1	1	2	1	3	3	3
5	2	3	3	3	2	2	1	2	1	2	2	2	3	3	3
Avg.	2.4	3	3	2.4	1.8	2	1	-	1	-	1.4	1.5	2.4	3	2.2

IT5009 **MULTIMEDIA TECHNOLOGIES** **L T P C**
3 0 0 3

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.

TEXT BOOKS

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.

MAPPING of CO’s with PO’s and PSO’s

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

3	3	3	3	3	3	2	-	-	2	-	-	1	1	2	1
4	3	3	3	2	2	2	-	-	1	-	-	-	1	2	1
5	2	3	3	2	3	1	-	-	1	-	-	1	1	2	2
6	2	3	3	3	3	1	-	-	3	1	1	1	1	2	1
Avg	3	3	3	2	3	2	-	-	2	1	1	1	1	2	1

AZ5021 ARTIFICIAL INTELLIGENCE IN CYBERSECURITY L T P C
3 0 0 3

UNIT I OVERVIEW OF CYBERSECURITY 9

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security Attacks– Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories – perimeter defense and encryption. Cyber security management framework.

Suggested Activities

- External learning on the statistics of cyber attacks
- External learning on reconnaissance for cyber security

Suggested Evaluation Methods

- Assignment on NIST Cybersecurity framework

UNIT II MALWARE ANALYSIS 9

Understanding Malware – Defining Malware Classification – Static and dynamic malware analysis –Feature Generation and classification - Malware detection using decision trees – Random forest malware classifier – Clustering malware with k-means – Detecting metamorphic malware with HMMs.

Suggested Activities

- Study on best practices for Malware analysis
- Demonstration of Malware detection

Suggested Evaluation Methods

- Group project on malware detection

UNIT III NETWORK PROTECTION 9

Introduction to Intrusion detection – Types of IDS– IDS threat taxonomy - IDS Evaluation Metrics - AI based techniques for ID - Detecting DDos Attack – Credit Card fraud detection – Counterfeit bank note detection – Ad blocker –IoT device type identification – Deepfake recognition. Anomaly Detection – Types of anomalies – Anomaly detection with data and algorithms – Challenges in Anomaly detection.

Suggested Activities

- Discussion papers on Deepfake recognition
- Demonstration of intrusion detection and anomaly detection.

Suggested Evaluation Methods

- Assignment on Penetration testing

UNIT IV APPLICATION SECURITY 9

Phishing Webpage and Email detection - Introduction to detecting spam – Spam filters – Perceptron based spam filter – Spam detection with SVMs – Phishing detection using logistic regression and decision trees – Spam detection with Naïve Bayes.

Suggested Activities

- Video lectures on Spam detection
- Demonstration of email URL Phishing

Suggested Evaluation Methods

- Programming assignment on predicting Spam or Ham.

UNIT V CASE STUDIES 9

Alert management – Raw data analysis – Risk Exposure Assessment – Cyber threat Intelligence.- Problems of AI in Cyber Security – Future of AI in Cybersecurity. Case studies

Suggested Activities

- Tutorial on Adversarial machine learning
- Case studies

Suggested Evaluation Methods

- Assignment on security issues in AI

. **TOTAL: 45 PERIODS**

OUTCOMES

On completion of the course, the students will be able to (5-6 outcomes)

1. Grasp the fundamentals of Cyber security
2. Knowledge of malware and countermeasures
3. Ability to detect Intrusion and Anomaly detection using AI algorithms
4. Able to realize Application security using AI
5. Gain knowledge of other roles of AI in Cyber security

TEXT BOOKS

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021 (Unit 1)
2. Clarence Chio, David Freeman, “ Machine Learning and Security : Protecting Systems with Data and Algorithms”, O’Reilly publication, !st Edition, ISBN -1491979909

REFERENCES

1. Apruzzese, Giovanni, et al. "The role of machine learning in cybersecurity." Digital Threats: Research and Practice 4.1 (2023): 1-38.
2. Sumeet Dua, Xian Du, “Data Mining and Machine Learning in Cybersecurity”, CRC Press Publication, 1st Edition, ISBN 9781439839423
3. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011
4. Research papers on AI for Cyber Security

