JEPPIAAR INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
Self-Belief | Self Discipline | Self Respect
Kunnam, Sunguvarchatram, Sriperumbudur-631604

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

AUTONOMOUS SYLLABUS

REGULATION 2024

JEPPIAAR INSTITUTE OF TECHNOLOGY
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
AUTONOMOUS CURRICULUM & SYLLABUS R2024
CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

- Jeppiaar Institute of Technology aspires to provide technical education in futuristic technologies with the perspective of innovative, industrial, and social applications for the betterment of humanity.

MISSION

- To produce competent and disciplined high-quality professionals with the practical skills necessary to excel as innovative professionals and entrepreneurs for the benefit of society.
- To improve the quality of education through excellence in teaching and learning, research, leadership, and by promoting the principles of scientific analysis, and creative thinking.
- To provide excellent infrastructure, serene, and stimulating environment that is most conducive to learning.
- To strive for productive partnership between the Industry and the Institute for research and development in the emerging fields and creating opportunities for employability.
- To serve the global community by instilling ethics, values, and life skills among the students needed to enrich their lives.

VISION AND MISSION OF THE DEPARTMENT

VISION

- The department will serve as a centre of excellence in practicing, training and implementing AI and AI associated techniques that will enable /support innovative thoughts and ideas across industries and society

MISSION

- M1: To collaborate with industry and provide the state of the art infrastructural Facilities to meet the global requirements and societal needs for AI.
- M2: Promote learning and development of students in Artificial Intelligence thought leadership, by providing them a suitable infrastructure and Environment, enabling them to grow into successful entrepreneurs.
- M3: To encourage students to pursue higher education and research in the field of AI.
- M4: To impart moral and ethical values in their profession

PROGRAMME EDUCATIONAL OBJECTIVES

- PEO 1: 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.
- PEO 2: 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.
- PEO 3: Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
- PEO 4: Design and model AI based solutions to critical problem domains in the real world
- PEO 5: Exhibit innovative thoughts and creative ideas for effective contribution towards economy building

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** (K3) Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** (K4) Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** (K4) Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** (K5) Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** (K3, K5, K6) Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** (A3) Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** (A2) Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** (A3) Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** (A3) Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** (A3) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** (A3) Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** (A2) Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO 1: To evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.

PSO 2: To arrive at actionable Foresight, Insight, hindsight from data for solving business and engineering problems

PSO 3: To create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve wicked societal problems

PSO 4: To develop data analytics and data visualization skills, skills pertaining to knowledge acquisition, knowledge representation and knowledge engineering, and hence be capable of coordinating complex projects.

PSO 5: To able to carry out fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
Autonomous Curriculum AI&DS - 2024 - 2025 - Credits Summary

S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management Courses(HS)	1	1	0	0	0	0	0	0	2
2	Basic Science Courses(BS)	4	4	4	0	0	0	0	0	12
3	Engineering Science Courses(ES)	10	12	0	0	0	0	0	0	22
4	Professional Core Courses(PC)	3	4	11	13	11	5	5	0	52
5	Professional Elective Courses(PE)	0	0	0	3	3	6	3	6	21
6	Open Electives(OE)	0	0	0	0	3	0	3	0	6
7	Employment Enhancement Courses(EEC)	1	1	1	1	1	2	7	11	25
8	Mandatory Courses(MC) - No Credit	EE, PE&HV	IC & LE	EVEng	0	0	0	0	0	0
	Total	19	22	16	17	18	13	18	17	140

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
AUTONOMOUS CURRICULUM R2024 (CBCS)
CURRICULUM AND SYLLABI FOR SEMESTERS I TO VIII

SEMESTER - I

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AIP001	Induction Program		0	0	0				
2	AMA101	Matrices and Calculus	BS	3	1	0	4	40	60	100
3	APH101	Computational Physics	ES	3	0	0	3	40	60	100
4	ACS101	Principles of programming	PC	3	0	0	3	40	60	100
5	ACS102	Python Programming	ES	3	0	0	3	40	60	100
6	AMC101	Employment Enhancement Skills	MC	2	0	0	-	-	-	100
7	AMC102	Professional Ethics and Human Values	MC	2	0	0	-	-	-	100
8	AHS101	Language Enhancement	HS	0	0	2	1	60	40	100
PRACTICALS										
9	APH301	Computational Physics Lab	ES	0	0	4	2	60	40	100
10	ACS301	Python Programming Lab	ES	0	0	4	2	60	40	100
11	AEEC301	Mini project/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	16	1	12	19			

SEMESTER - II

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AMA102	Discrete Mathematics	BS	3	1	0	4	40	60	100
2	AECS103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
3	AAI101	Introduction to Data Science	ES	3	0	0	3	40	60	100

4	ACS106	Data Structures and Algorithms	PC	3	1	0	3	40	60	100
5	ACS142	Fundamentals of Cloud Computing	ES	3	0	0	3	40	60	100
6	AHS301	Communication Skills and Technical Writing	HS	0	0	2	1	60	40	100
7	AMC103	Indian Constitution	MC	2	0	0	0	-	-	100
PRACTICALS										
8	AECS302	Basics of Electrical and Electronics Engineering Lab	ES	0	0	4	2	60	40	100
9	ACS304	Data Structures and Algorithms Lab	PC	0	0	4	1	60	40	100
10	ACS302	Cloud Computing Lab	ES	0	0	4	1	60	40	100
11	AMC301	Yoga and Happy Living	MC	0	0	3	0	-	-	100
12	AEEC302	Mini project/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	19	2	17	22			

SEMESTER - III

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AAI102	Artificial Intelligence	PC	3	1	0	4	60	40	100
2	ACS108	Database Management Systems	PC	3	0	0	3	60	40	100
3	AMA105	Probability and Statistics	BS	3	1	0	4	40	60	100
4	AMC108	Environmental Engineering and Sustainability	MC	3	0	0	0	40	60	100
PRACTICALS										
5	AHS302	Soft Skills I	HS	0	0	2	0	-	-	100
6	ACS306	Database Management Systems Lab	PC	0	0	4	2	60	40	100
7	AAI301	Artificial Intelligence Lab	PC	0	0	4	2	60	40	100
8	AEEC303	Mini Project/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	13	2	12	16			

SEMESTER - IV

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AAI103	Data Mining and Warehousing	PC	3	0	0	3	40	60	100

2	ACS107	Operating System	PC	3	1	0	3	40	60	100
3		Professional Elective 1	PE	3	0	0	3	40	60	100
4	ACS109	Computer Networks	PC	3	0	0	3	40	60	100
PRACTICALS										
5	AHS303	Soft Skills II	MC	0	0	2	0			100
6	ACS305	Operating system Lab	PC	0	0	4	2	60	40	100
7	ACS307	Computers Networks Lab	PC	0	0	4	2	60	40	100
9	AEEC304	Mini Project/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	12	1	12	17			

SEMESTER - V

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AAI104	Multi -modal Data Processing and Learning	PC	3	1	0	4	40	60	100
2	AAI105	Machine Learning	PC	3	0	0	3	40	60	100
3		Professional Elective 2	PE	3	0	0	3	40	60	100
4		Open Elective 1	OE	3	-	-	3	40	60	100
PRACTICALS										
5	AAI302	Multi -modal Data Processing and Learning Lab	PC	0	0	4	2	60	40	100
6	AAI303	Machine Learning Lab	PC	0	0	4	2	60	40	100
7	AEEC305	Mini Project/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	12	0	10	18			

SEMESTER - VI

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1		Professional Elective 3	PE	3	0	0	3	40	60	100
2		Professional Elective 4	PE	3	0	0	3	40	60	100
3	AAI106	Deep Learning	PC	3	1	0	3	40	60	100
PRACTICALS										
4		Seminar	PW	0	0	2	1	-	100	100
5	AAI304	Deep Learning Lab	PC	0	0	4	2	60	40	100

6	AEEC306	Miniproject/Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	9	1	8	13			

SEMESTER - VII

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AAI107	Cyber Security	PC	3	0	0	3	40	60	100
2		Professional Elective5	PE	3	0	0	3	40	60	100
3		Open Elective 2	OE	3	0	0	3	40	60	100
PRACTICALS										
4	AAI306	Project Phase I	PW	0	0	12	6	40	60	100
5	AAI305	Cyber Security Lab	PC	0	0	4	2	60	40	100
6	AEEC307	Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	9	0	18	18			

SEMESTER - VIII

S.No	Course Code	Course Title	Category	Periods			C	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1		Professional Elective 6	PE	3	0	0	3	40	60	100
2		Professional Elective 7	PE	3	0	0	3	40	60	100
PRACTICALS										
3	AAI307	Project Phase II	PW	0	0	20	10	40	60	100
4	AEEC308	Internship/Professional practices	EEC	0	0	2	1	60	40	100
			Total	6	0	22	17			

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
AUTONOMOUS SYLLABUS R2024 (CBCS)
PROFESSIONAL ELECTIVE

VERTICAL - I - Data Science

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI701	Data Visualization	3	0	0	3	3
2	AAI702	Data Analytics for Finance	3	0	0	3	3
3	AAI703	Internet of Things	3	0	0	3	3
4	AAI704	Network Security	3	0	0	3	3
5	AAI705	Brain Computer Interface	3	0	0	3	3

VERTICAL - II- Data Retrieval Techniques

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI706	Data Augmentation and Virtual Reality	3	0	0	3	3
2	AAI707	Multivariate Calculus And Forecasting	3	0	0	3	3
3	AAI708	Block Chain Technology	3	0	0	3	3
4	AAI709	Cryptography	3	0	0	3	3
5	AAI710	Computational Neuroscience	3	0	0	3	3

VERTICAL - III- Cyber Security and Data Privacy

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI711	Dependable Artificial Intelligence	3	0	0	3	3
2	AAI712	Computer Vision	3	0	0	3	3
3	AAI713	Quantum Computing	3	0	0	3	3
5	AAI714	Cognitive And Behavior Science	3	0	0	3	3

VERTICAL - IV- Data Centric Computation

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI715	Resource constraint AI	3	0	0	3	3
2	AAI716	Data Engineering	3	0	0	3	3
3	AAI717	Data centers management	3	0	0	3	3

VERTICAL - V Data Security

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI718	Reinforcement Learning	3	0	0	3	3
2	AAI719	Time Series Data Analysis	3	0	0	3	3
4	AAI720	Digital Forensic	3	0	0	3	3
5	AAI721	Natural Language Understanding	3	0	0	3	3

VERTICAL - VI-Computing

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI722	Optimization Techniques	3	0	0	3	3
2	AAI723	Bio Informatics	3	0	0	3	3
3	AAI724	Information Retrieval System	3	0	0	3	3
4	AAI725	Information Security	3	0	0	3	3
5	AAI726	Soft Computing	3	0	0	3	3

VERTICAL - VII- Block Chain Technology

S.No	Course Code	Course Title	Periods			Total Contact Periods	Credits
			L	T	P		
1	AAI727	AI techniques for Game Development	3	0	0	3	3
2	AAI728	Principles of Block Chain Technology	3	0	0	3	3
3	AAI729	Security in cloud Environment	3	0	0	3	3
4	AAI730	Neuro Morphic design and Computing	3	0	0	3	3

OPEN ELECTIVE										
S.No	Course Code	Course Title	Category	Periods			Credits	CIE	SEE	TOTAL
				L	T	P				
THEORY										
1	AME701	Drone Technologies	OE	3	0	0	3	40	60	100
2	AME702	Additive Manufacturing	OE	3	0	0	3	40	60	100
3	AME703	Electric and Hybrid Vehicle Technology	OE	3	0	0	3	40	60	100
4	AEC701	Sensors and Actuators	OE	3	0	0	3	40	60	100
5	AEC702	Applied Design Thinking	OE	3	0	0	3	40	60	100
6	AEC703	Project Report Writing	OE	3	0	0	3	40	60	100
7	AMB701	Corporate Governance	OE	3	0	0	3	40	60	100
8	AMB702	Digital Marketing	OE	3	0	0	3	40	60	100
9	AMB703	Rural Marketing	OE	3	0	0	3	40	60	100
10	ACS701	System Engineering	OE	3	0	0	3	40	60	100
11	ACS702	Green Computing	OE	3	0	0	3	40	60	100
12	ACS703	Fintech Regulation	OE	3	0	0	3	40	60	100
13	AIT701	Network Essentials	OE	3	0	0	3	40	60	100
14	AIT702	Soft Computing Methodologies	OE	3	0	0	3	40	60	100
15	AIT703	Knowledge Engineering	OE	3	0	0	3	40	60	100
16	ACB701	Business Research Methods	OE	3	0	0	3	40	60	100
17	ACB702	Automation Testing Tools	OE	3	0	0	3	40	60	100
18	ACB703	Social Network Analysis	OE	3	0	0	3	40	60	100
19	AAI701	Drinking Water Supply and Treatment	OE	3	0	0	3	40	60	100
20	AAI702	Geographical Information System	OE	3	0	0	3	40	60	100
21	AAI703	IT in Agricultural System	OE	3	0	0	3	40	60	100

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
AUTONOMOUS SYLLABUS R2024 (CBCS)

SEM-I

I YEAR I SEMESTER

AMA101 - MATRICES AND CALCULUS							
Programme&Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**BS**	**3**	**1**	**0**	**4**
Preamble	➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems. ➢ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications						
Unit 1	**MATRICES**						**9+3**
Matrices - Eigenvalues and eigenvectors - Diagonalization of matrices using orthogonal transformation – Cayley Hamilton Theorem (without proof) - Quadratic forms - Reduction to canonical form using orthogonal transformation							
Unit 2	**SOLUTION OF LINEAR SYSTEM OF EQUATIONS AND EIGENVALUE PROBLEMS**						**9+3**
Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Gauss Seidel iterative method - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method – Jacobi method.							
Unit 3	**DIFFERENTIAL CALCULUS**						**9+3**
Limit of a function-Continuity-Derivatives-Differentiation rules (sum, product, quotient, chain rules)-Implicit Differentiation-Logarithmic Differentiation-Applications: Maxima and Minima of functions of one variable							
Unit 4	**INTEGRAL CALCULUS**						**9+3**
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integrationof rational functions by partial fraction, Integration of irrational functions – Improper integrals.							
Unit 5	**MULTIPLE INTEGRALS**						**9+3**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids –Change of variables in double and triple integrals – Applications: Moments andcentres of mass, moment of inertia.							
							Total: 60
TEXTBOOKS							
1	Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.						
2	Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016						
3	Grewal. B.S., and Grewal. J.S., Numerical methods in Engineering and Science, Khanna Publishers, 9th Edition, New Delhi, 2001.						
REFERENCES							

1	Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
2	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Demonstrate the matrix techniques in solving the related problems in engineering and technology.	K4
CO2	Apply matrix methods to solve system of linear equations	K3
CO3	Apply differential calculus tools in solving various application problems	K3
CO4	Apply different methods of integration in solving practical problems.	K3
CO5	Evaluate multiple integrals to conduct investigations of complex problems	K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO1	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	1		1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-		1	1	-
CO3	3	2	3	-	-	-	-	-	-	-	-		1	1	-
CO4	3	2	3	-	-	-	-	-	-	-	1		-	1	-
CO5	3	2	3	-	-	-	-	-	-	-	-		1	-	-

APH101 - COMPUTATIONAL PHYSICS							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**BS**	**3**	**1**	**0**	**4**
Preamble	➢ To instill knowledge on physics of semiconductors, determination of charge carriers and device applications. ➢ The students will acquire knowledge on the concepts of Photonics						

	➢ To provide the basic concepts of quantum mechanics and various formalism of quantum mechanics ➢ To acquire the knowledge of basic sciences required to understand the fundamentals of nano materials ➢ To motivate the students towards the applications of quantum mechanics and quantum computing	
Unit 1	SEMICONDUCTOR AND DEVICES	9
Intrinsic Semiconductor- Energy Band Diagram- -Direct and Indirect Band Gap Semi-Conductors – Diode Laser-Hall Effect and Devices- Logic Gates-AND,OR, NOT,NAND, E-OR,E-NOR Gates.		
Unit 2	DIFFERENTIAL EQUATIONS IN COMPUTATIONAL PHYSICS	9
Solution of differential equations: Taylor series method, Euler method, Runge Kutta method, predictor-corrector method. Eigen values and Eigen vectors of matrix: Determinant of a matrix, characteristic equation of a matrix, eigen values and eigen vectors of a matrix, power method.		
Unit 3	FUNDAMENTALS OF QUANTUM MECAHNICS	9
Photons and light waves- Electrons and matter waves- The Schrodinger equation (Time dependent and time independent wave equation)- Physical significance of wave function- particle in an infinite potential well: 1D, 2D and 3D Boxes-Degeneracy and Non-Degeneracy.		
Unit 4	INTRODUCTION TO NANO MATERIAL	9
Introduction to nanomaterial -Electron density in bulk material - Size dependence of Fermi energy - Quantum confinement - Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure - Band gap of nanomaterial- Properties and Applications of nano materials- Tunneling: single electron phenomena and single electron transistor-Quantum dot laser.		
Unit 5	QUANTUM INFORMATION AND COMPUTING	9
Quantum computing: Introduction - Postulates of quantum Mechanics- Differences between quantum and classical computation. Quantum system for information processing-quantum states-Classical bits-quantum bits or qubits - Density matrices- Entanglement-Quantum gates-C-NOT Gate-Bloch sphere.		
		Total: 45

TEXTBOOKS	
1	Hitendra K Malik, A K Singh, “Engineering Physics” Tata Mcgraw Hill Education Private Limited, New Delhi 2010.
2	Vanchna Singh, Sheetal Kumar, “Engineering Physics” Cengage Learning India Pvt.Ltd. Delhi 2010.
3	V Rajendran, “Engineering Physics” Tata Mcgraw Hill Education Private Limited, New Delhi 2011.
REFERENCES	
1	Dattu R Joshi, “Engineering Physics” Tata Mcgraw Hill Education Private Limited, New Delhi 2010.
2	A Marikani, “Engineering Physics” PHI Learning Private Limited New Delhi 2010.
3	Kenneth B. Howell, “ Ordinary Differential Equations” CRC Press , 21 January 2023

COURSEOUTCOMES: At the end of the course, learners will be able to	Bloom’s Taxonomy Level

CO1	Understand clearly of semiconductor physics and functioning of semiconductor devices.	K2
CO2	Solution of differential equations to understand the computational physics.	K2
CO3	Understand the basic concepts and principles of quantum mechanics	K2
CO4	Explain the effects of quantum confinement on the electronic structure and corresponding physical and chemical properties of materials	K2
CO5	Apply the quantum mechanical principals and basic concept of quantum computing	K3

CO's-PO's & PSO's MAPPING

CO	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
AV	3	2	1.5	1.5	2	1	-	-	-	-	-	1	-	-	-

1-LOW, 2-MEDIUM,3-HIGH, "-" NO CORRELATION

ACS101 PRINCIPLES OF PROGRAMMING							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**PC**	**3**	**0**	**0**	**3**
Preamble	➢ Be exposed to the basics of computers and number systems. ➢ Learn to think logically and write pseudo code or draw flow charts for problems. ➢ Be familiar with syntax and programming in C. ➢ To develop modular applications in C using functions, pointers and structures ➢ To do input/output and file handling in C						
Unit 1	INTRODUCTION TO COMPUTERS					9	
Introduction – Characteristics of Computers – Evolution of Computers – Computer Generations – Classification of Computers – Basic Computer organization – Number Systems-Number Conversion							
Unit 2	PROBLEM SOLVING AND COMPUTER SOFTWARE					9	
Problem formulation – Problem Solving - Algorithm – Flow Charts – Pseudocode - Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – HTML -Getting connected to Internet Applications. Application Software Packages- Introduction to Office Packages							
Unit 3	INTRODUCTION TO C					9	
Overview of C – structure of a C program – compilation and linking processes, Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision							

Making – Arrays, Branching and Looping, Handling of Character Strings.		
Unit 4	FUNCTIONS, POINTERS AND STRUCTURES	9
Built-in Functions-User-defined Functions – Definitions – Declarations -Call by reference – Call by value – Structures and Unions – Pointers – The Preprocessor – Developing a C Program		
Unit 5	FILE MANIPULATION	9
Introduction, Character Input output in Files, Command Line Arguments, String Input Output in Files, High level Disk I/O Functions, Direct Input Output, Error Handling functions, File Positioning, Introduction to Preprocessor, Macro substitution, File Inclusion.		
		Total: 45

TEXTBOOKS	
1	Ashok.N.Kamthane,“ Computer Programming”, Pearson Education (India)
2	Behrouz A.Forouzan and Richard.F.Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks-Cole Thomson Learning Publication
REFERENCES	
1	Pradip Dey, Manas Ghoush, “Programming in C”, Oxford University Press
2	Byron Gottfried, “Programming with C”, 2nd Edition, (Indian Adapted Edition), TMH publications
3	Stephen G.Kochan, “Programming in C”, Third Edition, Pearson Education India.
4	Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc.
5	E.Balagurusamy, “Computing fundamentals and C Programming”, Tata McGraw-Hill Publishing Company Limited.