MAPPING of CO's with PO's and PSO's

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

AZ5022 AI FOR GENOMICS AND PROTEOMICS L T P C
3 0 0 3

UNIT I GENOMIC AND PROTEOMIC DATA ANALYSIS 9

Introduction to Proteomics techniques - Data Mining, Data Pre-Processing, Dimensionality problem, Predictive Model construction, Post-Processing-Principles of Microarray Investigations, Pre-Planning stage, Statistical Design principles - Affymetrix GeneChips, Two-Color microarrays-and pre-processing data-Caveats and Pitfalls-Mass Spectrometry data and pre-Processing, Tools and Resources - Visualization in Genomics and Proteomics

Suggested Activities

- Using dataset of microarray gene expression data, perform pre-processing and analyze the impact on data.
- Design a microarray experiment to investigate the gene expression differences between two groups of samples.
- Create a visualization of gene expression or protein expression data, explore various visualization techniques and their effectiveness in representing data.

Suggested Evaluation Methods

- Evaluate the students' engagement and participation in group discussions and activities related to data pre-processing, microarray design, mass spectrometry data analysis, and visualization techniques.
- Assign a data analysis project that need to apply the techniques learnt to analyze a real-world dataset.

UNIT II MACHINE LEARNING APPROACHES 9

Genomics and Proteomics data - Feature Selection, Dimensionality Reduction, Clustering in Genomic Data, Resampling for model selection and optimizing parameters- Methods, model selection Optimizing tuning parameters, Comparison of Resampling strategies, Classification of Genomic and Proteomic Data using support vector machines, Networks in cell Biology, Case studies.

Suggested Activities

- Use case studies to demonstrate the application of these technique in real-world scenarios.
- Create a protein network or metabolic network using graph definition.

Suggested Evaluation Methods

- Evaluate the effectiveness and performance of methods for a given genomic or proteomic dataset.
- Evaluate the quality of the protein network or metabolic network created using graph definition

UNIT III DATA MINING AND ONTOLOGIES IN GENOMICS 9

Integrative Data Analysis and Visualization, Motivation and Approaches, Goals and challenges-Multiple data types-Text mining and NLP, Database and resources-Applications, NLP in Biomedicine, Text mining in Genomics, Biomedicine- Ontologies and Information Mining in Genome, Functional Analysis, Bio-Ontologies and the Gene Ontology in Functional Genomics.

Suggested Activities

- Case studies on integrative data analysis of biomedical data using various tools and techniques.
- Hands-on training on text mining and NLP tools to extract relevant information from biomedical databases.

Suggested Evaluation Methods

- Evaluating the accuracy and effectiveness of text mining and NLP tools in extracting biomedical information.
- Evaluating the understanding on the concepts, tools, and techniques covered through quizzes.

UNIT IV MODELS AND APPLICATIONS 9

Applying Deep Learning in a Biological Context, Deep learning Tools/Software/Pipelines in genomics, Deep Learning Models for Sequence Analysis- RNN, CNN, and Transformers, Applications of Deep Learning in Proteomics, Models, Prediction of Protein Structure, Deep Learning based Genomics and Proteomics Research

Suggested Activities

- Group discussions and critique deep learning-based approaches in genomics and proteomics research.
- Develop and implement deep learning models for gene expression analysis using available tools and pipelines.
- Collaborate with biologists and bioinformaticians to design experiments and analyze genomic and proteomic data using deep learning tools and techniques.

Suggested Evaluation Methods

- Assign coding assignments that involve implementing deep learning models for sequence analysis, protein structure prediction, or other related tasks and evaluate it.
- Assign projects or case studies related to deep learning models in genomics and proteomics. Evaluate them based on their methodology, accuracy, and feasibility of the solution.

UNIT V ETHICS, PRIVACY AND SOCIAL IMPLICATIONS 9

Ethics in genomics and proteomics research, Privacy concerns and data sharing, Emerging ethical and policy issues in genomics and proteomics research, Ethical Issues in the Use of AI and Machine Learning in Genomics and Proteomics, Social Implications, Impact of genomic research on healthcare, Future directions and Challenges.