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom’s Taxonomy Level
CO1	To enable the student to learn the major components of a computer system	K2
CO2	To demonstrate knowledge on logical thinking and problem solving	K2
CO3	Design and implement applications on C Programming constructs using arrays and strings	K2
CO4	Develop and implement modular applications in C using functions, structures and pointers.	K2
CO5	Design applications using sequential and random access file processing.	K3

CO’s-PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

1-LOW, 2-MEDIUM,3-HIGH, “-“ NO CORRELATION

ACS102 - PYTHON PROGRAMMING							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**ES**	**3**	**0**	**0**	**3**
Preamble	To understand the basics of algorithmic problem solving. To learn to solve problems using Python conditionals and loops. To define Python functions and use function calls to solve problems. To use Python data structures - lists, tuples, dictionaries to represent complex data. To do input/output with files in Python.						
Unit 1	BASICS OF PYTHON PROGRAMMING					9	
Overview of programming language- Python history-Interactive mode – script mode-Tokens:Literal-Keyword-Delimiter-Identifier-Data types: Integer-Floating-Complex-Boolean-String-Indentation-Input operation-Comments							
Unit 2	CONTROL STRUCTURE, OPERATORS AND FUNCTIONS					9	
Statements: if, if-else, nested if, if –elif - Iterative statements: while, for, Nested loops, else in loops, break, continue and pass statements. Operators: Arithmetic-Membership-Identity-Bitwise Functions: Types, parameters, arguments: positional arguments, keyword arguments, parameters with default values, functions with arbitrary arguments, Scope of variables: Local and global scope, Recursion							
Unit 3	COLLECTIONS, STRINGS AND REGULAR EXPRESSIONS					9	
List: Create Access, Negative Indices, Slicing, Splitting, List Methods, and comprehensions Tuples: Create, Indexing and Slicing, Operations on tuples. Dictionary: Create, add, traversing and replace values, operations on dictionaries. Sets: Create and operations on set. Strings: Formatting, Comparison, Slicing, Splitting, Stripping, Negative indices, String functions. Regular expression: Matching the patterns, Search and replace							
Unit 4	FILE HANDLING AND EXCEPTIONS					9	
Files: Open, Read, Write, Append, Tell, Seek and Close. Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, Userdefined Exceptions, Defining Clean-Up actions							
Unit 5	NUMPY, PANDAS, MATPLOTLIB					9	
Introduction - Basics of NumPy - N-dimensional Array in NumPy – Methods and Properties - Basics of SciPy - Broadcasting in NumPy Array Operations - Array Indexing in NumPy, Pandas - Introduction - Series - Data Frame - Matplotlib - Basics - Figures and Axes - Method subplot() - Axis container							
						Total: 45	
TEXTBOOKS							
1	Ashok Namdev Kamthane, Amit Ashok Kamthane “Programming and Problem Solving with Python” , 2nd edition , Mc Graw Hill						
2	Dr.R.Nageswara Rao, “Core Python Programming”,3rd edition, Deamtech Publisher						
REFERENCES							

1	Paul Dietel, Harvey Deitel, " Python for Programmers", Pearson
2	Reema Thareja," Problem Solving and programming with Python, Oxford University Press

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Develop algorithmic solutions to simple computational problems.	K3
CO2	Develop and execute simple Python programs.	K3
CO3	Write simple Python programs using conditionals and loops for solving problems.	K2
CO4	Decompose a Python program into functions.	K3
CO5	Represent compound data using Python lists, tuples, dictionaries etc.	K3

CO's-PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

1-LOW, 2-MEDIUM,3-HIGH, "-" NO CORRELATION

AMC101 - EMPLOYMENT ENCHANCEMENT SKILLS

Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**MC**	**2**	**0**	**0**	**0**

Preamble		
Unit 1	RESUME WRITING	6
Resume: Objective; Formats; Meticulous & Attention to Detail; Organizing Information; Highlight skills; Mistakes to avoid; Qualification & Skill; SWOT Analysis; Assignment – Draft Resume & Corrections		

Unit 2	INTERVIEW SKILLS	6
Types of Interviews; Preparation – Company, Role, Brush up Concepts, Technical Strengths; Strengths & Weakness; Importance of Grooming; Interview Questions – HR & Technical; Non Verbal Communication; Negotiation Skills; How to start/end an interview; Group Discussion; Assignment – Preparation for "Tell me about yourself", Mock Interviews.		
Unit 3	PROFESSIONAL ETIQUETTES	6
Workplace Etiquette – Global & Local; Culture Sensitivity; Gender Sensitivity; Communication Netiquettes – Phone, Email, Social Media; Avoid Gossip; How to be personable yet be professional. Meetings: Types of meetings; Agenda; Schedule & Participants; Materials required; Minutes of Meeting.		
Unit 4	PRESENTATION SKILLS	6
What is a Presentation; Develop an effective slide; Know your Slides; Know your Audience; Barriers in Presentation; Time Management; Listening to the silent audience; Question & Answer session; Feedback.		
Unit 5	COMMUNICATION AT WORKPLACE	6
Language & Communication; Types of Communication – Internal & External, Formal & Informal; Direction of Communication Flow – Downward, Upward, Lateral, Diagonal; Team Work; Emotional Intelligence		
Total: 30		
TEXTBOOKS		
1	"Soft Skills & Employability Skills" by Sabina Pillai&Agna Fernandez	
2	"Soft Skills" by Meenakshi Raman &ShaliniUpadhyay	
3	"Campus Recruitment" by Ramanadhan Ramesh Babu, Israel Battu, Akash R Bhutada&Vijaya Lakshmi Krishnan	
REFERENCES		
1	"Personality Development & Soft Skills (Old Edition)" by Barun K Mitra	
2	"Soft Skills Training: A Workbook to develop Skills for Employment" by Frederick H Wentz	
3	"Ten Soft Skills You Need to Advance Your Career(Andre Keys Book 9)" by Lisa Smith	
4	"Get Your First Job: A Companion For Getting Your First Job – A Guide to Employability Skills & Career Planning" by AJ Balasubramanian&Dr J Sadakkadulla	

CO's-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

1-LOW, 2-MEDIUM, 3-HIGH, "-"NO CORRELATION

AMC102 - PROFESSIONAL ETHICS AND HUMAN VALUES							
Programme & Branch	B.Tech & AI&DS	Sem.	Category	L	T	P	C
		1	MC	2	0	0	0
Preamble	To create an awareness on Engineering Ethics and Human Values. To understand social responsibility of an engineer. To appreciate ethical dilemma while discharging duties in professional life.						
Unit 1	HUMAN VALUES						2
Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Character							
Unit 2	ENGINEERING ETHICS						4
Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories. Valuing Time – Co-operation – Commitment							
Unit 3	ENGINEERING AS SOCIAL EXPERIMENTATION						3
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study							
Unit 4	SAFETY, RESPONSIBILITIES AND RIGHTS						3
Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies							
Unit 5	GLOBAL ISSUES						3
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral							

leadership	
Total: 15	
TEXTBOOKS	
1	Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996
2	Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004
REFERENCES	
1	Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).
2	Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available).
3	John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4	Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

CO’s-PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

1-LOW, 2-MEDIUM,3-HIGH, “-“ NO CORRELATION

AHS101 - தமிழர்மரபு							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**HS**	**1**	**0**	**0**	**1**

Preamble		
அலகு I	மொழிமற்றும்இலக்கியம்	3

இந்திய மொழிக் குடும்பங்கள்-திராவிட மொழிகள்-தமிழ் ஒரு செம்மொழி தமிழ் செவ்விலக்கியங்கள்-சங்க இலக்கியத்தின் சமயச்சார் பற்ற தன்மை சங்க இலக்கியத்தில்பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள்-தமிழ்க் காப்பியங்கள்,தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம்-பக்தி இலக்கியம்,ஆழ்வார்கள் மற்றும் நாயன்மார்கள்-சிற்றிலக்கியங்கள்-தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II	மரபு –பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை சிற்பக்கலை	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன்சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் – தேர்செய்யும்கலை – சுடுமண்சிற்பங்கள் – நாட்டுப்புறத்தெய்வங்கள் – குமரி முனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் – மிருதங்கம் , பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III	நாட்டுப் புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்	3

தெருக்கூத்து,கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

அலகு IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும்,விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும்

இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.		
அலகு V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3
இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின்பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சுவரலாறு.		
Total: 15		
TEXTBOOKS		
1	தமிழகவரலாறு – மக்களும்பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு:தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).	
2	கணினித்தமிழ் – முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).	
3	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)	
REFERENCES		
1	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல்துறைவெளியீடு)	
2	பொருநை ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)	
3	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies	
4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)	

CO's-PO's & PSO's Mapping

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO 3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	-	1	-	2	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APH301 COMPUTATIONAL PHYSICS LAB							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**BS**	**0**	**0**	**4**	**2**
Preamble	To learn the proper use of various kinds of physics laboratory equipment. To learn how data can be collected, presented and interpreted in a clear and concise manner To make the student an active participant in each part of all exercises.						
LIST OF EXPERIMENTS							
1. Determination of Band Gap of a semiconductor.							
2. Verification and interpretation of truth table for AND, OR, NOT Gates.							
3. Verification and interpretation of truth table for NAND, NOR, Ex-OR, EX-NOR Gates.							
4. Analysis and Synthesis of Boolean expression using logic gates.							
5. Laser- Determination of the wavelength of the laser using grating							
6. Air wedge - Determination of thickness of a thin sheet/wire							
7. (a) Optical fibre -Determination of Numerical Aperture and acceptance angle (b) Compact disc- Determination of width of the groove using laser.							

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Understand the functioning of various physics laboratory equipment.	K2
CO2	Use graphical models to analyze laboratory data.	K4
CO3	Use mathematical models as a medium for quantitative reasoning and describing physical reality.	K2
CO4	Access, process and analyze scientific information.	K4
CO5	Solve problems individually and collaborative.	K3

CO's-PO's & PSO's MAPPING

CO	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
2	3	3	3	1	1	-	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
5	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
AV	3	2	1.5	1	1	-	-	-	-	-	-	-	-	-	-

1-LOW, 2-MEDIUM,3-HIGH, "-" NO CORRELATION

ACS301 - PYTHON PROGRAMMING LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**ES**	**0**	**0**	**4**	**2**
Preamble	To understand the problem solving approaches. To learn the basic programming constructs in Python. To practice various computing strategies for Python-based solutions to real world problems. To use Python data structures - lists, tuples, dictionaries. To do input/output with files in Python.						
LIST OF EXPERIMENTS							
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)							
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).							
3 Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)							
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)							
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)							

6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool. 12. Developing a game activity using Pygame like bouncing ball, car race etc.
Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Develop algorithmic solutions to simple computational problems	K3
CO2	Develop and execute simple Python programs.	K3
CO3	Implement programs in Python using conditionals and loops for solving problems.	K3
CO4	Deploy functions to decompose a Python program.	K3
CO5	Process compound data using Python data structures.	K3

CO's-PO's & PSO's MAPPING

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AHS301 - COMMUNICATION SKILLS AND TECHNICAL WRITING							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		1	**HS**	**0**	**0**	**2**	**1**
Preamble	Impart a thorough understanding of the principles underlying effective technical communication. Develop the skills necessary to tailor technical communication to diverse audience needs. Enhance proficiency in using language techniques and understanding genres related to technical communication. Equip students with the ability to utilize technological tools to improve technical communication practices. Foster an awareness of ethical considerations and global perspectives in technical communication.						
Unit 1	PRINCIPLES OF TECHNICAL COMMUNICATION						12
Listening -Brief video snippets of conversational moments from movies and short documentaries Speaking- Presenting oneself, introducing others, inviting people, and explaining places. Reading - Short passages that need understanding include inference and critical analysis. Writing-Finishing missing phrases and constructing suggestions based on supplied information. Grammar- Who-Questions and Yes/No Questions - Parts of Speech. Vocabulary development: prefixes, suffixes, articles, countable and uncountable nouns.							
Unit 2	AUDIENCE-CENTERED COMMUNICATION						12
Listening: Deep Listening - Talk Shows and Debates. Reading: In depth Reading: Scanning Passages Speaking: Describe current issues, happenings, etc. Writing: Instructions, Recommendations, Note Taking, and Paragraph Writing Grammar: Continuous tenses, prepositions and articles Vocabulary: Phrasal verbs and one-word substitutes							
Unit 3	LANGUAGE TECHNIQUES AND GENRES IN TECHNICAL COMMUNICATION						12
Listening: Listening to lectures, podcasts, audio books. Reading: Interpretation of Tables, Charts and Graphs Speaking: SWOT Analysis on oneself and Narrating incidents Writing: Formal Letter Writing, Covering Letter and Memos. Grammar: Perfect Tenses and Discourse Markers Vocabulary: Nouns, usage of keywords							
Unit 4	TECHNOLOGICAL TOOLS USED IN COMMUNICATION						12
Listening: Instructional videos, webinars on personal branding and networking and TED talks Reading: Manuals, Research papers or articles, Graphic narratives, AI tools used in reading Speaking: Participating in and conducting mock virtual meetings, focusing on presentation skills and etiquette. Mock networking events and Elevator Pitch Writing: E-Mails, drafting formal messages in social media handles, and Usage of AI prompts.							

Grammar: Adjectives, Verbs and Adverbs.		
Unit 5	ETHICAL AND GLOBAL PERSPECTIVES IN TECHNICAL COMMUNICATION	12
Listening: Podcasts, documentaries and webinars on digital ethics and cybersecurity. Reading: Articles on fundamental ethical principles and case studies. Speaking: Cultural sensitivity and representation ross-cultural communication strategies Mock meetings to practice global collaboration. Writing: Case study analysis reports on legal and ethical responsibilities. Proposals for implementing sustainable communication practices. Grammar: Reported Speech, Idioms and phrases and Loan words		
Total: 60		

TEXTBOOKS	
1	Effective Technical Communication by M. Ashraf Rizvi (Author) 2nd Edition Paperback 2017
2	Sylvan Barnet and Hugo Bedau, 'Critical Thinking Reading and Writing', Bedford/st. Martin's: Fifth Edition (June 28, 2004)
3	Meenakshi Upadhyay, Arun Sharma – Verbal Ability and Reading Comprehension.
4	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine Chuen Meng Goh, Cambridge.
REFERENCES	
1	Technical Communication: A Reader-Centered Approach" by Paul V. Anderson
2	"Technical Writing: Process and Product" by Sharon J. Gerson and Steven M. Gerson
3	"English for Engineers and Technologists: A Skill Approach" by Jeyanthi G. and Ramasamy P
4	"A Handbook for Technical Writers and Editors" by M. Ragunathan and M. Sundararajan

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	To create clear and successful technical publications, use core technical communication concepts.	K2
CO2	Modify technical communication to the requirements and expectations of various audiences.	K2
CO3	Use proper language and genres to effectively communicate technical knowledge.	K2
CO4	Use technology technologies to improve the generation, management, and dissemination of technical material.	K2
CO5	Navigate ethical quandaries and explore global views in technological communication methods.	K2

JEPPIAAR INSTITUTE OF TECHNOLOGY

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Self-Belief | Self Discipline | Self Respect

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SEM-II

AMA102 DISCRETE MATHEMATICS							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		2	**BS**	**3**	**1**	**0**	**4**
Preamble	Extend student's Logical and Mathematical ability to deal with abstraction Acquire basics of set theory, functions and counting ,apply them in day to day problems Understand the fundamental concepts of the Graph theory and Network connectivity Gain the concepts to identify structures of algebraic nature, prove and use properties about them Learn relations, Lattice, Boolean algebras and their properties to comprehend problems in computer Science.						
Unit 1	FOUNDATION OF LOGIC AND PROOFS						9+3
Propositional Logic- Connectives - Propositional equivalences -Normal form –Predicates and Quantifiers – Nested Quantifiers -Validity of a well-formed formula– Rules of inference.							
Unit 2	COMBINATORICS						9+3
Counting: The basics of counting - The pigeonhole principle - Permutations and Combinations - Recurrence relations: solving recurrence relations, generating functions - Inclusion-Exclusion principle : application of inclusion-exclusion.							
Unit 3	RELATIONS						9+3
Relations - Equivalence relations – Functions - Bijections - Binary relations and graphs- Posets and Lattices -Hasse Diagrams – Boolean algebra.							
Unit 4	GRAPH THEORY						9+3
Graphs and Graph models- Graph terminology and special types of Graphs – Matrix representation of Graphs and Graph isomorphism – connectivity – Eulerian and Hamiltonian Graphs.							
Unit 5	ALGEBRAIC STRUCTURE						9+3
Algebraic structures with one binary operation – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Algebraic structures (Definitions and simple examples only) with two binary operation- Ring, Integral domain and field.							
Total: 60							
TEXTBOOKS							

1	J.P.Tremblay., R.Manohar., "Discrete Mathematical Structures with Applications" Tata MCGRAW Hill 38th edition 2010
2	Kenneth.H. Rosen " Discrete Mathematics and its Applications" Tata MCGRAW Hill Special edition 2010
3	T.Veerarajan "Discrete Mathematics with Graph Theory and Cominatorics" Tata MCGRAW Hill 33rd edition 2021
REFERENCES	
1	Bernard Kolman., Robert Busby., Sharon C.Ross " Discrete Mathematical Structures " Pearson Publications 6th edition 2013.
2	Varsha H.Patil., Seymour Lipschutz., Mare lars lipson., " Discrete Mathematics" Revised 3rd edition 2013
3	https://home.iitk.ac.in/~arlal/book/mth202.pdf
4	https://archive.nptel.ac.in/courses/106/103/106103205

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Demonstrate the ability to write and evaluate a proof or outline the basic structure and give examples of each proof technique described.	K2
CO2	Apply counting principles to determine probabilities in engineering problems.	K3
CO3	Demonstrate the relations and functions and to determine their properties in solving engineering problems.	K2
CO4	Develop graph theory tools to map day-to-day applications.	K4
CO5	Expose to the concepts and properties of algebraic structures which provides solutions in design and analysis of algorithms.	K2

CO With PO & PSO Mapping

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	3	-	-	-	-	-	-	-	-	1	1	-	-
Average	3	2.2	2.2	1								1	1	1	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

AEC103 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Programme &Branch	B.Tech-AI&DS	Sem.	Category	L	T	P	Credit
Prerequisites		2	ES	3	0	0	3

Preamble	This course provides the foundation for under standing various aspects of electrical and electronics engineering. From the basics of circuit theory to the intricacies of semiconductor devices, this subject delves into the heart of electrical and electronic systems.

Unit–I	**ELECTRICAL CIRCUITS**	**9**
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)		
Unit–II	**ELECTRICAL MACHINES**	**9**
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.		
Unit–III	**ANALOG ELECTRONICS**	**9**
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters		
Unit–IV	**DIGITAL ELECTRONICS**	**9**
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).		
Unit–V	**MEASUREMENTS AND INSTRUMENTATION**	**9**
Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.		
		Total:45

TEXTBOOK:	
1.	Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020
2.	S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3.	Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008
4.	James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5.	A.K. Sawhney, PuneetSawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, DhanpatRai and Co, 2015.
REFERENCES:	
1.	Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill Education, 2019.
2.	Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
3.	Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4.	MahmoodNahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill,

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Compute the electric circuit parameters for simple problems.	K4
CO2	Explain the working principle and applications of electrical machines.	K2
CO3	Analyze the characteristics of analog electronic devices.	K4
CO4	Explain the basic concepts of digital electronics.	K2
CO5	Explain the operating principles of measuring instruments	K2

COs	**POs**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	3	-	-	-	-	-	-	-	-	1	1	-	-
Average	3	2.2	2.2	1								1	1	1	-

AAI101 - INTRODUCTION TO DATA SCIENCE							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		2	**ES**	**3**	**0**	**0**	**3**
Preamble	To understand the data science fundamentals and process. To learn to describe the data for the data science process. To learn to describe the relationship between data. To utilize the Python libraries for Data Wrangling. To present and interpret data using visualization libraries in Python						
Unit 1	INTRODUCTION						9
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Definingresearch goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model–presenting findings and building applications - Data Mining - Data Warehousing – Basic Statisticaldescriptions of Data							
Unit 2	DESCRIBING DATA						9
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Datawith Averages - Describing Variability - Normal Distributions and Standard (z) Scores							
Unit 3	DESCRIBING RELATIONSHIPS						9
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula forcorrelation coefficient – Regression –regression line –least squares regression line – Standarderror of estimate – interpretation of r2 –multiple regression equations –regression towards the mean							
Unit 4	PYTHON LIBRARIES FOR DATA WRANGLING						9
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, booleanlogic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing andselection – operating on data – missing data – Hierarchical indexing – combining datasets –aggregation and grouping – pivot tables							
Unit 5	DATA VISUALIZATION						9
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.							
Total: 45							
TEXTBOOKS							

1	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.(Units II and III
3	Jake Vander Plas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)
REFERENCES	
1	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom’s Taxonomy Level
CO1	Define the data science process	K1
CO2	Understand different types of data description for data science process	K2
CO3	Gain knowledge on relationships between data	K2
CO4	Use the Python Libraries for Data Wrangling	K3
CO5	Apply visualization Libraries in Python to interpret and explore data	K3

CO’s- PO’s & PSO’s MAPPING

CO / PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	3	-	-	-	1	2	2	2	1	1	2
CO2	2	2	2	3	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	2	2	2	-	-	-	2	1	2	2	2	2	1
CO4	2	2	1	3	3	-	-	-	1	1	1	1	1	2	2
CO5	2	2	2	3	2	-	-	-	2	2	1	2	3	3	1

DATA STRUCTURES AND ALGORITHMS

Programme & Branch	B.Tech & AI&DS	Sem.	Category	L	T	P	Credit
Prerequisites		2	PC	3	0	0	3

Preamble	• To understand the concepts of ADTs. • To Learn linear data structures – lists, stacks, and queues. • To understand non-linear data structures – trees and graphs • To understand sorting, searching and hashing algorithms • .To apply Tree and Graph structures.

Unit–I	INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS	9

Introduction to Data Structures - Need - Classification-Arrays - Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Circular linked list - Doubly linked list. Fundamentals of Algorithmic Problem Solving - Time Complexity - Space complexity with examples - Growth of Functions - Asymptotic Notations and its properties - Complexity Analysis Examples - Performance measurement - Instance Size, Test Data, Experimental setup.

Unit–II	STACK AND QUEUES	9

Basic Stack Operations - Representation of a Stack using Arrays - Algorithm for Stack Operations - Infix to postfix Transformation - Evaluating Arithmetic Expressions.Basic Queue Operations - Representation of a Queue using array - Enqueue - Dequeue - Circular Queues - Priority Queues. Solving Recurrence Equations - Substitution Method - Recursion Tree Method - Master Method - Sorting in Linear Time - Lower bounds for Sorting: Counting Sort.

Unit–III	TREES AND GRAPHS	9

Trees- Binary Trees - Properties of Binary trees -Implementation using Array and Linked list - Recursive and Non-Recursive Binary Tree traversals - Binary Search Tree - Insertion and Deletion. Graph - Representation using Array and Linked List - Types of graphs - Graph traversals - BFS and DFS - Minimum Spanning Tree - Kruskal‘s, Prim‘s Algorithm - Shortest path using Dijkstra‘s, Bellman Ford and Floyd Warshall Algorithm.

Unit–IV	ALGORITHM DESIGN TECHNIQUES	9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort , Binary Search: Dynamic programming: Elements of dynamic programming - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

Unit–V	STATE SPACE SEARCH ALGORITHMS	9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem- Polynomial time algorithms - NP Complete Problems.

Total:45

TEXTBOOK:

1.	Anany Levitin, ―Introduction to the Design and Analysis of Algorithms‖, 3rd Edition, Pearson Education, 2012.
2.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, ―Fundamentals of Computer Algorithms‖, 2nd Edition, Universities Press, 2007.
3.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, 4th Edition, MIT Press, 2022.

REFERENCES:

1.	Goodrich MT, Tamassia R, Goldwasser MH., ― Data structures and Algorithms in Python‖, John Wiley and Sons Ltd; 2013.
2.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms David E. Goldberg, ―Genetic Algorithm In Search Optimization And Machine Learning‖ Pearson Education India, 2013

COURSEOUTCOMES: **Attheendof thecourse, learners willbeable to**		**Bloom'sTaxonomyLevel**
CO1	Comprehend the concepts of data structures and analyze the efficiency of an algorithm based on time and space complexity.	K4
CO2	Design applications of linear data structures and apply appropriate algorithms for solving problems like sorting and searching.	K2
CO3	Demonstrate the representation and traversal techniques of graphs and their applications.	K4
CO4	Design a solution by using branch and bound, backtracking techniques and implement the various non-linear data structures and perform the intended operations.	K2
CO5	Utilize the state space tree method for solving problems.	K2

CO's-PO's & PSO's MAPPING

CO / PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	2	2	-	-	-	1	2	2	2	3	1	2
CO2	2	2	2	1	3	-	-	-	2	1	3	1	1	3	2
CO3	3	3	3	1	2	-	-	-	2	2	2	2	3	2	2
CO4	1	2	1	1	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	2

ACS104 - FUNDAMENTALS OF CLOUD COMPUTING							
Programme & Branch	B.Tech & AI&DS	Sem.	Category	L	T	P	C
		2	ES	3	0	0	3
Preamble	To understand the principles of cloud architecture, models and infrastructure. To understand the concepts of virtualization and virtual machines. To gain knowledge about virtualization Infrastructure. To explore and experiment with various Cloud deployment environments. To learn about the security issues in the cloud environment.						
Unit 1	BASIC CONCEPTS OF CLOUD COMPUTING		9				

Network-Based Systems- Concepts of Distributed Systems. Definition of Cloud, Concepts of Cloud Computing. Cloud Service Providers, NIST Cloud Computing, Cloud Characteristics		
Unit 2	CLOUD INFRASTRUCTURE	9
Cloud Pros and Cons. Layered Architectural Design, Cloud Delivery Models. Cloud Deployment Models, Architectural Design Challenges, Cloud Storage - Storage-as-a-Service – Advantages of Cloud Storage - Cloud Storage Providers - S3.		
Unit 3	VIRTUALIZATION BASICS	9
Virtual Machine and its architecture–VM primitive operations- Virtual Infrastructures- Data Center Virtualization for Cloud Computing–Levels of Virtualization Implementation – VMM Design Requirements, Virtualization Support at the OS Level, Physical versus Virtual Clusters. Live VM Migration Steps		
Unit 4	BUILDING CLOUD NETWORKS	9
Designing and Implementing a Data Center-Based Cloud Installing Open Source Cloud service. Virtual Box – Eucalyptus Public Cloud Platforms: Google App Engine, Amazon Web Services (AWS). Google Cloud Platform. Emerging Cloud Software Environments		
Unit 5	CLOUD SECURITY AND APPLICATIONS	9
Cloud Security Infrastructure Security Network level security- Host level security, Application level security- Data privacy and security Issues. Access Control and Authentication in cloud computing, IAM Security Standards		
Total: 45		
TEXTBOOKS		
1	Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.	
2	Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi	
REFERENCES		
1	Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013	
2	Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010	
COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom’s Taxonomy Level

CO1	Understand the design challenges in the cloud.	K2
CO2	Apply the concept of virtualization and its types.	K3
CO3	Experiment with virtualization of hardware resources.	K3
CO4	Develop and deploy services on the cloud and set up a cloud environment.	K3
CO5	Explain security challenges in the cloud environment.	K2

CO's-PO's & PSO's MAPPING

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

AHS301 - COMMUNICATION SKILLS AND TECHNICAL WRITING							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		2	**HS**	**0**	**0**	**2**	**1**
Preamble	Impart a thorough understanding of the principles underlying effective technical communication. Develop the skills necessary to tailor technical communication to diverse audience needs. Enhance proficiency in using language techniques and understanding genres related to technical communication. Equip students with the ability to utilize technological tools to improve technical communication practices. Foster an awareness of ethical considerations and global perspectives in technical communication.						
Unit 1	PRINCIPLES OF TECHNICAL COMMUNICATION						12
Listening -Brief video snippets of conversational moments from movies and short documentaries Speaking- Presenting oneself, introducing others, inviting people, and explaining places. Reading - Short passages that need understanding include inference and critical analysis. Writing-Finishing missing phrases and constructing suggestions based on supplied information. Grammar- Who-Questions and Yes/No Questions - Parts of Speech. Vocabulary development:							

prefixes, suffixes, articles, countable and uncountable nouns.		
Unit 2	AUDIENCE-CENTERED COMMUNICATION	12
Listening: Deep Listening - Talk Shows and Debates. Reading: In depth Reading: Scanning Passages Speaking: Describe current issues, happenings, etc. Writing: Instructions, Recommendations, Note Taking, and Paragraph Writing Grammar: Continuous tenses, prepositions and articles Vocabulary: Phrasal verbs and one-word substitutes		
Unit 3	LANGUAGE TECHNIQUES AND GENRES IN TECHNICAL COMMUNICATION	12
Listening: Listening to lectures, podcasts, audio books. Reading: Interpretation of Tables, Charts and Graphs Speaking: SWOT Analysis on oneself and Narrating incidents Writing: Formal Letter Writing, Covering Letter and Memos. Grammar: Perfect Tenses and Discourse Markers Vocabulary: Nouns, usage of keywords		
Unit 4	TECHNOLOGICAL TOOLS USED IN COMMUNICATION	12
Listening: Instructional videos, webinars on personal branding and networking and TED talks Reading: Manuals, Research papers or articles, Graphic narratives, AI tools used in reading Speaking: Participating in and conducting mock virtual meetings, focusing on presentation skills and etiquette. Mock networking events and Elevator Pitch Writing: E-Mails, drafting formal messages in social media handles, and Usage of AI prompts. Grammar: Adjectives, Verbs and Adverbs.		
Unit 5	ETHICAL AND GLOBAL PERSPECTIVES IN TECHNICAL COMMUNICATION	12
Listening: Podcasts, documentaries and webinars on digital ethics and cybersecurity. Reading: Articles on fundamental ethical principles and case studies. Speaking: Cultural sensitivity and representation ross-cultural communication strategies Mock meetings to practice global collaboration. Writing: Case study analysis reports on legal and ethical responsibilities. Proposals for implementing sustainable communication practices. Grammar: Reported Speech, Idioms and phrases and Loan words		
Total: 60		
TEXTBOOKS		
1	Effective Technical Communication by M. Ashraf Rizvi (Author) 2nd Edition Paperback 2017	
2	Sylvan Barnet and Hugo Bedau, ‘Critical Thinking Reading and Writing’, Bedford/st. Martin’s: Fifth Edition (June 28, 2004)	
3	Meenakshi Upadhyay, Arun Sharma – Verbal Ability and Reading Comprehension.	
4	Teaching Speaking: A Holistic Approach, Book by Anne Burns and Christine Chuen Meng Goh, Cambridge.	
REFERENCES		
1	Technical Communication: A Reader-Centered Approach" by Paul V. Anderson	

2	"Technical Writing: Process and Product" by Sharon J. Gerson and Steven M. Gerson
3	"English for Engineers and Technologists: A Skill Approach" by Jeyanthi G. and Ramasamy P
4	"A Handbook for Technical Writers and Editors" by M. Ragunathan and M. Sundararajan

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	To create clear and successful technical publications, use core technical communication concepts.	K2
CO2	Modify technical communication to the requirements and expectations of various audiences.	K2
CO3	Use proper language and genres to effectively communicate technical knowledge.	K2
CO4	Use technology technologies to improve the generation, management, and dissemination of technical material.	K2
CO5	Navigate ethical quandaries and explore global views in technological communication methods.	K2

AMC103 - INDIAN CONSTITUTION							
Programme & Branch	B.Tech & AI&DS	Sem.	Category	L	T	P	Credit
		2	MC	2	0	0	0
Preamble	This Course intends to impart a comprehensive outlook about the nature of the Indian constitution; rights and duties of the citizens, Political Institutions of Central and State governments and its relationship with each other and the organization and functions of local government. A detailed analysis of the functions of the statutory bodies are incorporated in this course.						
Unit 1							9
Constitutional Assembly – Philosophy – Preamble – Salient Features of Indian Constitution							
Unit 2							9
Fundamental Rights – Directive Principles of State Policy – Fundamental Duties.							
Unit 3							9
Union Executive – President : Election – Powers and Functions – Council of Ministers – Prime Minister : Position and Powers – Relationship between Prime Minister and President. State Executive – Governor : Powers and functions – Chief Minister : Position and Powers – Relationship between Chief							

Minister and Governor.		
Unit 4		9
Union Legislature : Structure, Powers and Functions – Speaker : Power and Functions – Procedures of Constitutional Amendment – State Legislature : Structure, Powers and Functions.		
Unit 5		9
Judiciary – Supreme Court: Powers and Functions – High Court : Powers and Functions – Judicial Review		
Total: 45		
TEXTBOOKS		
1	Siwach,J.R, Dynamics of Indian Government and Politics, New Delhi: Sterling, 1985.	
2	Narang, A.S., Indian Government and Politics New Delhi: Gitanjali ,1995	
REFERENCES		
1	Thakur, R. The Government and Politics of India : London: Macmillan, 1995.	
2	Gupta,D.C, Indian Government and Politic, New Delhi, 1996	

CO's-PO's & PSO's Mapping

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO 3
CO1	1		-	-	-	3	3	3	-	3	-	2	-	1	-
CO2	2		-	-	-	3	3	3	-	3	-	2	-	1	-
CO3	2		-	-	-	3	3	3	-	3	-	2	-	1	-
CO4	-	3	-	-	-	3	3	3	-	3	-	2	-	1	-
CO5	1		-	-	-	3	3	3	-	3	-	2	-	1	-

AEC302 - BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		2	**ES**	**0**	**0**	**4**	**2**
Preamble	Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB. Study of basic electrical and digital equipment.						

LIST OF EXPERIMENTS
1. Soldering simple electronic circuits and checking continuity.
2. Assembling and testing electronic components on a small PCB.
3. Study of electronic components and equipment's.
(a) Resistor Color coding using digital multi-meter.
(b) Assembling electronic components on breadboard.
4. Verification of Logic Gates
5. Verification of Half Adder and Full Adder
6. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
7. Verification of KVL, KCL
8. Verification of Thevenin, Norton, Superposition Theorem
9. Fluorescent lamp wiring
10. Stair case wiring
11. Study of iron box wiring and working
12. Assembly and dismantle of computer/ laptop
Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.	K3
CO2	Demonstrate the wiring of various electrical joints in common household electrical wire work.	K3
CO3	Test the working of basic logic gates.	K3
CO4	Understand the working of basic electrical devices	K3
CO5	Apply basic electrical concepts to implement basic electrical circuits.	K3

CO's-PO's & PSO's Mapping

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

CO3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO4	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO5	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

ACS304-DATA STRUCTURES AND ALGORITHMS LABORATORY						
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	P
Prerequisites		**2**	**PC**	**0**	**0**	4

Preamble	To demonstrate array implementation of linear data structure algorithms. To implement the applications using Stack To implement the applications using Linked list To implement Binary search tree and AVL tree algorithms. To implement the Heap algorithm. To implement Dijkstra's algorithm. To implement Prim's algorithm To implement Sorting, Searching and Hashing algorithms.
ListofExercises/Experiments:	
1.	Implement Linear Search and recursive Binary Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2.	Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3.	Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4.	Develop a program to implement graph traversal using Breadth First Search and Depth First Search.
5.	From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6.	Find the minimum cost spanning tree of a given undirected graph using Prim's

	algorithm.
7.	Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
8.	Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
9.	Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
	Total: 60

REFERENCES/MANUAL/SOFTWARE:	
1.	LaboratoryManual

COURSEOUTCOMES: Attheendofthecourse,learnerswillbeableto		Bloom's Taxonomy Level
CO1	Implement Linear data structure algorithms using arrays and Linked lists.	K3
CO2	Analyze the efficiency of algorithms using various frameworks	K3
CO3	Analyze the various searching and sorting algorithms.	K4
CO4	Apply graph algorithms to solve problems and analyze their efficiency.	K2
CO5	Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems.	K3

Mapping of Cos with Pos and PSOs

COs/ Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	2	1	-	-	2	2	3	1	2	2	2	2	3	3	3
CO2	3	2	-	-	3	3	3	1	2	2	2	2	3	3	3
CO3	3	-	1	-	2	2	2	1	2	2	2	2	3	3	3
CO4	3	2	1	1	2	2	2	1	2	2	2	2	3	3	3
CO5	3	2	1	-	2	2	2	1	2	2	2	1	3	3	3

1–Slight,2–Moderate,3–Substantial,BT-Bloom'sTaxonomy

ACS302-CLOUD COMPUTING LAB							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		2	**ES**	**0**	**0**	**4**	**2**
Preamble	To learn the basics and types of Virtualization To understand the Hypervisors and its types To Explore the Virtualization Solutions To Experiment the virtualization platforms						
LIST OF EXPERIMENTS							
Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.							
2. Find a procedure for the following Shrink and extend virtual disk Create, Manage, Configure and schedule snapshots Create Spanned, Mirrored and Striped volume Create RAID 5 volume							
3.Desktop Virtualization using VNC and Chrome Remote Desktop							
4.Create type 2 virtualization on ESXI 6.5 server							
5.Create a VLAN in CISCO packet tracer							
6.Install KVM in Linux							
7.Create Nested Virtual Machine(VM under another VM)							
8.Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs							
9. Install Google App Engine. Create a hello world app and other simple web applications using python/java.							
10.Find a procedure to transfer the files from one virtual machine to another virtual machine							
Total: 60							
COURSEOUTCOMES: At the end of the course, learners will be able to				Bloom's Taxonomy Level			