Suggested Activities

- Group discussions and debates on ethical and policy issues related to genomics and proteomics research, such as privacy concerns and data sharing.

- Case studies analyzing real-world ethical issues that have arisen in genomics and proteomics research, and the implications of those issues for the field as a whole.
- Guest lectures by experts in bioethics or related fields.

Suggested Evaluation Methods

- Presentations and case studies on the use of AI and machine learning in genomics and proteomics, highlighting ethical considerations and potential challenges.
- Quizzes that test understanding of key ethical concepts and principles in genomics and proteomics research.

TOTAL: 45 PERIODS

OUTCOMES

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

1. Apply the techniques and tools of genomics and proteomics data analysis and identify the principles.
2. Analyze genomic and proteomic data using feature selection and model assessment techniques.
3. Apply statistical methods to analyze microarray investigations and mass spectrometry data.
4. Utilize text mining and ontology-based analysis to explore biomedical data.
5. Apply deep learning models for sequence analysis and protein structure prediction in genomics and proteomics research and evaluate its effectiveness.
6. Identify the ethical and social implications of genomics and proteomics research and its impact on society.

TEXT BOOKS

1. Werner Dubitzky , Martin Granzow , Daniel P. Berrar “Fundamentals of Data Mining in Genomics and Proteomics”, Springer.
2. Francisco Azuaje , Joaquin Dopazo “Data Analysis and Visualization in Genomics and Proteomics, Wiley
3. Faheem Masoodi, Mohammad Quasim, Syed Bukhari, Sarvottam Dixit, Shadab Alam “Applications of Machine Learning and Deep Learning on Biological Data”, CRC Press, 2023

REFERENCES

1. Kenneth Baclawski and Tianhua Niu “Ontologies for Bioinformatics”, MIT Press
2. Soraj Hongladarom “Genomics and Bioethics: Interdisciplinary Perspectives, Technologies and Advancements”, IGI Global
3. Upendra Kumar Devisetty “Deep Learning for Genomics”, O’Reilly, 2022
4. Paula Boddington “AI Ethics”, Springer, 2023.
5. Gary D. Miner, John Elder, Andrew Fast, Thomas Hill, Robert Nisbet, Dursun Delen “Practical Text Mining and Statistical Analysis for Non-structured Text Data Applications”, O’Reilly, 2012.

MAPPING of CO’s with PO’s and PSO’s

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	2	2	3	2	2	3	3	3	2
2	3	3	3	3	3	2	1	2	3	3	2	3	3	3	2
3	3	3	3	3	3	2	2	2	3	3	2	3	3	3	2
4	3	3	3	3	3	2	1	2	3	2	2	3	3	3	2
5	3	3	3	3	3	2	2	2	3	3	2	3	3	3	2
6	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2

Avg.	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**

AZ5023 **ETHICS FOR AI** **L T P C**
3 0 0 3

UNIT I INTRODUCTION **9**

Introduction to AI - Descriptive Ethics - Normative Ethics- Meta-ethics – Applied ethics - Relationship Between Ethics and Law - Machine Ethics

Suggested Activities:

- Flipped classroom on introduction to AI.
- External learning – Learn about other type of ethics and their relation to AI.
- Group discussion on workplace ethics conflicts.

Suggested Evaluation Methods:

- Assignment on the relationship between ethics and law.
- Quiz on Machine ethics.

UNIT II TRUST AND FAIRNESS IN AI **9**

User Acceptance and Trust - Functional Elements of Trust - Ethical Principles for Trustworthy and Fair AI - Responsibility and Liability in AI Systems - Examples- Crash of an Autonomous Vehicle - Mistargeting by an Autonomous Weapon -Attribution of Responsibility and Liability - Moral Responsibility Versus Liability - Strict Liability

Suggested Activities:

- Case study on ethics in designing autonomous vehicle.
- Flipped classroom learning on mistargeting by an autonomous weapon.
- Reflect on how self-driving cars is going to continue to grow in the future.

Suggested Evaluation Methods:

- Assignment on ethical dilemmas self-driving cars pose to our society.
- Quiz on Responsibility and Liability.

UNIT III RISKS IN AI **9**

General Business Risks - Ethical Risks of AI - Managing Risk of AI - Business Ethics for AI Companies - Risks of AI to Workers -- Privacy Issues of AI - What Is Privacy? - Why AI Needs Data - Private Data Collection and Its Dangers - Persistence Surveillance -Usage of Private Data for Non-intended Purposes

Suggested Activities:

- Present a business case for the importance of integrity and ethics in business.
- Case study on the risks of AI to workers and how it affects them.
- Flipped classroom learning on a privacy issue created by AI.

Suggested Evaluation Methods:

- Quiz on Privacy related issues in AI.
- Tutorial on ethical risks of AI.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 9

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

Suggested Activities:

- Case study on how robots creates ethical issues in the society.
- Flipped classroom learning on Ethical Issues in an ICT Society.

Suggested Evaluation Methods:

- Assessment on ethics and morality and how it is affected by Robots.
- Quiz on Roboethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES 9

Challenges – Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

Suggested Activities:

- Case study on ethical decisions that affect individuals and companies.
- Flipped classroom learning on Artificial Intelligence in medicine and how it affects individuals.

Suggested Evaluation Methods:

- Assignment on National and International Strategies on AI.
- Quiz in Challenges and opportunities in artificial intelligence.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand and differentiate the different ethics in AI.
2. Identify the Responsibility and Liability in AI Systems.
3. Understand the ethical risks of AI and the risks of companies and workers in AI.
4. To understand the privacy issues of the data.
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOKS:

1. Sean Welsh, Alan R. Wagner, Christoph Lütge, Christoph Bartneck , An Introduction to Ethics in Robotics and AI, SpringerBriefs in Ethics, 2019.
2. Patrick Lin, Keith Abney, George A Bekey, Robot Ethics: The Ethical and Social Implications of Robotics, The MIT Press- January 2014.

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,The ethics of artificial intelligence: Issues and initiatives, EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
3. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020
4. S.Matthew Liao, Ethics of Artificial Intelligence, Oxford University Press, 2020

MAPPING of CO's with PO's and CO's

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	2	3	1	3	2	2	1	2	1	1	1
2	2	2	2	2	2	3	1	3	2	2	1	2	2	1	1
3	2	2	1	2	2	3	1	3	2	2	1	2	1	1	2
4	2	2	2	2	2	3	1	3	2	2	1	2	1	2	1
5	2	2	2	2	2	3	1	3	2	2	1	2	1	1	1
6	2	2	2	2	2	3	1	3	2	2	1	2	1	1	1
Avg	2	2	2	2	2	3	1	3	2	2	1	2	1	1	1

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT 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

Literature 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.

AD5091 CONSTITUTION OF INDIA L T P C
3 0 0 0

OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- 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

COURSE OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to 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, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, Lexis Nexis, 7th Edition, 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:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- 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: 45PERIODS

COURSE OUTCOMES:

CO1: Gain knowledge of self-development
CO2: Learn the importance of Human values
CO3: Develop the overall personality through value education
CO4: Overcome the self destructive habits with value education
CO5: Interpret social empowerment with value education

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

REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

AD5093 PEDAGOGY STUDIES L T P C
3 0 0 0

OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- 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

COURSE OUTCOMES:

CO1: Understand the methodology of pedagogy.

CO2: Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.

CO3: Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

CO4: Know the factors necessary for professional development.

CO5: Identify the Research gaps in pedagogy.

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

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AD5094 STRESS MANAGEMENT BY YOGA L T P C

3 0 0 0

OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’t’s in life through Yam
- Categorize Do’s and Don’t’s in life through Niyam

- Develop a healthy mind and body through Yog Asans
- 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

Do`s and Don't's in life.

Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN 9

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM 9

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45PERIODS

COURSE OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency

CO2 – Learn Do's and Don't's in life through Yam

CO3 – Learn Do's and Don't's in life through Niyam

CO4 – Develop a healthy mind and body through Yog Asans

CO5 – Learn breathing techniques through Pranayam

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

REFERENCES:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
3 0 0 0

OBJECTIVES:

- Develop basic personality skills holistically

- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- 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: 45PERIODS

COURSE OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's Three Satakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016.

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: 45 PERIODS

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
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AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
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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.

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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