CO1	Analyze the virtualization concepts and Hypervisor	K4
CO2	Apply the Virtualization for real-world applications	K3
CO3	Install & Configure the different VM platforms	K2
CO4	Experiment with the VM with various software	K4

CO's-PO's & PSO's MAPPING

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

JEPPIAAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Self-Belief | Self Discipline | Self Respect

Kunnam, Sunguvarchatram, Sriperumbudur-631604

SEM-III

AAI102 - ARTIFICIAL INTELLIGENCE							
Programme&Branch	**B.TECH& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	**PC**	**3**	**1**	**0**	**4**
Preamble	➢ Learn the basic AI approaches ➢ Develop problem solving agents ➢ Perform logical and probabilistic reasoning						
Unit 1	INTELLIGENT AGENTS						**9**
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies							
Unit 2	PROBLEM SOLVING						**9**
Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments							
Unit 3	GAME PLAYING AND CSP						**9**
Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.							
Unit 4	LOGICAL REASONING						**9**
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution							
Unit 5	PROBABILISTIC REASONING						**9**
Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.							
							Total: 60

TEXTBOOKS	
1	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
REFERENCES	
1	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007
2	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4	Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Explain intelligent agent frameworks	K4
CO2	Apply problem solving techniques	K3
CO3	Apply game playing and CSP techniques	K3

CO4	Perform logical reasoning	K3
CO5	Perform probabilistic reasoning under uncertainty	K5

CO's- PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	3	1	3	3	-	-	-	-	2	3	3	1	2	1	1
CO2	2	2	1	1	1	-	-	-	2	2	3	1	3	2	2
CO3	2	1	2	1	-	-	-	-	2	1	1	3	1	2	1
CO4	2	1	2	2	1	-	-	-	2	1	2	2	2	2	1
CO5	3	2	2	1	1	-	-	-	3	2	1	2	2	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

ACS108 - DATABASE MANAGEMENT SYSTEMS							
Programme&Branch	**B.TECH& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	**PC**	**3**	**0**	**0**	**3**
Preamble	➢ This course aims to understand the concepts of database design, database languages, database-system implementation and maintenance. ➢ To represent a database system using ER diagrams and to learn normalization techniques ➢ To understand the fundamental concepts of transaction, concurrency and recovery processing ➢ To understand the internal storage structures using different file and indexing techniques which will help in physical DB design ➢ To have an introductory knowledge about the Distributed databases, NOSQL and database security						
Unit 1	**RELATIONAL DATABASES**						**9**
Introduction: Overview of DBMS fundamentals – Overview of Relational Databases and Keys. Relational Data Model: Structure of relational databases – Database schema – Formal Relational Query Languages – Overview of Relational Algebra and Relational Operations. Database Design: Overview of the design process - The E-R Models – Constraints - Removing Redundant Attributes in Entity Sets - E-R Diagrams - Reduction to Relational Schemas - Entity Relationship Design Issues - Extended E-R Features – Alternative E-R Notations – Overview of Unified Modeling Language (UML).							
Unit 2	**DATABASE DESIGN**						**9**
Relational Database Design: Features of Good Relational Designs - Atomic Domains and 1NF - Decomposition using Functional Dependencies: 2NF, 3NF, BCNF and Higher Normal Forms. Functional Dependency Theory - Algorithm for Decomposition – Decomposition using multi-							

valued dependency: 4NF and 4NF decomposition. Database design process and its issues. SQL: review of SQL – Intermediate SQL – Advanced SQL.		
Unit 3	**TRANSACTIONS**	**9**
Transaction concept – A simple transaction model - Storage structure - Transaction atomicity and durability - Transaction isolation – Serializability – Recoverable schedules, Cascadeless schedules. Concurrency control: Lock-based protocols – Locks, granting of locks, The two-phase locking protocol, implementation of locking, Graph-based protocols. Deadlock handling: Deadlock prevention, Deadlock detection and recovery.		
Unit 4	**DISTRIBUTED DATABASE**	**9**
Distributed Database concepts, Data Fragmentation, Replication, Allocation Techniques for Distributed Database Design, Distributed Database Architectures, Types of distributed database Distributed Catalog Management, Transaction Management, Concurrency Control and Recovery, Query processor and optimization in distributed database, Views - Integrity Procedures, Functions, Cursor and Triggers		
Unit 5	**NOSQL Databases**	**9**
Introduction to NOSQL, CAP Theorem, Document-Based NOSQL System and MongoDB, NOSQL Key-Value Stores, Column-Based, NOSQL Graph Database and Neo4j, Big Data Technologies Based on MapReduce and Hadoop: Introduction, HDFS, MapReduce, HadoopV2 alias YARN. Case Study: Different types of high level databases – MongoDB, Hadoop/Hbase, Redis, IBM Cloudant, DynamoDB, Cassandra and CouchDB etc . Tips for choosing the right database for the given problem..		
		Total: 60
TEXTBOOKS		
1	Silberschatz A, Korth HF, Sudharshan S. Database System Concepts. Sixth Edition, TMH publishing company limited; 2011. (unit 1,2,3)	
2	Elmasri R, Navathe SB. Fundamentals of Database Systems. Seventh Edition, Addison Wesley;2017. (unit 4&5).	
REFERENCES		
1	Garcia-Molina H, Ullman JD, Widom J. Database System ; The complete book. Second Edition, Pearson Education India, 2011. Ramakrishnan R, Gehrke J. Database Management Systems. Third Edition, TMH; 2003.	
2	Ramakrishnan R, Gehrke J. Database Management Systems. Third Edition, TMH; 2003.	

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Formulate and apply relational algebraic expressions, SQL and PL/SQL statements to query relational databases.	K4
CO2	Design and build ER models for real world databases.	K3
CO3	**Design and build a normalized database management system for real world databases.**	K3
CO4	Understand and apply the principles of transaction processing and concurrency control.	K3
CO5	To learn different high level databases and selection of right database.	K5

CO-PO-PSO Mapping

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

AMA105 - PROBABILITY AND STATISTICS							
Programme&Branch	**B.TECH& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	**PC**	**3**	**0**	**0**	**3**
Preamble	➢ Determine the probability value of one-dimensional random variables. ➢ Illustrate the concepts of covariance, correlation and regression. ➢ Discuss the concept of testing of hypothesis for small and large samples. ➢ Demonstrate the difference between the types of design to experiments. ➢ Identify and interpret the control charts for variables and attributes						
Unit 1	**ONE DIMENSIONAL RANDOM VARIABLES**						**9+3**
Random variable – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.							
Unit 2	**TWO DIMENSIONAL RANDOM VARIABLES**						**9+3**
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.							
Unit 3	**TESTING OF HYPOTHESIS**						**9+3**
Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means – Tests based on t, Chi-square and F distributions for mean, variance, and proportion – Contingency table (test for independent) – Goodness of fit.							
Unit 4	**DESIGN OF EXPERIMENTS**						**9+3**
One way and Two-way classifications – Completely randomized design – Randomized block design – Latin square design.							
Unit 5	**STATISTICAL QUALITY CONTROL**						**9+3**
Control charts for measurements ($\bar{X}$and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.							
							Total: 60
TEXTBOOKS							

1	R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015
2	J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
REFERENCES	
1	J.L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2	A. Papoulis, and S. Unni Krishna pillai, Probability, "Random Variables and Stochastic
3	.M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4	M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5	R.E.Walpole, R.H.Myers, S.L. Myers and K.Ye, "Probability and Statistics for Engineers and Scientists".Pearson Education, Asia, 9th Edition, 2012

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the fundamental knowledge of modern probability theory and standard distributions.	K4
CO2	Categorize the probability models and function of random variables based on one and two dimensional random variables.	K3
CO3	Employ the concept of testing the hypothesis in real life problems.	K3
CO4	Implement the analysis of variance for real life problems.	K3
CO5	Apply the statistical quality control in engineering and management problems.	K5

CO's- PO's & PSO's MAPPING

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

1 - low, 2 - medium, 3 - high, '-' - no correlation

AMC108 ENVIRONMENTAL ENGINEERING AND SUSTAINABILITY							
Programme&Branch	**B.TECH& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	**MC**	**3**	**0**	**0**	**0**
Preamble	➢ To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation. ➢ To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters. ➢ To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them. ➢ To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management. ➢ To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.						
Unit 1	**ENVIRONMENT AND BIODIVERSITY**						**6**
Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – 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.							
Unit 2	**ENVIRONMENTAL POLLUTION**						**6**
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts							
Unit 3	**RENEWABLE SOURCES OF ENERGY**						**6**
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.							
Unit 4	**SUSTAINABILITY AND MANAGEMENT**						**6**
Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.							
Unit 5	**SUSTAINABILITY PRACTICES**						**6**
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy							

Cyclescarbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization-Socioeconomical and technological change.	
	Total:30
TEXTBOOKS	
1	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016
3	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall
5	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
REFERENCES	
1	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 . edition 2010.
2	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.	K4
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.	K3
CO3	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.	K3
CO4	To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.	K3
CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.	K5

CO's-PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CO1	3	2	3	1	3	-	-	-	2	2	2	2	3	1	2
CO2	2	2	3	2	1	-	-	-	2	3	3	3	3	3	2
CO3	3	3	1	2	2	-	-	-	3	2	1	2	3	1	3
CO4	3	2	2	2	2	-	-	-	2	2	2	3	3	2	1
CO5	2	2	2	3	2	-	-	-	3	2	1	2	3	3	3

AHS302 COMPREHENSIVE SOFT SKILLS DEVELOPMENT							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	**HS**	**0**	**0**	**2**	**0**
Preamble							
Unit 1	**FOUNDATIONS OF COMMUNICATION SKILLS**						**8**
Introduction to Communication Skills Understanding the Communicative Environment Active Listening Skills Effective Speaking Techniques Initiating and Sustaining Conversations							
Unit 2	**ADVANCED COMMUNICATION TECHNIQUES**						**8**
Presentation Skills – Structuring Content Using Multimedia in Presentations Understanding Communication Styles Group Communication and Dynamics							
Unit 3	**CRITICAL THINKING AND COMMUNICATION**						**8**
Introduction to Critical Thinking Analyzing Arguments and Information Constructing Clear and Persuasive Arguments Problem-Solving and Decision-Making Interactive Exercises and Case Studies							
Unit 4	**EMOTIONAL INTELLIGENCE IN COMMUNICATION**						**8**
Introduction to Emotional Intelligence (EI) . Self-Awareness and Self-Regulation Empathy and Social Skills Managing Stress and Emotions in Communication. Practical Exercises in EI							
Unit 5	**INTEGRATING SOFT SKILLS FOR EFFECTIVE COMMUNICATION**						**8**

Motivation and Persuasion Techniques Negotiation Skills Leadership Communication Applying Soft Skills in the Workplace Final Project and Presentations
Total: 40

REFERENCES	
1	Business Communication: Making Connections in a Digital World by Raymond V. Lesikar, Marie E. Flatley, Kathryn Rentz.
2	Everyone Communicates, Few Connect: What the Most Effective People Do Differently by John C. Maxwell
3	Emotional Intelligence: Why It Can Matter More Than IQ by Daniel Goleman
4	Leaders Eat Last: Why Some Teams Pull Together and Others Don't by Simon Sinek

ACS306 DATABASE MANAGEMENT SYSTEMS LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	PC	0	0	4	2
Preamble	To learn and implement important commands in SQL. To learn the usage of nested and joint queries. To understand functions, procedures and procedural extensions of databases. To understand design and implementation of typical database applications. To be familiar with the use of a front end tool for GUI based application development.						

LIST OF EXPERIMENTS
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 a 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 a database table.
9. Create View and index for database tables with a large number of records.
10. Create an 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
13. Case Study using any of the real life database applications from the following list a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management c) Cop Friendly App – Eseva d) Property Management – eMall e) Star Small and Medium Banking and Finance Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application. Apply Normalization rules in designing the tables in scope. Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features. Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer. ● Ability to showcase ACID Properties with sample queries with appropriate settings
Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Create databases with different types of key constraints.	K4
CO2	Construct simple and complex SQL queries using DML and DCL commands.	K3
CO3	Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.	K3
CO4	Create an XML database and validate with meta-data (XML schema).	K3
CO5	Create and manipulate data using NOSQL database.	K5

CO's-PO's & PSO's MAPPING

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

AAI301-ARTIFICIAL INTELLIGENCE LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		3	PC	0	0	4	2

Preamble	• To design and implement search strategies • To implement game playing techniques • To implement CSP techniques • To develop systems with logical reasoning • To develop systems with probabilistic reasoning
LIST OF EXPERIMENTS	
1. Implement basic search strategies – 8-Puzzle, 8 – Queens problem, Cryptarithmetic.	
2. Implement A* and memory bounded A* algorithms	
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)	
4. Solve constraint satisfaction problems	
5. Implement propositional model checking algorithms	
6. Implement forward chaining, backward chaining, and resolution strategies	
7. Build naïve Bayes models	
8. Implement Bayesian networks and perform inferences	
9. Mini-Project	
	Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Design and implement search strategies	K4
CO2	Implement game playing and CSP techniques	K3
CO3	Develop logical reasoning systems	K3
CO4	Develop probabilistic reasoning systems	K3

CO's-PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

JEPPIAAR INSTITUTE OF TECHNOLOGY

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SEM- IV

AAI106- DATA MINING AND DATA WAREHOUSING							
Programme & Branch	**B.Tech&AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Preamble	To understand Data Warehouse concepts, Architecture, Business Analysis and Tools. To understand Data Preprocessing and Data Visualization techniques. To study algorithms for finding Hidden and Interesting patterns in Data. To understand and apply various Classification and Clustering techniques.						
Unit 1	DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING						9
Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support - Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations - OLAP and OLTP.							
Unit 2	INTRODUCTION TO DATA MINING						9
Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – Applications- Data Objects and Attribute Types - Statistical Description of Data - Data Preprocessing – Cleaning - Integration - Reduction - Transformation and Discretization - Data Visualization – Data Similarity and Dissimilarity Measures.							
Unit 3	FREQUENT PATTERN ANALYSIS						9
Mining Frequent Patterns - Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel - Multi Dimensional Space – Constraint Based Frequent Pattern Mining - Classification Using Frequent Patterns.							
Unit 4	CLASSIFICATION AND CLUSTERING						9
Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection - Techniques to improve Classification Accuracy - Clustering Techniques – Cluster Analysis - Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering – Clustering High Dimensional Data - Clustering with Constraints - Outlier Analysis - Outlier Detection Methods.							
Unit 5	DATA ANALYSIS TOOL						9
Datasets – Introduction, Iris plants database, Breast cancer database, Auto Imports Database - Introduction to WEKA - Explorer – Getting started, Exploring the Explorer - Learning algorithms -							

Clustering algorithms - Association–Rule Learners.	
Total: 45 PERIODS	
TEXTBOOKS	
1	Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
2	Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, 35th Reprint 2016.
REFERENCES	
1	K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
2	Ian H.Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier, Second Edition, 2005.
3	Parteek Bhatia, “Data Mining and Data Warehousing: Principles and Practical Techniques”, Cambridge University Press, 2019.
4	Pranjali Deshpande, Soudamini Patil, “Data Warehousing and Data Mining”, First Edition, Technical Publications, 2020.
5	Dr. B. Shadaksharappa,Mr. P.Ramkumar,Dr. T.N. Prabakar, “ Data Warehousing and Data Mining”, First Edition, Book Rivers, 2022.

COURSE OUTCOMES: At the end of the course, learners will be able to		Bloom’s Taxonomy Level
CO1	Use a Data Warehouse system and perform Business Analysis with OLAP Tools.	K4
CO2	Recognize and identify suitable Pre-processing and Visualization techniques for Data Analysis.	K3
CO3	Apply frequent Pattern and Association Rule Mining techniques for Data Analysis.	K3
CO4	Apply appropriate Classification techniques for Data Analysis.	K3
CO5	Apply appropriate Clustering techniques for Data Analysis.	K5
CO6	Use WEKA tools for feature selection, classification and clustering for real time data.	K3

CO's- PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

ACS107 OPERATING SYSTEM							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**MC**	**3**	**0**	**0**	**3**
Preamble	To understand the basics and functions of operating systems. To understand processes and threads. To analyze scheduling algorithms and process synchronization. To understand the concept of deadlocks. To analyze various memory management schemes. To be familiar with I/O management and file systems. To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.						
Unit 1	INTRODUCTION						7
Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.							
Unit 2	PROCESS MANAGEMENT						11
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads -Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.							
Unit 3	MEMORY MANAGEMENT						10
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table -							

Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write – Page Replacement - Allocation of Frames –Thrashing.		
Unit 4	STORAGE MANAGEMENT	10
Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - File system mounting - File Sharing and Protection; File System Implementation - File System Structure – Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.		
Unit 5	VIRTUAL MACHINES AND MOBILE OS	7
Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economic and technological change.		
Total: 45 PERIODS		
TEXTBOOKS		
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts” Ⅱ, 10th Edition, John Wiley and Sons Inc., 2018.	
2	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.	
REFERENCES		
1	Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.	
2	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.	
3	Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.	
COURSE OUTCOMES: At the end of the course, learners will be able to		Bloom’s Taxonomy Level
CO1	Analyze various scheduling algorithms and process synchronization.	K4
CO2	Explain deadlock prevention and avoidance algorithms.	K2
CO3	Compare and contrast various memory management schemes.	K2

CO4	Explain the functionality of file systems, I/O systems, and Virtualization	K2
CO5	Compare iOS and Android Operating Systems.	K2

CO's-PO's & PSO's Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
AVG	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	1.8	-	-	-

ACS109 COMPUTER NETWORKS							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**MC**	**3**	**0**	**0**	**3**
Preamble	To understand the protocol layering and physical level communication. To analyze the performance of a network. To understand the various components required to build different networks. To learn the functions of network layer and the various routing protocols. To familiarize the functions and protocols of the Transport layer.						
Unit 1	INTRODUCTION AND PHYSICAL LAYER					9	
Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.							
Unit 2	DATA-LINK LAYER & MEDIA ACCESS					9	
Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC– PPP -							

Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction –IEEE 802.11, Bluetooth – Connecting Devices.		
Unit 3	NETWORK LAYER	9
Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.		
Unit 4	TRANSPORT LAYER	9
Introduction – Transport Layer Protocols – Services – Port Numbers – User DatagramProtocol – Transmission Control Protocol – SCTP.		
Unit 5	APPLICATION LAYER	9
WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.		
Total: 45 PERIODS		
TEXTBOOKS		
1	Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.	
REFERENCES		
1	Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.	
2	William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.	
3	Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.	
4	Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.	
5	James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach.	
6	Featuring the Internet, Sixth Edition, Pearson Education, 2013.	

COURSE OUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Understand the basic layers and its functions in computer networks.	K2
CO2	Evaluate the performance of a network.	K3

CO3	Understand the basics of how data flows from one node to another.	K2
CO4	Analyze and design routing algorithms.	K4
CO5	Design protocols for various functions in the network.	K3
CO6	Understand the working of various application layer protocols.	K2

CO's-PO's & PSO's MAPPING

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

AHS303 SOFT SKILLS-II							
NATURE OF THE COURSE: SKILL ENHANCEMENT COURSE (SEC)							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**MC**	**3**	**0**	**0**	**3**
Preamble	To acquaint the students with some very relevant and necessary soft skills and also to help them to develop their personality as well as to be self motivated. The different units are designed in such a manner so as to give the students inputs on personality development, social skills, etiquette, communication skills, attitude, appearing and grooming.						
Unit 1	FOUNDATIONS OF PERSONAL DEVELOPMENT			8			
Attitude and Motivation-Significance –Positive and Negative Attitude Attitude-Advantages and Disadvantages of Attitude- Relationship between Attitude and Motivation- Concept, Significance and Importance of Self Motivation- De-motivation-Factors Affecting Motivation in Learning-Self and Identity-Distinction between Self- Respect and Ego-Transforming Ego to Self-Respect-Indian Perspective in Personality Development.							
Unit 2	PERSONALITY DEVELOPMENT			8			

Concept of Personality and Personality Development Definition-Determinants of Personality Development- Deterrents to Personality Development-Types of Personality-Introvert, Extrovert, and Ambivert- Dimensions of Personality-Physical, Intellectual, Emotional, Moral, Social, and Spiritual-Perception- Concept and Definition- Perceptual Process-Self.		
Unit 3	MORAL OF ESTEEM AND LEADERSHIP	8
Esteem-Maslow and Eric Erikson's Idea of Self-Esteem- Mind Mapping, Competency Mapping, and 360Degree Assessment-Cultivating Assertiveness-Leadership: Concept, Dimensions, and Types of Leadership.		
Unit 4	ETIQUETTE AND GROOMING	8
Etiquette-Importance in Personal and Professional Life- Principles and their Significance-Culture and Gender Sensitivity in Communication-Conversation Skills and Small Talk-Email and Telephone Etiquette-Online Etiquette: Managing Digital Presence and Reputation- Dress Code and Professional Appearance.		
Unit 5	EXPERIENTIAL PARADIGM IN PRACTICE	8
Self Awareness Definition and Development- SWOT Analysis-Interpersonal and Communication Skills-Self-Management Skills Definition and Examples-Goal Setting-Definition, Process and Examples-Positive Emotions and Well-being Resilience, Optimism, Compassion, Forgiveness, Gratitude.		
Total: 40 PERIODS		
RECOMMENDED BOOKS		

1	Atherton, J.B. (2002) Learning and teaching: Teaching from experience, Columbus. Ohio: Merrill. Carr, A. (2011). Positive Psychology: The Science of happiness and human strength. Routledge.
2	Cornelissen, R. M. M., Misra, G., & Varma, S., (2011). Foundation of Indian Psychology: Concepts and Theories. (Vol. 1), New Delhi: Pearson.
3	Covey, S. R. (2013). The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change. Simon & Schuster.
4	Exeter, D. J. (2001). Learning in the outdoors. London: Outward Bound.
5	Salmon, D & Maslow, J., (2007). Yoga Psychology and the Transformation of Consciousness: Seeing through the eyes of infinity. St. Paul, MN., USA: Paragon House
6	Vohra, S. S. & Kailash. S. (2010). Experiential learning (section III) in Psychology of Turbulent Relationships. New Delhi: Icon Publishers.
7	Wentz, Frederick H. (2012). Soft Skills Training: A Workbook to Develop Skills for Employment. Create Space Independent Publishing Platform.

COURSE OUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	On the completion of this course, the students will be able to appreciate the significance of soft skills and personality augmentation with reference to their personal as well as their professional lives. This course module will enhance the employability quotient of the students as well. In a nutshell, the module is on the lines of the 'finishing schools'.	K4

ACS305 OPERATING SYSTEMS LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**ES**	**0**	**0**	**4**	**2**
Preamble	To install windows operating systems. To understand the basics of Unix command and shell programming. To implement various CPU scheduling algorithms. To implement Deadlock Avoidance and Deadlock Detection Algorithms To implement Page Replacement Algorithms To implement various memory allocation methods. To be familiar with File Organization and File Allocation Strategies.						
LIST OF EXPERIMENTS							
1. Installation of windows operating system							
2. Install any guest operating system like Linux using VMware.							
3. Illustrate UNIX commands and Shell Programming							
4. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close							
5. Write C programs to implement the various CPU Scheduling Algorithms							
6.Illustrate the inter process communication strategy							
7. Implement mutual exclusion by Semaphore							
8. Write C programs to avoid Deadlock using Banker's Algorithm and to Implement Deadlock							

Detection Algorithm	
9. Write C programs to implement the following Memory Allocation Methods First Fit b. Worst Fit c. Best Fit	
10. Write C programs to implement the various Page Replacement Algorithms	
11. Implement the following File Allocation Strategies using C programs Sequential b. Indexed c. Linked	
12. Write C programs for the implementation of various disk scheduling algorithms	
Total: 60 PERIODS	

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Define and implement UNIX Commands.	K3
CO2	Compare the performance of various CPU Scheduling Algorithms.	K2
CO3	Compare and contrast various Memory Allocation Methods.	K4
CO4	Define File Organization and File Allocation Strategies.	K3
CO5	Implement various Disk Scheduling Algorithms.	K2

CO's-PO's & PSO's Mapping

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

ACS307 COMPUTER NETWORKS LABORATORY							
Programme & Branch	**B.Tech & AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	C
		4	**ES**	**0**	**0**	**4**	2
Preamble	To understand the concept of layering in networks. To know the functions of protocols of each layer of TCP/IP protocol suite. To visualize the end-to-end flow of information. To learn the functions of network layer and the various routing protocols. To familiarize the functions and protocols of the Transport layer.						
LIST OF EXPERIMENTS							
1.Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.							
2. Write a HTTP web client program to download a web page using TCP sockets.							
3.Applications using TCP sockets like: a) Echo client and echo server b) Chat							
4. Simulation of DNS using UDP sockets.							
5. Use a tool like Wireshark to capture packets and examine the packets.							
6. Write a code simulating ARP /RARP protocols.							
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.							
8 Study of TCP/UDP performance using Simulation tool.							
9. Simulation of Distance Vector/ Link State Routing algorithm.							
10. Simulation of an error correction code (like CRC).							
Total: 60 PERIODS							

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Device various protocols using TCP and UDP.	K3
CO2	Compare the performance of different transport layer protocols.	K2
CO3	Use simulation tools to analyze the performance of	K4

	variousnetwork protocols.	
CO4	Analyze various routing algorithms.	K3
CO5	Implement error correction codes.	K2

CO's-PO's & PSO's Mapping

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

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SEM - V

AAI104-MULTI -MODAL DATA PROCESSING AND LEARNING							
Programme &Branch	**B.Tech&AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to • To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis. • To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance. • To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance. • To build the graph based learning models for standard data sets. • To compare the performance of different ML algorithms and select the suitable one based on the application.						
Unit 1	**INTRODUCTION TO MULTIMODAL DATA AND APPLICATIONS**						**9**
Introduction – Definition and scope, Historical Background, Significance, Multimodal data, Applications, Challenges of multimodal data, Data collection & cleaning.							
Unit 2	**TEXT PROCESSING**						**9**
Text Processing: Text normalization, Lemmatization, Morphology, Subword tokenization; Text processing and statistics: TFIDF, BM-25, Zipf's law, Hipf's law; Language models and smoothing techniques; Vector space models.							
Unit 3	**SPEECH PROCESSING**						**9**
Speech Processing: Speech production and perception, Acoustic and articulatory phonetics; Short-term analysis: Need and windowing, Energy, Zero-crossing rate, Autocorrelation function, Fourier transform, Spectrogram; Short-term synthesis: Overlap-add method; Cepstrum analysis: Basis and development, mel-cepstrum.							
Unit 4	**DIGITAL IMAGE AND VIDEO PROCESSING**						**9**
Digital Image and Video Processing: Point processing, Neighborhood processing, Enhancement, Edge detection, Segmentation, Feature descriptors, Restoration, Morphological operations, Image transforms, Spatial and temporal data handling.							
Unit 5	**OTHER MODALITIES AND MULTIMODAL LEARNING**						**9**
Other Modalities: Biomedical signals, and Conventional multi-modal learning, Applications of Multimodal Learning.							
							Total: 45
TEXTBOOKS							

1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson, Prentice-Hall, 2008.
2	R. Klette, Concise Computer Vision: An Introduction into Theory and Algorithms, Springer, 2014.
3	L. R. Rabiner, R. W. Schafer, Introduction to Digital Speech Processing, Now Publishers Inc, 2007.
REFERENCES	
1	D. Jurafsky, J.H. Martin, Speech and Language Processing, 3rd ed. Jan 2022

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Demonstrate the matrix techniques in solving the related problems in engineering and technology.	K4
CO2	Apply matrix methods to solve system of linear equations	K3
CO3	Apply differential calculus tools in solving various application problems	K3
CO4	Apply different methods of integration in solving practical problems.	K3
CO5	Evaluate multiple integrals to conduct investigations of complex problems	K5

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 1	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	1	3	1	1	-	-	-	1	3	3	3	2	1	3
CO 2	3	1	1	2	2	-	-	-	3	2	1	1	3	1	2
CO 3	3	3	2	1	2	-	-	-	3	3	1	2	2	2	2
CO 4	1	2	2	3	2	-	-	-	3	1	3	1	1	2	1
CO 5	2	2	1	2	3	-	-	-	1	2	2	3	1	3	3

AAI105- MACHINE LEARNING							
Programme &Branch	**B.Tech&AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to • To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis. • To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance. • To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance. • To build the graph based learning models for standard data sets. • To compare the performance of different ML algorithms and select the suitable one based on the application.						
Unit 1	INTRODUCTION TO MACHINE LEARNING						**9**
Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off..							
Unit 2	SUPERVISED LEARNING						**9**
Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.							
Unit 3	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING						**9**
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.							
Unit 4	NEURAL NETWORKS						**9**
Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.							
Unit 5	DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS						**9**
Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and							

comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test	
Total: 45	
TEXTBOOKS	
1	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020..
2	Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014..
REFERENCES	
1	D Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Explain the basic concepts of machine learning.	K4
CO2	Construct supervised learning models	K3
CO3	Construct unsupervised learning algorithms	K3
CO4	Evaluate and compare different model	K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO1	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	1	1	-	-	-	1	3	3	3	2	1	3
CO2	3	1	1	2	2	-	-	-	3	2	1	1	3	1	2
CO3	3	3	2	1	2	-	-	-	3	3	1	2	2	2	2
CO4	1	2	2	3	2	-	-	-	3	1	3	1	1	2	1
CO5	2	2	1	2	3	-	-	-	1	2	2	3	1	3	3

AAI303-MACHINE LEARNING LABORATORY							
Programme&Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	PC	0	0	4	2
Preamble	• To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis. • To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance. • To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance. • To build the graph based learning models for standard data sets. • To compare the performance of different ML algorithms and select the suitable one based on the application.						
LIST OF EXPERIMENTS							
1.For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.							
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.							
3. . Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.							
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file and compute the accuracy with a few test data sets.							
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.							
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.							
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.							
8.Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.							
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.							
Total: 60							

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Apply suitable algorithms for selecting the appropriate features for analysis.	K4
CO2	Implement supervised machine learning algorithms on standard datasets and evaluate the performance.	K3
CO3	Apply unsupervised machine learning algorithms on	K3

	standard datasets and evaluate the performance.	
CO4	Build the graph based learning models for standard data sets.	K3
CO5	Assess and compare the performance of different ML algorithms and select the suitable one based on the application.	K5

CO's-PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

AAI302-**MULTI -MODAL DATA PROCESSING AND LEARNING LABORATORY**

Programme&Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	PC	0	0	4	2

Preamble	• To understand the Data Collection and Data Preprocessing Techniques from Various Modalities • To learn to Noise Reduction and Filtering and handling missing data • To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance. • To build the graph Dimensionality Reduction Techniques, Real-time Multimodal Data Processing • To compare the performance multimodal data tools

LIST OF EXPERIMENTS

1. Write a program to demonstrate Data Collection and Preprocessing from Various Modalities.
2. Write a program to perform
   a.Noise Reduction and Filtering
   b.Data Annotation and Labeling
   c.Handling Missing Data
   d.Integration of Multimodal Data
3. Write a program to perform Dimensionality Reduction Techniques
4. Write a program to perform Real-time Multimodal Data Processing.
5. Write a program Privacy and Ethical Considerations
6. Write a program Validation and Quality Control,Case Study Analysis.

7. Write a program to demonstrate tool Exploration for Multimodal Data.
8. Write a program to demonstrate Feature Extraction from Multimodal Data
9. Write a program to demonstrate Multimodal Data Fusion Techniques.
10. Write a program to Multimodal Machine Learning
Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Apply suitable algorithms for selecting the appropriate features for analysis.	K4
CO2	Implement supervised machine learning algorithms on standard datasets and evaluate the performance.	K3
CO3	Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.	K3
CO4	Build the graph based learning models for standard data sets.	K3
CO5	Assess and compare the performance of different ML algorithms and select the suitable one based on the application.	K5

CO's-PO's & PSO's MAPPING

CO / PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

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SEM - VI

AAI106-DEEP LEARNING							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to • To understand and need and principles of deep neural networks • To understand CNN and RNN architectures of deep neural networks • To comprehend advanced deep learning models • To learn the evaluation metrics for deep learning models						
Unit 1	**DEEP NETWORKS BASICS**						**9**
Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting --Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization							
Unit 2	**CONVOLUTIONAL NEURAL NETWORKS**						**9**
Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers --Gradient Computation.							
Unit 3	**RECURRENT NEURAL NETWORKS**						**9**
Unfolding Graphs -- RNN Design Patterns: Acceptor -- Encoder --Transducer; Gradient Computation -- Sequence Modeling Conditioned on Contexts -- Bidirectional RNN -- Sequence to Sequence RNN – Deep Recurrent Networks -- Recursive Neural Networks -- Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.							
Unit 4	**MODEL EVALUATION**						**9**
Performance metrics -- Baseline Models -- Hyperparameters: Manual Hyperparameter -- Automatic Hyperparameter -- Grid search -- Random search -- Debugging strategies.							
Unit 5	**AUTOENCODERS AND GENERATIVE MODELS**						**9**
Autoencoders: Undercompleteautoencoders -- Regularized autoencoders -- Stochastic encoders and decoders -- Learning with autoencoders; Deep Generative Models: Variationalautoencoders – Generative adversarial networks.							
							Total: 45
TEXTBOOKS							
1	Ian Goodfellow, YoshuaBengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016.						
2	Andrew Glassner, “Deep Learning: A Visual Approach”, No Starch Press, 2021.						

REFERENCES	
1	Salman Khan, HosseinRahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2	Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3	Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018
4	1. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018. 5. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Explain the basics in deep neural networks	K4
CO2	Apply Convolution Neural Network for image processing	K3
CO3	Apply Recurrent Neural Network and its variants for text analysis	K3
CO4	Apply model evaluation for various applications	K3
CO5	Applyautoencoders and generative models for suitable applications	K5

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	1	1	1	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	1	1	1	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

AAI304-DEEP LEARNING LABORATORY							
Programme&Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	PC	0	0	4	2
Preamble	• To understand the tools and techniques to implement deep neural networks • To apply different deep learning architectures for solving problems • To implement generative models for suitable applications • To learn to build and validate different models						
LIST OF EXPERIMENTS							
1. Solving XOR problem using DNN							
2. Character recognition using CNN							
3. Face recognition using CNN							
4.Language modeling using RNN							
5.Sentiment analysis using LSTM							
6. Parts of speech tagging using Sequence to Sequence architecture.							
7.Machine Translation using Encoder-Decoder model							
8.Image augmentation using GANs 9. Mini-project on real world applications							
							Total: 60

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Apply deep neural network for simple problems	K4
CO2	Apply Convolution Neural Network for image processing	K3
CO3	Apply Recurrent Neural Network and its variants for text analysis	K3
CO4	Apply generative models for data augmentation	K3
CO5	Develop real-world solutions using suitable deep neural networks	K5

CO's- PO's & PSO's MAPPING

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	1	2	2	2	3	1	2
CO2	3	3	3	2	3	-	-	-	2	1	2	1	2	3	2
CO3	3	3	3	2	2	-	-	-	3	2	3	2	3	1	1
CO4	3	3	3	2	3	-	-	-	1	2	2	2	1	2	1
CO5	2	2	3	3	2	-	-	-	3	2	1	2	3	3	1

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SEM - VII

AAI107-CYBER SECURITY							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to • To learn cybercrime and cyberlaw. • To understand the cyber attacks and tools for mitigating them. • To understand information gathering. • To learn how to detect a cyber attack. ➢ • To learn how to prevent a cyber attack						
Unit 1	**INTRODUCTION**						**9**
Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.							
Unit 2	**ATTACKS AND COUNTERMEASURES**						**9**
OSWAP;Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.							
Unit 3	**RECONNAISSANCE**						**9**
Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.							
Unit 4	**INTRUSION DETECTION**						**9**
Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.							
Unit 5	**INTRUSION PREVENTION**						**9**
Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.							
							Total: 45
TEXTBOOKS							
1	Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021 (Unit 1)						
2	Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011 (Unit 1)						

REFERENCES	
1	David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2	Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011 (Unit 3)
3	Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers, 2007 (Unit 3)
4	William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015 (Units 4 and 5)
5	Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014 (Lab)

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Explain the basics of cyber security, cyber crime and cyber law	K4
CO2	Classify various types of attacks and learn the tools to launch the attacks	K3
CO3	Apply various tools to perform information gathering	K3
CO4	Apply intrusion techniques to detect intrusion	K3
CO5	Apply intrusion prevention techniques to prevent intrusion	K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO1	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	1		1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-		1	1	-
CO3	3	2	3	-	-	-	-	-	-	-	-		1	1	-
CO4	3	2	3	-	-	-	-	-	-	-	1		-	1	-
CO5	3	2	3	-	-	-	-	-	-	-	-		1	-	-

AAI305-CYBER SECURITY LAB							
Programme&Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	PC	0	0	4	2
Preamble	• Get the skill to identify cyber threats/attacks. • Get the knowledge to solve security issues in day to day life. • Able to use Autopsy tools • Perform Memory capture and analysis • Demonstrate Network analysis using Network miner tools						
LIST OF EXPERIMENTS							
1. Perform an Experiment for port scanning with nmap							
2. Set Up a honeypot and monitor the honeypot on the network.							
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures							
4. Generate minimum 10 passwords of length 12 characters using open SSL command							
5. Perform practical approach to implement Footprinting-Gathering target information using Dmitry-Dmagic, UAtester							
6. Working with sniffers for monitoring network communication (Wireshark).							
7.Using Snort, perform real time traffic analysis and packet logging							
8. Perform email analysis using the Autopsy tool.							
9. Perform Registry analysis and get boot time logging using process monitor tool							
10. Perform File type detection using Autopsy tool							
11. Perform Memory capture and analysis using FTK imager too							
12. Perform Network analysis using the Network Miner tool							
Total: 60							

COURSEOUTCOMES: At the end of the course, learners will be able to		Bloom's Taxonomy Level
CO1	Get the skill to identify cyber threats/attacks..	K4
CO2	Get the knowledge to solve security issues in day to day life.	K3
CO3	Able to use Autopsy tools .	K3
CO4	Perform Memory capture and analysis	K3
CO5	Demonstrate Network analysis using Network miner tools	K5

PROFESSIONAL ELECTIVE-I
AAI701-DATA VISUALIZATION

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		4	BS	3	0	0	3

Preamble	The objective of the course is to ➢ To outline an overview of exploratory data analysis. ➢ To implement data visualization using Matplotlib. ➢ To perform univariate data exploration and analysis. ➢ To apply bivariate data exploration and analysis. ➢ To use Data exploration and visualization techniques for multivariate and time series data.

Unit 1	**EXPLORATORY DATA ANALYSIS**	**9**
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.		
Unit 2	**VISUALIZING USING MATPLOTLIB**	**9**
Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn		
Unit 3	**UNIVARIATE ANALYSIS**	**9**
Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.		
Unit 4	**BIVARIATE ANALYSIS**	**9**
Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.		
Unit 5	**MULTIVARIATE AND TIME SERIES ANALYSIS**	**9**
Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling		
		Total: 45

TEXTBOOKS

1	Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)

2	Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit 2)
3	Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)
REFERENCES	
1	Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2	Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.
3	Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Understand the fundamentals of exploratory data analysis.	K4
CO2	Implement the data visualization using Matplotlib.	K3
CO3	Perform univariate data exploration and analysis.	K3
CO4	Apply bivariate data exploration and analysis.	K3
CO5	Use Data exploration and visualization techniques for multivariate and time series data.	K5

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

AAI702-DATA ANALYTICS FOR FINANCE							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**BS**	**3**	**0**	**0**	**3**

Preamble	The objective of the course is to • To understand the Analytics Life Cycle. • To comprehend the process of acquiring Business Intelligence • To understand various types of analytics for Business Forecasting • To model the supply chain management for Analytics. • To apply analytics for different functions of a business

Unit 1	**INTRODUCTION TO BUSINESS ANALYTICS**	**9**
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration		
Unit 2	**BUSINESS INTELLIGENCE**	**9**
Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions		
Unit 3	**BUSINESS FORECASTING**	**9**
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.		
Unit 4	**HR & SUPPLY CHAIN ANALYTICS**	**9**
Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.		
Unit 5	**MARKETING & SALES ANALYTICS**	**9**
Marketing Strategy- Marketing Mix-Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.		
		Total: 45

TEXTBOOKS

1	R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2	R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3	Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4	VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.

5	Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education,2018.
REFERENCES	
1	VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
2	Mahadevan B, “Operations Management -Theory and Practice”,3rd Edition, Pearson Education,2018.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Explain the real world business problems and model with analytical solutions	K4
CO2	Identify the business processes for extracting Business Intelligence	K3
CO3	Apply predictive analytics for business fore-casting	K3
CO4	Apply analytics for supply chain and logistics management	K3
CO5	Use analytics for marketing and sales.	K5

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	3	1	1	-	-	-	1	2	1	1	3	2	1
2	3	3	3	2	3	-	-	-	1	2	2	2	3	1	2
3	2	2	3	3	2	-	-	-	3	1	1	3	3	1	2
4	2	1	1	2	2	-	-	-	3	3	2	1	1	3	1
5	2	3	2	3	2	-	-	-	3	3	1	3	3	1	1
AVG	2.2	2.2	2.4	2.2	2	-	-	-	2.2	2.2	1.4	2	2.6	1.6	1.4

AAI703-INTERNET OF THINGS							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ To understand Smart Objects, IoT Architectures and IoT protocols ➢ To build simple IoT Systems using Arduino and Raspberry Pi ➢ To understand Data Analytics and Cloud in the context of IoT ➢ To develop IoT infrastructure for popular applications						
Unit 1	**FUNDAMENTALS OF INTERNET OF THINGS**						**9**
Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M - IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack - Fog, Edge and Cloud in IoT – Functional Blocks of an IoT Ecosystem – Sensors - Actuators - Smart Objects and Connecting Smart Objects.							
Unit 2	**IOT PROTOCOLS**						**9**
IoT Access Technologies - Physical and MAC Layers - Topology and Security of IEEE 802.15.4,802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer - IP Versions - Constrained Nodes and Constrained Networks – Optimizing IP for IoT - From 6LoWPAN to 6Lo - Routing Over Low Power and Lossy Networks – Application Transport Methods - Supervisory Control and Data Acquisition – Application Layer Protocols - CoAP and MQTT.							
Unit 3	**DESIGN AND DEVELOPMENT**						**9**
Design Methodology - Embedded Computing Logic - Microcontroller – System on Chips - IoT System Building Blocks - Arduino - Board Details – IDE Programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming							
Unit 4	**IOT PHYSICAL SERVERS CLOUD**						**9**
Physical servers and cloud - XaaS, M2M , WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django – Designing a RESTful Web API –Google cloud for IoT.							
Unit 5	**APPLICATIONS**						**9**
Retail, Health care, Transportation, Agriculture and environmental, Smart city, Government and military, Smart home.							
							Total: 45
TEXTBOOKS							
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton andJerome Henry,						

	"IoT Fundamentals: Networking Technologies, Protocolsand Use Cases for Internet of Things", Cisco Press, 2017.
2	Rajkamal,"Internet of Things: Architecture, Design Principles AndApplications",McGraw Hill HigherEducation,2017
3	Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key Applications and Protocols‖, Wiley, 2012.
REFERENCES	
1	Vijay Madisetti and ArshdeepBahga, ―Internet of Things (A Hands-on-Approach)‖,1st Edition,VPT, 2014.
2	Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything‖, 1st Edition, Apress Publications, 2013.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Interpret the concept of IoT ,its Components and its architecture	K4
CO2	Learn the design methods of various protocol	K3
CO3	Build the design methodology for a IoT system using Raspberry	K3
CO4	Apply the Data analytics and Support servicing tool related to IoT	K3
CO5	Experiment the case study and application of IoT in real time scenario	K5
CO6	Design and develop the various applications in IoT	K5

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

AAI704-NETWORK SECURITY							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ To learn the fundamentals of cryptography. ➢ To learn the key management techniques and authentication approaches. ➢ To explore the network and transport layer security techniques. ➢ To understand the application layer security standards. ➢ To learn the real time security practices.						
Unit 1	**INTRODUCTION**						**9**
Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures							
Unit 2	**KEY MANAGEMENT AND AUTHENTICATION**						**9**
Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption							
Unit 3	**ACCESS CONTROL AND SECURITY**						**9**
Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.							
Unit 4	**APPLICATION LAYER SECURITY**						**9**
Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security .							
Unit 5	**SECURITY PRACTICES**						**9**
Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security							
							Total: 45
TEXTBOOKS							
1	Cryptography and Network Security: Principles and Practice, 6th Edition, William						

	Stallings, 2014, Pearson, ISBN 13:9780133354690.
REFERENCES	
1	Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2	Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Classify the encryption techniques	K4
CO2	Illustrate the key management technique and authentication	K3
CO3	Evaluate the security techniques applied to network and transport layer	K3
CO4	Discuss the application layer security standards.	K3
CO5	Apply security practices for real time applications	K5

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	2	1	2	3	1
2	1	1	3	2	2	-	-	-	2	2	1	1	3	1	2
3	1	2	1	1	2	-	-	-	3	3	1	3	2	1	3
4	2	2	3	2	3	-	-	-	3	3	2	1	2	1	3
5	2	1	3	2	2	-	-	-	2	1	1	3	2	1	1
AVG	1.8	1.8	2.4	1.8	2.2	-	-	-	2.4	2	1.4	1.8	2.2	1.4	2

AAI705-BRAIN COMPUTER INTERFACE							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		4	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to ➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give						

	procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems. ➢ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications	
Unit 1	**INTRODUCTION TO BCI**	**9**
Introduction - Brain structure and function, Brain Computer Interface Types - Synchronous and Asynchronous -Invasive BCI -Partially Invasive BCI - Non Invasive BCI, Structure of BCI System, BCI Monitoring Hardware, EEG, ECoG, MEG, fMRI		
Unit 2	**BRAIN ACTIVATION**	**9**
Brain activation patterns - Spikes, Oscillatory potential and ERD, slow cortical potentials, Movement related potentials-Mu rhythms, motor imagery, Stimulus related potentials - Visual Evoked Potentials – P300 and Auditory Evoked Potentials, Potentials related to cognitive tasks.		
Unit 3	**FEATURE EXTRACTION METHODS**	**9**
Data Processing – Spike sorting, Frequency domain analysis, Wavelet analysis, Time domain analysis, Spatial filtering -Principal Component Analysis (PCA), Independent Component Analysis (ICA), Artifacts reduction, Feature Extraction - Phase synchronization and coherence.		
Unit 4	**MACHINE LEARNING METHODS FOR BCI**	**9**
Classification techniques –Binary classification, Ensemble classification, Multiclass Classification, Evaluation of classification performance, Regression - Linear, Polynomial, RBF's, Perceptron's, Multilayer neural networks, Support vector machine, Graph theoretical functional connectivity analysis.		
Unit 5	**APPLICATIONS OF BCI**	**9**
Case Studies - Invasive BCIs: decoding and tracking arm (hand) position, controlling prosthetic devices such as orthotic hands, Cursor and robotic control using multi electrode array implant, Cortical control of muscles via functional electrical stimulation. Noninvasive BCIs: P300 Mind Speller, Visual cognitive BCI, Emotion detection, Ethics of Brain Computer Interfacing		
		Total: 45
TEXTBOOKS		
1	Rajesh.P.N.Rao, "Brain-Computer Interfacing: An Introduction", Cambridge University Press, First edition, 2013.	
2	Jonathan Wolpaw, Elizabeth Winter Wolpaw, ―Brain Computer Interfaces: Principles and practice‖, Oxford University Press, USA, Edition 1, January 2012.	
3	Grewal. B.S., and Grewal. J.S., Numerical methods in Engineering and Science, Khanna Publishers, 9th Edition, New Delhi, 2001.	
REFERENCES		

1	Ella Hassianien, A &Azar.A.T (Editors), “Brain-Computer Interfaces Current Trends and Applications”, Springer, 2015.
2	Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010
3	Ali Bashashati, Mehrdad Fatourechi, Rabab K Ward, Gary E Birch,” A survey of signal Processing algorithms in brain–computer interfaces based on electrical brain signals” Journal of Neural Engineering, Vol.4, 2007, PP.32-57.
4	Arnon Kohen, “Biomedical Signal Processing”, Vol I and II, CRC Press Inc, Boca Rato, Florida.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Understand Comprehend and appreciate the significance and role of this course in the present contemporary world	K4
CO2	Analyse Differentiate various concept of BCI.	K3
CO3	Apply Allocate functions appropriately to the human and to the machine	K3
CO4	Analyse Select appropriate for feature extraction methods	K3
CO5	Apply Design a system using machine learning algorithms for translation.	K5

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 1	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	-	-	-	-	-	-	1		1	1	-
CO 2	3	2	1	-	-	-	-	-	-	-	-		1	1	-
CO 3	3	2	3	-	-	-	-	-	-	-	-		1	1	-
CO	3	2	3	-	-	-	-	-	-	-	1		-	1	-

4															
CO 5	3	2	3	-	-	-	-	-	-	-	-		1	-	-

PROFESSIONAL ELECTIVE II **AAI706-DATA AUGMENTATION AND VIRTUAL REALITY**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**0**	**3**

Preamble	The objective of the course is to ➢ Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences. ➢ Describe how VR and AR systems work. ➢ Choose, develop, explain, and defend the use of particular designs for AR and VR experiences. ➢ Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body. ➢ Identify and examine state-of-the-art AR and VR design problems and solutions from the industry and academia.

Unit 1	**INTRODUCTION**	**9**
Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR ,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.		
Unit 2	**VR SYSTEMS**	**9**
VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.		
Unit 3	**STEREOSCOPIC VISION&HAPTICRENDERING**	**9**
Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.		
Unit 4	**VRSOFTWARE DEVELOPMENT**	**9**
Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available sdk to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR).		
Unit 5	**3D INTERACTIONTECHNIQUES &**	**9**

	ARSOFTWAREDEVELOPMENT	

3D Manipulation tasks, Manipulation Techniques and Interaction Techniques for 3D Manipulation. ARsoftware development : AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.AR software development : AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

Total: 45

TEXTBOOKS

1	George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 20 09.
2	Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016
3	Grewal. B.S., and Grewal. J.S., Numerical methods in Engineering and Science, Khanna Publishers, 9th Edition, New Delhi, 2001.

REFERENCES

1	Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
2	The VR Book: Human-Centered Design for Virtual Reality, by Jason Jerald 3. 2.Learning Virtual Reality by Tony Parisi, O' Reilly 4.
3	Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-IEEE Pres s, 2003/2006.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences.	K4
CO2	Describe how VR and AR systems work.	K3
CO3	Choose, develop, explain, and defend the use of particular designs for AR and VR experiences.	K3
CO4	Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.	K3
CO5	Identify and examine state-of-the-art AR and VR design problems and solutions from the industry and academia.	K5

CO	**PO**	**PSO**

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

AAI706-IMAGE AND VIDEO ANALYTICS

Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**2**	**0**	**2**	**3**

Preamble	The objective of the course is to ➢ To understand the basics of image processing techniques for computer vision. ➢ To learn the techniques used for image pre-processing. ➢ To discuss the various object detection techniques. ➢ To understand the various Object recognition mechanisms. ➢ To elaborate on the video analytics techniques.

Unit 1	**INTRODUCTION**	**9**

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

Unit 2	**IMAGE PRE-PROCESSING**	**9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

Unit 3	**OBJECT DETECTION USING MACHINE LEARNING**	**9**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

Unit 4	**FACE RECOGNITION AND GESTURE**	**9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face RecognitionDeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNetGesture Recognition.

Unit 5	**VIDEO ANALYTICS**	**9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-

RestNet architecture-RestNet and skip connections-Inception Network-GoogleNetarchitecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.	
Total: 45	
TEXTBOOKS	
1	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
2	Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)
REFERENCES	
1	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2	Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3	D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the basics of image processing techniques for computer vision and video analysis.	K4
CO2	Explain the techniques used for image pre-processing.	K3
CO3	Develop various object detection techniques.	K3
CO4	Understand the various face recognition mechanisms.	K3
CO5	Elaborate on deep learning-based video analytics.	K5

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

AAI707-MULTIVARIATE CALCULUS AND FORECASTING							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**2**	**0**
Preamble	The objective of the course is to ● To enable learning of Multivariate calculus as it's one of the most important data science skills and multivariate calculus is used everywhere in Machine Learning Projects. ● To demonstrate an understanding of Calculus beyond the manipulation of symbols, ● To enable classification or regression when operations are related with multiple variables ● To understand the theory and methods of Calculus to solve a variety of problems in terms of multivariate dataset						
Unit 1	FUNCTIONS OF SEVERAL VARIABLES						**9**
Partial derivatives – Homogeneous functions and Euler's theorem –Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians.							
Unit 2	PARTIAL DIFFERENTIAL EQUATIONS						**9**
Hours Linear Homogeneous partial differential equations of second and higher order with constant coefficients							
Unit 3	**DIFFERENTIAL CALCULUS**						**9**
Limit of a function-Continuity-Derivatives-Differentiation rules (sum, product, quotient, chain rules)-Implicit Differentiation-Logarithmic Differentiation-Applications: Maxima and Minima of functions of one variable							
Unit 4	MULTIPLE INTEGRALS						**9**
Hours Signature of BOS chairman, CSE Double integration – Cartesian coordinates – Change of order of integration – Triple integration in Cartesian coordinates – Applications: Area as double integral and Volume as triple integral.							
Unit 5	VECTOR CALCULUS						**9**
Hours Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (Only statements							

excluding proofs)	
	Total: 45
TEXTBOOKS	
1	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2014.
2	Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3	Grewal B.S. and Grewal J.S., "Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
4	Montgomery D.C., Johnson. L.A., Gardiner J.S., "Forecasting and Time series Analysis", McGraw Hill, 1990.
REFERENCES	
1	Kreyzig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, 2011.
2	Venkataraman M.K., "Engineering Mathematics", The National Publishing Co., Chennai,2003

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Evaluate the total derivative of a function, expand the given function as a series and locate the maximum and minimum for multivariate functions which is an important part of data science.	K4
CO2	Solve higher order partial differential equations arising in real world situations.	K3
CO3	Evaluate double and triple integrals in Cartesian coordinates and apply them to calculate area and volume.	K3
CO4	Evaluate gradient, divergence and curl which form the basis of gradient descent and apply them to real life problems.	K3
CO5	Analyze and apply the knowledge of time series and interpolation to predict the future	K5

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

2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2
3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2
4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2
5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3

AAI708-BLOCK CHAIN TECHNOLOGY

Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**0**	**3**

Preamble	The objective of the course is to ➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems. ➢ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

Unit 1	**HISTORY**	**9**

Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, SignatureHash chain to Block chain-Basic consensus mechanisms.

Unit 2	**CONSENSUS PROTOCOLS**	**9**

Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.

Unit 3	**CONSENSUS PROCESS**	**9**

Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.

Unit 4	**BLOCK CHAIN INFSS**	**9**

Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.

Unit 5	**VBLOCK CHAIN FOR GOVERNMENT**	**9**

Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography:

Privacy and Security on Block chain	
	Total: 45
TEXTBOOKS	
1	Mark Gates, "Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates 2017.
2	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3	Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	State the basic concepts of block chain	K4
CO2	Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger Fabric	K3
CO3	Implement SDK composer tool and explain the Digital identity for government	K3
CO4	To understand the concepts of block chain technology	K3
CO5	To understand the consensus and hyper ledger fabric in block chain technology	K5

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	2	1	-	-	-	1	-	-	2	3	3	1
2	3	3	3	3	1	-	-	-	2	-	-	2	3	3	1
3	3	3	3	3	2	-	-	-	3	-	-	2	3	3	3
4	3	2	3	2	3	-	-	-	3	-	-	2	3	2	3
5	3	3	2	2	1	-	-	-	1	-	-	2	3	3	
AVG	3	2.75	2.75	2.5	1.75	2.25	2	3	2.75	2	3	2.75	2.75	2.5	1.75

AAI709-CRYPTOGRAPHY							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems.						
Unit 1	**INTRODUCTION TO SECURITY**						**9**
Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern							
Unit 2	**SYMMETRIC CIPHERS**						**9**
Number theory – Algebraic Structures – Modular Arithmetic - Euclid‘s algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.							
Unit 3	**ASYMMETRIC CRYPTOGRAPHY**						**9**
MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography.							
Unit 4	**INTEGRITY AND AUTHENTICATION ALGORITHMS**						**9**
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr							

Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.		
Unit 5	**CYBER CRIMES AND CYBER SECURITY**	**9**
Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security		
		Total: 45

TEXTBOOKS	
1	William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2	Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.
REFERENCES	
1	Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2	Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities	K4
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	K3
CO3	Apply the different cryptographic operations of public key cryptography	K3
CO4	Apply the various Authentication schemes to simulate different applications.	K3
CO5	Understand various cyber crimes and cyber security.	K5

CO	**PO**	**PSO**

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

AAI710-COMPUTATIONAL NEUROSCIENCE							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		5	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to ➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems. ➢ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications						
Unit 1	**INTRODUCTION**						**9**
Domains in Computational Neuroscience, Brain metaphors-computer and brain, Basic neuroscience, Basic synaptic mechanisms and the generation of action potentials , Nernst Potential Hodgkin-Huxley equations ,The propagation of action potentials							
Unit 2	**SPIKING NEURONS AND RESPONSE VARIABILITY**						**9**
Spiking neurons- concept neurons- the neural code, Spike trains- cable theory- Spike time variability ,. Post synaptic potential(PSP) , firing threshold and action potential ,Neurons in a Network- Population Dynamics ,Rate code and Information in spike trains ,Population coding and decoding- single neuron models , Hodgkin-Huxley Model, spiking neuron models, Integrate and firing model , Noise in spiking neuron models- compartmental modeling .							
Unit 3	**FEED-FORWARD MAPPING NETWORKS**						**9**
Perception, function representation, and look-up tables , The sigma node as perception , Multi-layer mapping networks , Learning, generalization and biological interpretations , Self-organizing network architectures and genetic algorithms , Mapping networks with context units , Probabilistic mapping networks , Associators and synaptic plasticity, Associative memory and Hebbian learning, Hebian plasticity- features of associators and Hebbian learning.							

Unit 4	AUTO-ASSOCIATIVE MEMORY AND NETWORK DYNAMICS	9
Long-term memory and auto-associators , Point attractor networks, The Grossberg-Hopfield model , sparse attractor neural networks , Chaotic networks, biologically more realistic variations of attractor networks , Continuous attractor and competitive networks		
Unit 5	**SUPERVISED LEARNING AND REWARDS SYSTEMS**	**9**
The delta rule and back propagation , Generalized delta rules, plasticity and coding , Reward learning, System level organization and coupled networks , System level anatomy of the brain, Modular mapping networks , Coupled attractor networks, working memory , Attentive vision, an interconnecting workspace hypothesis , CASE STUDY Introduction to the MATLAB programming environment .A MATLAB guide to computational neuroscience, Spiking neurons and numerical integration in MATLAB		
		Total: 45

TEXTBOOKS	
1	Thomas Trappenberg, Fundamentals of Computational Neuroscience, oxford University Press, June 2002
2	Lytton, William W, From Computer to Brain - Foundations of Computational Neuroscience, Springer publications, 2002
REFERENCES	
1	Gerstner and Kistler, Spiking Neuron Models. Single Neurons, Populations, Plasticity -Cambridge University Press, 2002

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

PROFESSIONAL ELECTIVE III

AAI711-DEPENDABLE ARTIFICIAL INTELLIGENCE

Programme	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**

&Branch							
	6	**BS**	**3**	**1**	**0**	**4**	

Preamble	The Instructor will: Provide characteristic details of AI and machine learning systems to make them dependable, such as explainability, interpretability, safety etc. Learning Outcomes The students are expected to have the ability to: 1. Assess the dependability of AI systems. 2. Develop explainable, robust, and safe AI models.

Unit 1	**Introduction to Explainable AI**	**9**
Overview, Motivation, Challenges – medical and surveillance Accuracy-explainabilityTradeoff, Interpretability Problem, Predictability, Transparency, Traceability, Causality, Reasoning, Attention and Saliency		
Unit 2	**Interpretable AI**	**9**
Prediction Consistency, Application Level Evaluation, Human Level Evaluation, Function Level Evaluation		
Unit 3	**Adversarial Robustness**	**9**
Adversarial Attacks and Defences		
Unit 4	**Trustworthy AND Bias-free AI**	**9**
Integrity, Reproducibility, Accountability ,Accessibility, Fair, Data Agnostics Design, Disentanglement		
Unit 5	**Privacy Preserving AI**	**9**
Federated Learning, Differential Privacy and Encrypted Computation		
		Total: 45

TEXTBOOKS

1	J. PEARL (2018), The Book of Why: The New Science of Cause and Effect, Basic Books.
2	N. BOSTROM (2014), The Ethics of Artificial Intelligence. The Cambridge Handbook of Artificial Intelligence, Cambridge University Press. Self-learning Material Udacity course on Secure and Private AI: https://www.udacity.com/course/secure-and-private-ai-- ud185

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

5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3

AAI712-COMPUTER VISION							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**2**	**0**	**2**	**3**
Preamble	The objective of the course is to • To understand the fundamental concepts related to Image formation and processing. • To learn feature detection, matching and detection • To become familiar with feature based alignment and motion estimation • To develop skills on 3D reconstruction • To understand image based rendering and recognition						
Unit 1	**INTRODUCTION TO IMAGE FORMATION AND PROCESSING**						**9**
Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.							
Unit 2	**FEATURE DETECTION, MATCHING AND SEGMENTATION**						**9**
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.							
Unit 3	**FEATURE-BASED ALIGNMENT & MOTION ESTIMATION**						**9**
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.							
Unit 4	**3D RECONSTRUCTION**						**9**
Shape from X - Active rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.							
Unit 5	**IMAGE-BASED RENDERING AND RECOGNITION**						**9**
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.							

	Total: 45
TEXTBOOKS	
1	Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer- Texts in Computer Science, Second Edition, 2022.
2	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
REFERENCES	
1	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2	Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3	E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	To understand basic knowledge, theories and methods in image processing and computer vision.	K4
CO2	To implement basic and some advanced image processing techniques in OpenCV.	K3
CO3	To apply 2D a feature-based based image alignment, segmentation and motion estimations.	K3
CO4	To apply 3D image reconstruction techniques	K3
CO5	To design and develop innovative image processing and computer vision applications.	K5

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

AAI713-QUANTUM COMPUTING

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		6	BS	3	0	0	3

Preamble	The objective of the course is to ➢ To know the background of classical computing and quantum computing ➢ To learn the fundamental concepts behind quantum computation. ➢ To study the details of quantum mechanics and its relation to Computer Science. ➢ To gain knowledge about the basic hardware and mathematical models of quantum ➢ computation. ➢ To learn the basics of quantum information and the theory behind it.

Unit 1	**QUANTUM COMPUTING BASIC CONCEPTS**	**9**
Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions		
Unit 2	**QUANTUM GATES AND CIRCUITS**	**9**
Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction		
Unit 3	**QUANTUM ALGORITHMS**	**9**
Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm		
Unit 4	**QUANTUM INFORMATION THEORY**	**9**
Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels		
Unit 5	**QUANTUM CRYPTOGRAPHY**	**9**
Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart		
		Total: 45

TEXTBOOKS

1	Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2	Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3	Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCES

1	Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2	N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the basics of quantum computing	K4
CO2	Understand the background of Quantum Mechanics.	K3
CO3	Analyze the computation models.	K3
CO4	Model the circuits using quantum computation. environments and frameworks	K3
CO5	Understand the quantum operations such as noise and error–correction.	K5

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

AAI714- COGNITIVE AND BEHAVIOR SCIENCE

Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**2**	**0**	**2**	**3**

Preamble	The objective of the course is to ➢ To know the theoretical background of cognition. ➢ To understand the link between cognition and computational intelligence. ➢ To explore probabilistic programming language. ➢ To study the computational inference models of cognition.

	➢ To study the computational learning models of cognition	
Unit 1	**PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE**	**9**
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.		
Unit 2	**COMPUTATIONAL INTELLIGENCE**	**9**
Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.		
Unit 3	**PROBABILISTIC PROGRAMMING LANGUAGE**	**9**
WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration		
Unit 4	**INFERENCE MODELS OF COGNITION**	**9**
Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference		
Unit 5	**LEARNING MODELS OF COGNITION**	**9**
Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.		
		Total: 45

TEXTBOOKS

1	Vijay V Raghavan,VenkatN.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2	Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3	Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”,The MIT Press, 1999.
4	Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES

1	Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, https://dippl.org/.

2	Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the underlying theory behind cognition	K4
CO2	Connect to the cognition elements computationally.	K3
CO3	Implement mathematical functions through WebPPL.	K3
CO4	Develop applications using cognitive inference model	K3
CO5	Develop applications using cognitive learning model.	K5

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

PROFESSIONAL ELECTIVE IV
AAI715-RESOURCE CONSTRAINED AI

Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**3**	**1**	**0**	**4**

Preamble	The objective of the course is to 1. To provide motivation and understanding of the need and importance of deploying Machine Learning in resource constrained devices 2. To provide details about various optimized and resource efficient algorithms in Machine Learning Learning Outcomes The students are expected to have the ability to: 1. Understand the constraints of implementing AI algorithms on limited memory devices 2. Design and develop techniques to reduce inference time memory footprint of machine learning models

Unit 1	**INTRODUCTION**	**9**
Overview and motivation, challenges of resource constrained AI, why AI on edge		
Unit 2	**EDGE COMPUTING**	**9**
Edge devices and their limitations, Edge and fog computing, Distributed computing, communication links, communication overhead in IoT devices		
Unit 3	**MONITORING, MEMORY OPTIMIZATION OF MODELS**	**9**
Prediction accuracy, numeric accuracy, precision, memory footprints, computational complexity of AI models , KiloByte-size models, floating-point v/s fixed-point, SeeDot		
Unit 4	**EDGE AI**	**9**
Resource-efficient kNN, SVM and deep learning models, Toeplitz matrix, Bonsai, ProtoNN, EMIRNN, FastRNN, FastGRNN		
Unit 5	**CURRENT TRENDS AND FUTURE**	**9**
Hardware accelerators for Edge AI, Vision Processing Unit (VPU), Streaming Hybrid Architecture Vector Engine (SHAVE), Intel's Movidius Neural Compute Stick (NCS), Open Neural Network Exchange (ONNX), Future trends		
		Total: 45
TEXTBOOKS		
1	C. ALIPPI (2014), Intelligence for Embedded Systems: A Methodological Approach, Springer, 1st Edition.Preparatory Course Material 1. EdgeML by Microsoft,https://github.com/Microsoft/EdgeML/#edge-machine-learning	
2	NCSDK by Intelhttps://github.com/movidius/ncsdk	

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI716-DATA ENGINEERING							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to The Instructor will: 1. Introduce fundamental concepts in representing data, accessing it and analysing it 2. Explore applications in data science and big data projects Learning Outcomes The students will have the ability to: 1. Develop suitable data science ecosystem for the given application 2. Understand various data storage and retrieval techniques 3. Understand SQL and NoSQL databases and their usage 4. Analyse data using Python and Python-based tools						
Unit 1	**INTRODUCTION**						**9**
Data source, Big Data, Structured and unstructured data (2 Lectures)							
Unit 2	**DATA MODELS AND STORAGE**						**9**
Relational databases, NoSQL database, normalized and denormalized data models, Data cleaning, Distributed Data Storage and Management, Hashing, Indexing							
Unit 3	**QUERY PROCESSING**						**9**
Querying big data using SQL and NoSQL, Elastic Search, Query optimization, speeding up, maintaining ACID property, Design Patterns, Data reliability, quality and provenance, Distributed query processing, Query optimization and Processing							
Unit 4	**DATA WAREHOUSING**						**9**
OLAP, OLTP (4 Lectures) Streaming Data analytics: In-memory Analytics, data pipelines and dashboards, Predictive Analytics (6 Lectures)							
Unit 5	**CASE STUDY**						**9**
Data Collection Techniques, Indexing implementation for the structured data and unstructured data , SQL queries (schema, DDL, DML, DQL), Data format interchange using XML, JSON NoSQL system (HBase, Hive, MongoDB) , Data wrangling, data operations (e.g. NumPy) Hadoop, Spark and MapReduce							
							Total: 45
TEXTBOOKS							
1	M. KLEPPMANN (2017), Designing Data-Intensive Applications The Big Ideas Behind Reliable, Scalable, and Maintainable Systems, O'Reilly.						

2	L. WEISE (2015), Advanced Data Management: For SQL, NoSQL, Cloud and Distributed Databases, Walter de Gruyter GmbH.
3	A. SILBERSCHATZ, H.F. KORTH, S. SUDARSHAN (2011), Database System Concepts, McGraw Hill Publications, 6th Edition.
REFERENCES	
1	H.G. MOLINA, J. ULLMAN, J. WIDOM (2014), Database Systems: The Complete Book, Pearson, 2nd Edition.
2	P. RAJ, A. RAMAN, D. NAGARAJ, S. DUGGIRALA (2015), High-Performance Big-Data Analytics: Computing Systems and Approaches, Springer, 1st Edition.

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI717-ETHICAL HACKING							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		6	**BS**	**2**	**0**	**2**	**3**
Preamble	The objective of the course is to • To understand the basics of computer based vulnerabilities. • To explore different foot printing, reconnaissance and scanning methods. • To expose the enumeration and vulnerability analysis methods. • To understand hacking options available in Web and wireless applications. • To explore the options for network protection. • To practice tools to perform ethical hacking to expose the vulnerabilities.						
Unit 1	**INTRODUCTION**						**9**
Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security							
Unit 2	**FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS**						**9**
Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites,							

Website, Email - Competitive Intelligence - Footprinting through Social Engineering - 136 Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall		
Unit 3	**ENUMERATION AND VULNERABILITY ANALYSIS**	**9**
Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS VulnerabilitiesVulnerabilities of Embedded Oss		
Unit 4	**SYSTEM HACKING**	**9**
Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – WardrivingWireless Hacking - Tools of the Trade		
Unit 5	**NETWORK PROTECTION SYSTEMS**	**9**
Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.		
		Total: 45

TEXTBOOKS

1	Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2	The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013. 137
3	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES

1	Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	To express knowledge on basics of computer based vulnerabilities	K4
CO2	To gain understanding on different foot printing, reconnaissance and scanning methods.	K3

CO3	To demonstrate the enumeration and vulnerability analysis methods	K3
CO4	To gain knowledge on hacking options available in Web and wireless applications.	K3
CO5	To acquire knowledge on the options for network protection. CO6: To use tools to perform ethical hacking to expose the vulnerabilities.	K5

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

PROFESSIONAL ELECTIVE V
AAI718-REINFORCEMENT LEARNING

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		7	BS	3	0	0	3

Preamble	The objective of the course is to ➢ Introduce the different basic elements of Reinforcement Learning (RL) ➢ Study about Tabular methods and Q-networks. ➢ Study about policy optimization. ➢ Learn current advancements and applications in RL.

Unit 1	BASICS OF REINFORCEMENT LEARNING (RL)	9

Elements of RL- RL framework- Markov property- Partially Observable Markov Decision Process- policies value functions and Bellman equations.

Unit 2	TABULAR METHODS	9

Planning with dynamic Programming- Monte Carlo control- and Temporal-Difference learning methods - TD (0), SARSA, and Q-Learning.

Unit 3	**Q-NETWORKS**	**9**
Deep Q-networks - DQN, DDQN, Dueling DQN, Prioritized Experience Replay		
Unit 4	**POLICY OPTIMIZATIONS**	**9**
Optimal policies and optimal value functions- Bellman optimality equations- Vanilla Policy GradientREINFORCE algorithm and stochastic policy search- Actor-critic methods - A2C and A3C- Advanced policy gradient - PPO, TRPO, DDPG.		
Unit 5	**RECENT ADVANCEMENTS AND APPLICATIONS**	**9**
Meta-learning, Multi-Agent RL, Model-based RL approach, Code Standards and Python Libraries used in RL: SuperSuit, Stable Baselines3, Pistonball and MAgent. RL for real-world problems: Autonomous Driving- Train an RL agent to navigate a self-driving car through complex urban environments, obeying traffic rules, and making safe decisions.		
		Total: 45

TEXTBOOKS

1	Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction”, MIT Press, 2nd edition, 2018.

REFERENCES

1	Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach. “Pearson Education Limited, 2022.
2	Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective",2012.
3	Csaba Szepesvari, “Algorithms for Reinforcement learning”,2009.
4	Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012).
5	Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018). Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Explain the elements of reinforcement learning.	K4
CO2	Apply tabular methods and Q-networks to solve classical problems.	K3

CO3	Interpret policy gradient methods from vanilla to more complex cases.	K3
CO4	Implement real-world problems applying code standards.	K3

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI719-TIME SERIES ANALYSIS							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to 1.To provide working knowledge of time series and forecasting methods 2. To provide with techniques and receipts for estimation and assessment of quality of economic models with time series data Learning Outcomes To develop the skills needed to do empirical research in fields operating with time series data sets Contents						
Unit 1	**STATIONARY PROCESSES**						**9**
Strong and weak, autocorrelation function, linear processes, estimation of mean and covariance functions, Wold decomposition Theorem.							
Unit 2	**ARMA MODELS**						**9**
ARMA (p, q) processes, ACF and PACF, Modeling using ARMA processes, estimation of parameters, testing model adequacy, Order estimation.							
Unit 3	**FORECASTING**						**9**
Prediction in stationary processes, special reference to ARMA processes, Frequency domain analysis – spectral density and its estimation, transfer functions.							
Unit 4	**NON-STATIONARY MODELS**						**9**
ARMAX, ARIMAX models and introduction to ARCH models.							

Unit 5	MULTIVARIATE TIME SERIES	9
Multivariate Time Series, State Space Models.		
		Total: 45
TEXTBOOKS		
1	P.J. BLOCKWELL, R.A. DAVIS (2017), Introduction to Time Series and Forecasting, Springer, 2nd Edition.	
2	C. CHATFIELD (2004), The Analysis of Time Series – An Introduction, Chapman and Hall / CRC, 4th Edition.	
REFERENCES		
1	G.E.P. BOX, G. JENKINS, G. REINSEL (1994), Time Series Analysis-Forecasting and Control, Pearson, 3rd Edition. Online Learning material https:// ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/recitations/.	

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI720-DIGITAL FORENSICS

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		7	BS	2	0	2	3

Preamble	The objective of the course is to • To understand basic digital forensics and techniques. • To understand digital crime and investigation. • To understand how to be prepared for digital forensic readiness. • To understand and use forensics tools for iOS devices. • To understand and use forensics tools for Android devices.

Unit 1	INTRODUCTION TO DIGITAL FORENSICS	9
Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated data blocks of a disk image. Data extraction from call logs using Sleuth Kit.		

Unit 2	DIGITAL CRIME AND INVESTIGATION	9
Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence		
Unit 3	**DIGITAL FORENSIC READINESS**	**9**
Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics		
Unit 4	**iOS FORENSICS**	**9**
Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit– iCloud. Data extraction using Sleuth Kit. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups. Process and parse records from the iOS system.		
Unit 5	**ANDROID FORENSICS**	**9**
Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling .Extract installed applications from Android devices.Extract diagnostic information from Android devices through the adb protocol. 8. Generate a unified chronological timeline of extracted records,		
		Total: 45

TEXTBOOKS

1	Andre Arnes, “Digital Forensics”, Wiley, 2018.
2	Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.

REFERENCES

1	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Have knowledge on digital forensics.	K4
CO2	Know about digital crime and investigations.	K3
CO3	Be forensic ready.	K3

CO4	Investigate, identify and extract digital evidence from iOS devices.	K3
CO5	Investigate, identify and extract digital evidence from Android devices.	K5

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI721-NATURAL LANGUAGE UNDERSTANDING							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to 1. To provide insights into fundamental concepts and algorithms related to Natural Language Understanding. 2. Impart working expertise by introducing practical problems. Learning Outcomes The students are expected to have the ability to: 1. Formulate natural language understanding tasks 2. Design and implement basic applications of NLU						
Unit 1	**TRADITIONAL NLU**						**9**
Introduction to NLU, Motivation, Morphology, Parts-of-Speech, Language Models, Word Sense Disambiguation, Anaphora Resolution, Basics of Supervised and Semi-supervised Learning for NLU, Hidden Markov Models for language modeling, EM Algorithm, Structured Prediction, Dependency Parsing, Topic Models, Semantic Parsing, Sentiment analysis.							
Unit 2	**DEEP LEARNING FOR NLU**						**9**
Intro to Neural NLU, Word Vector representations, Neural Networks and backpropagation -- for named entity recognition, Practical tips: gradient checks, overfitting, regularization, activation functions,							
Unit 3	**RECURRENT NEURAL NETWORKS FOR NLU**						**9**
RNN for language modeling and other tasks, GRUs and LSTMs -- for machine translation, Recursive neural networks -- for parsing							

Unit 4	CONVOLUTIONAL NEURAL NETWORKSFOR NLU	9
CNN for sentence classification, Question answering and dialogue system, Graph Neural Network for NLU, Natural Language Generation, Analysis and Interpretability of Neural NLU. (22 Lectures)		
Unit 5	**KNOWLEDGE GRAPHS FOR NLU**	**9**
Knowledge graph embedding techniques, Inference on knowledge graphs.		
		Total: 45

TEXTBOOKS	
1	C. MANNING, H. SCHÜTZE (1999), Foundations of Statistical Natural Language Processing, MIT Press.
2	D. JURAFSKY, J.H. MARTIN, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (3rd Edition Draft), 2019.
REFERENCES	
1	E. BENDER (2013), Linguistic Fundamentals for NLP, Morgan Claypool Publishers..
2	J. ALLEN (1995), Natural Language Understanding, Pearson Education, 1995.
3	Research Literature. Self Learning Material 1. http://web.stanford.edu/class/cs224n/index.html#schedule (Deep learning for NLP)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

PROFESSIONAL ELECTIVE VI

AAI722-OPTIMIZATION TECHNIQUES

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		8	BS	3	0	0	3

Preamble	The objective of the course is to • To understand fundamental topics in bio-inspired optimization techniques • To Learn the collective systems such as ACO, PSO, and BCO • To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems • To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies. • To implement the Bio-inspired technique with other traditional algorithms.

Unit 1	INTRODUCTION	9

Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

Unit 2	SWARM INTELLIGENCE	9

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – SACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

Unit 3	NATURAL TO ARTIFICIAL SYSTEMS	9

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

Unit 4	SWARM ROBOTICS	9

Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering. UNIT V CASE STUDIES 9 Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning

Problems – Travelling Salesman problem.	
	Total: 45
TEXTBOOKS	
1	A. E. Elben and J. E. Smith, “Introduction to Evolutionary Computing”, Springer, 2010.
2	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
3	Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
REFERENCES	
1	Eric Bonabeau, Marco Dorigo, Guy Theraulaz, “Swarm Intelligence: From Natural to Artificial Systems”, Oxford University press, 2000.
2	Christian Blum, Daniel Merkle (Eds.), “Swarm Intelligence: Introduction and Applications”, Springer Verlag, 2008.
3	Leandro N De Castro, Fernando J VonZuben, “Recent Developments in Biologically Inspired Computing”, Idea Group Inc., 2005.
4	Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
5	C. Ebelhart et al., “Swarm Intelligence”, Morgan Kaufmann, 2001.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Familiarity with the basics of several biologically inspired optimization techniques.	K4
CO2	Familiarity with the basics of several biologically inspired computing paradigms.	K3
CO3	Ability to select an appropriate bio-inspired computing method and implement for any application and data set.	K3
CO4	Theoretical understanding of the differences between the major bio-inspired computing methods.	K3
CO5	Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other	K5

	traditional algorithms.	

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI723-**BIOINFORMATICS**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to • To launch the Bioinformatics core concepts to students. • To provide knowledge on Biological databases, sequence analysis,evolutionary analysis and applications of Bioinformatics.						
Unit 1	**BIOLOGICAL DATABASES**						**9**
Introduction to Bioinformatics and Computational Biology, Biological sequences, Classification of biological databases - Sequence Databases, Structure Databases, Genome specific databases, Special Databases and applications- Microarray, Metabolic pathway, motif, and domain databases, Data file formats							
Unit 2	**SEQUENCE ANALYSIS**						**9**
Sequence Alignment- Homology vs Similarity, Similarity vs Identity. Types of Sequence alignment - Pairwise and Multiple sequence alignment, Global alignment, Local alignment, Dotplot, Alignment algorithms- Needleman wunsch and Smith and waterman algorithm, Substitution matrices- PAM, 97 BLOSUM.Multiple Sequence Alignment- Application of multiple alignments, Viewing and editing of MSA and Scoring function.Database Similarity Searching- Basic Local Alignment Search Tool (BLAST), FASTA, PHI BLAST, PSI BLAST, BLAST algorithm.							
Unit 3	**MOLECULAR PHYLOGENY**						**9**
Phylogenetics Basics, Molecular clock theory, Ultrametric trees, Distance matrix methodsUPGMA,NJ, Character based methods-Maximum Parsimony. Methods of evaluating phylogenetic methods- boot							

strapping, jackknifing.		
Unit 4	**MACROMOLECULAR STRUCTURE ANALYSIS**	**9**
Gene prediction, Conserved domain analysis, Protein structure visualization, Prediction of protein secondary structure, Tertiary structure prediction- Homology modeling, Threading, Ab-initio prediction. Validation of the predicted structure using Ramachandran plot, steriochemical properties, Structure- structure alignment.		
Unit 5	**APPLICATIONS**	**9**
Introduction to Systems Biology and Synthetic Biology, Microarray data analysis, DNA computing, Bioinformatics approaches for drug discovery, Applications of Bioinformatics in genomics and proteomics- Assembling the genome, STS content mapping for clone contigs, Functional annotation, Peptide mass fingerprinting.		
		Total: 45

TEXTBOOKS

1	Arthur K. Lesk- Introduction to Bioinformatics, Oxford University Press
2	Baxivanis and FouletteD- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiely Indian Edition, 2001.
3	Attwood TK, parry DJ-Smith, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint 2005.
4	David W. Mount-Bioinformatics Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press. 1st edition 2001.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Apply computational based solutions for biological perspectives	K4
CO2	Analyze the evolutionary relationship between the organisms	K3
CO3	Understand the macromolecules structure prediction methods	K3
CO4	Relate how bioinformatics methods can be used in sequence to structure and function	K3
CO5	analysis. Learn the applications of bioinformatics approach for drug discovery, genomics and proteomics.	K5

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

1	2	2	1	2	2	-	-	-	-	1	1	2	2	2	1
2	2	3	2	3	2	-	-	-	2	2	3	2	3	2	1
3	2	3	2	1	1	-	-	-	2	2	3	2	2	3	1
4	2	3	2	2	3	-	-	-	2	2	3	2	2	3	1
5	2	3	1	2	2	-	-	-	-	-	-	1	3	2	2
AVG	2	2	1	2	2	-	-	-	1.2	1	1	2	2	2	1

AAI724-**INFORMATION RETRIEVAL SYSTEM**

Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**

Preamble	The objective of the course is to ➢ To understand the basics of information retrieval with pertinence to modeling ➢ To understand various components of IR system ➢ To understand machine learning techniques for text classification and clustering ➢ To explore various IR applications.

Unit 1	**INTRODUCTION AND MODELING**	**9**

Basic Concepts: Retrieval process – Architecture – Boolean retrieval; IR Models: Taxonomy and characterization of IR models – Classical IR models – Alternative algebraic models – Models for Browsing – Retrieval Evaluation: Performance evaluation.

Unit 2	**INDEXING AND QUERYING**	**9**

Indexing: Inverted indices – Suffix trees – Suffix arrays – Compression; Querying: Query languages; Query Operations: Relevance feedback and query expansion – Automatic local and global analysis.

Unit 3	**SEARCHING**	**9**

Searching: Sequential searching – Pattern matching; Searching the Web: Characterizing the Web – Search engines – Browsing – Searching using hyperlinks.

Unit 4	**CLASSIFICATION AND CLUSTERING**	**9**

Text Classification: Naive Bayes; Vector Space Classification: Rocchio – k-Nearest Neighbour; Flat Clustering: K-Means – Model-based clustering – Hierarchical clustering – Matrix decom- positions and latent semantic indexing.

Unit 5	**APPLICATIONS**	**9**
XML Retrieval – Multimedia IR – Parallel and Distributed IR – Digital Libraries – Social Media Retrieval – Content-based Image Retrieval – Online Public Access Catalogs (OPACs).		
		Total: 45

TEXTBOOKS	
1	Ricardo Baeza Yates, Berthier Ribeiro Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", ACM Press Books, 2nd Edition, 2011.
2	Christopher D Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, 1st South Asian Edition, 2008.
REFERENCES	
1	Stefan Buttcher, Charles L A Clarke, Gordon V Cormack, "Information Retrieval – Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.
2	Cheng Xiang Zhai, Sean Massung, "Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining", ACM Books, 2016.
3	Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining: An Introduction", 1st Edition, Cambridge University Press, 2014.
4	Vipin Tyagi, "Content-Based Image Retrieval: Ideas, Influences, and Current Trends", 1st Edition, Springer, 2017.
5	Marcia J Bates, "Understanding Information Retrieval Systems: Management, Types, and Standards", CRC Press, 2012.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Apply the IR modeling techniques for the document retrieval problem and measure the performance of IR systems by making use of IR evaluation metrics (K3)	K4
CO2	Construct the basic components of an IR system namely indexing and querying	K3

CO3	Explain the searching techniques for IR and Web	K3
CO4	Apply machine learning techniques to text classification and clustering for efficient In- formation Retrieval	K3
CO5	Develop an IR application by applying best practices with proper documentation in teams	K5

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	2	3	2		-	-	3	2	1	2	3	3	2
2	2	2	222	3	3		-	-	1	2	2	3	3	3	2
3	2	1	1	3	2		-	-	1	2	1	1	1	3	3
4	3	3	3	3	2		-	-	1	1	1	1	2	1	3
5	1	3	2	2	2		-	-	1	1	3	1	2	3	2

AAI725-**INFORMATION SECURITY**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ To understand the basics of Information Security ➢ To know the legal, ethical and professional issues in Information Security ➢ To equip the students' knowledge on digital signature, email security and web security						
Unit 1	**INTRODUCTION**						**9**
History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC							
Unit 2	**SECURITY INVESTIGATION**						**9**
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies							
Unit 3	**DIGITAL SIGNATURE AND AUTHENTICATION**						**9**
Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols -							

Applications - Kerberos -X.509 Directory Services		
Unit 4	**E-MAIL AND IP SECURITY**	**9**
E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management.		
Unit 5	**WEB SECURITY**	**9**
Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.		
		Total: 45

TEXTBOOKS	
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017.
2	Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.
REFERENCES	
1	Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016.
2	Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012.
3	Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.
4	Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the basics of data and information security	K4
CO2	Understand the legal, ethical and professional issues in information security	K3
CO3	Understand the various authentication schemes to simulate different applications.	K3

CO4	Understand various security practices and system security standards	K3
CO5	Understand the Web security protocols for E-Commerce applications	K5

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

AAI726-**SOFT COMPUTING**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**1**	**0**	**4**
Preamble	The objective of the course is to ➢ To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience. ➢ To provide the mathematical background for carrying out the optimization associated with neural network learning ➢ To learn various evolutionary Algorithms. ➢ To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems. ➢ To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing						
Unit 1	**INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC**						**9**
Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems							
Unit 2	**NEURAL NETWORKS**						**9**
Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks							

Unit 3	GENETIC ALGORITHMS	9
Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function		
Unit 4	**NEURO FUZZY MODELING**	**9**
ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability		
Unit 5	**APPLICATIONS**	**9**
Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.		
		Total: 45

TEXTBOOKS	
1	SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2	Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python
3	With Case Studies and Applications from the Industry, Apress, 2020
REFERENCES	
1	Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2	S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
3	Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4	S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
5	R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the fundamentals of fuzzy logic operators and inference mechanisms	K4
CO2	Understand neural network architecture for AI	K3

	applications such as classification and clustering	
CO3	Learn the functionality of Genetic Algorithms in Optimization problems	K3
CO4	Use hybrid techniques involving Neural networks and Fuzzy logic	K3
CO5	Apply soft computing techniques in real world applications	K5

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

PROFESSIONAL ELECTIVE 7

AAI727-**AI TECHNIQUES FOR GAME DEVELOPMENT**

Programme &Branch	B.Tech& AI&DS	Sem.	Category	L	T	P	C
		7	BS	3	0	0	3

Preamble	The objective of the course is to ➢ To have an introduction into the Game programming and rendering. ➢ To learn the principles, mechanics and logics of Game Design. ➢ To learn the various Game Development process and its design attributes. ➢ To gain working knowledge in various game platforms.

Unit 1	INTRODUCTION	9

Elements of Game Play — Artificial Intelligence — Getting Input from the Player - Sprite Programming — Sprite Animation - Multithreading — Importance of Game Design — Game Loop, Software and Hardware Rendering.

Unit 2	GAME DESIGN PRINCIPLES	9

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level

design, Genres of Games, Collision Detection, Game Logic, Path Finding. Game Engine Design: Rendering, Controller based animation, collision detection, standard objects, and physics, Design Scope in Redesigning games.		
Unit 3	**GAME DEVELOPMENT**	**9**
Game development: Developing 2D and 3D interactive games using OpenGL, DirectX — Puzzle games, Single /Multi-player games-Games using HTML and Java Script, Scratch 2.0, Unity 3D - Introduction, Creating games and Designing and Coding game play systems.		
Unit 4	**GAMING PLATFORMS AND FRAMEWORKS**	**9**
Basics of Augmented Reality, Virtual Reality and Mixed Reality- Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DX Studio		
Unit 5	**GAME PROGRAMMING USING PYTHON**	**9**
Basic game objects, Getting started with cocos2d, Creating game assets, Implementing steering behaviours, Seek andflee, Arrival, Pursuit and evade Wander, Obstacle avoidance, Gravitation game, Pygame and 3D.		
		Total: 45
TEXTBOOKS		
1	Jeannie Novak, Game Development Essentials, Third Edition, Delmar Cengage Learning, ISBN-13:978-1111307653, 2011.	
2	Jeannie Novak, Game Development Essentials, Third Edition, Delmar Cengage Learning, ISBN-13:978-1111307653, 2011.	
3	Joseph Howse, Alejandro Rodas de Paz, Python Game Programming by Example, PacktPublishing,First edition, 2015.	
REFERENCES		
1	Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 3rd edition 2016.	
2	John Horton, ―Learning Java by Building Android Games‖, Packt Publishing Limited, 1st edition, 2015.	
3	Jorge Palacios, ―Unity 5.x Game AI Programming Cookbook‖, Packt Publishing Limited, 1st edition, 2016.	
COURSE OUTCOMES:		**Bloom's Taxonomy**

At the end of the course, learners will be able to		Level
CO1	Identify the need for Game programming.	K4
CO2	Have knowledge on the concepts and techniques used in Game design.	K3
CO3	Design and model interactive game.	K3
CO4	Understand the need for advanced game development platforms	K3
CO5	Design and develop games with open source components.	K5

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

AAI728-**PRINCIPLES OF BLOCK CHAIN TECHNOLOGY**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ Introduce the matrix techniques and to explain the nature of the matrix. ➢ provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in Engineering and Technology. ➢ familiarize the students with differential calculus. ➢ understand techniques of calculus which are applied in the Engineering problems. ➢ acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications						

Unit 1	HISTORY	9
Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, SignatureHash chain to Block chain-Basic consensus mechanisms		
Unit 2	**CONSENSUS PROTOCOLS**	**9**
Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.		
Unit 3	**CONSENSUS PROCESS**	**9**
Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.		
Unit 4	**BLOCK CHAIN INFSS**	**9**
Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting		
Unit 5	**BLOCK CHAIN FOR GOVERNMENT ULTIPLE INTEGRALS**	**9**
Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain		
		Total: 45

TEXTBOOKS

1	Mark Gates, "Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates 2017.
2	Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3	Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	State the basic concepts of block chain	K4
CO2	Paraphrase the list of consensus and Demonstrate and	K3

	Interpret working of Hyper ledger Fabric	
CO3	Implement SDK composer tool and explain the Digital identity for government	K3
CO4	To understand the concepts of block chain technology	K3
CO5	To understand the consensus and hyper ledger fabric in block chain technology	K5

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	1	-	-	-	1	-	-	2	3	3	1
2	3	3	3	3	1	-	-	-	2	-	-	2	3	3	1
3	3	3	3	3	2	-	-	-	3	-	-	2	3	3	3
4	3	2	3	2	3	-	-	-	3	-	-	2	3	2	3
5	3	3	2	2	1	-	-	-	1	-	-	2	3	3	
AVG	3	2.75	2.75	2.5	1.75	2.25	2	3	2.75	2	3	2.75	2.75	2.5	1.75

AAI729-**SECURITY IN CLOUD ENVIRONMENT**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to ➢ To Introduce Cloud Computing terminology, definition & concepts ➢ To understand the security design and architectural considerations for Cloud ➢ To understand the Identity, Access control in Cloud ➢ To follow best practices for Cloud security using various design patterns ➢ To be able to monitor and audit cloud applications for security						
Unit 1	**FUNDAMENTALS OF CLOUD SECURITY CONCEPTS**						**9**
Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography,							

hash functions, authentication, and digital signatures. \		
Unit 2	**SECURITY DESIGN AND ARCHITECTURE FOR CLOUD**	**9**
Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key		
Unit 3	**ACCESS CONTROL AND IDENTITY MANAGEMENT**	**9**
Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention		
Unit 4	**CLOUD SECURITY DESIGN PATTERNS**	**9**
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud		
Unit 5	**MONITORING, AUDITING AND MANAGEMENT**	**9**
Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management		
		Total: 45

TEXTBOOKS	
1	Raj Kumar Buyya , James Broberg, andrzejGoscinski, “Cloud Computing:”, Wiley 2013
2	Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013
3	Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011
REFERENCES	
1	Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011 2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

COURSE OUTCOMES: **At the end of the course, learners will be able to**		**Bloom’s Taxonomy Level**
CO1	Understand the cloud concepts and fundamentals.	K4

CO2	Explain the security challenges in the cloud.	K3
CO3	Define cloud policy and Identity and Access Management.	K3
CO4	Understand various risks and audit and monitoring mechanisms in the cloud.	K3
CO5	Define the various architectural and design considerations for security in the cloud	K5

AAI730-**NEUROMORPHIC DESIGN AND COMPUTING**							
Programme &Branch	**B.Tech& AI&DS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		7	**BS**	**3**	**0**	**0**	**3**
Preamble	The objective of the course is to 1. To provide information about neuroscientific progress towards reverse-engineering the brain 2. To provide essentials on key hardware building blocks, system level VLSI design and practical realworld applications of neuromorphic Systems **Learning Outcomes** The students are expected to have the ability to: 1. View neuromorphic computing as a computer architecture research problem 2. Perform software and hardware implementation of basic biological neural circuits						
Unit 1	**FOUNDATIONAL CONCEPTS**						**9**
Introduction to neuromorphic engineering, neuroanatomy of human brain, signaling and operation of biological neurons							
Unit 2	**NEURON MODELS**						**9**
LIF, IF, HH, synapses and plasticity rules, spike-time-dependent plasticity (STDP), biological neural circuits, non-von Neumann computing approach, learning rules, retina, cochlea. (14 Lectures)							
Unit 3	**NEUROMORPHIC COMPUTING**						**9**

Spiking Neural Networks (SNN), Advanced Nanodevices for Neuron Implementation, Synaptic emulation		
Unit 4	**MEMORY**	**9**
Non-volatile memory (NVM), Flash, RRAM, memristors, CNT, Case study on Intel's Loihi neuromorphic chip.		
Unit 5	**HARDWARE IMPLEMENTATION**	**9**
Electronic synapses, Digital/Analog neuromorphic VLSI, Hardware Implementation of Neuron circuits, Hardware Implementation of Synaptic and Learning circuits, Synaptic programming methodology optimization.		
		Total: 45

TEXTBOOKS

1	S. C. LIU (2002), Analog VLSI: Circuits and Principles, MIT Press.
2	R. KOZMA (2012), Advances in Neuromorphic Memristor Science, Springer.
3	E. KANDEL (2012), Principles of Neural Science, McGraw Hill.

OPEN ELECTIVES

AME701 - DRONE TECHNOLOGIES							
Programme &Branch	**BE& MECH**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**
Preamble	➢ To understand the basics of drone concepts. ➢ To learn and understand the fundaments of design, fabrication and programming of drone. ➢ To impart the knowledge of a flying and operation of drone. ➢ To know about the various applications of drone. ➢ To understand the safety risks and guidelines of fly safely.						
Unit 1	**INTRODUCTION TO DRONE TECHNOLOGY**						**9**
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability							
Unit 2	**DRONE DESIGN, FABRICATION AND PROGRAMMING**						**9**
Classifications of the UAV -Overview of the main drone parts- Technical characteristics -Function of the components -Assembling a drone- The energy sources- Level of autonomy- Drones configurations - The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.							
Unit 3	**DRONE FLYING AND OPERATION**						**9**
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment. Drone controls Flight operations –management tool –Sensors-Onboard storage capacity - Removable storage devices- Linked mobile devices and applications.							
Unit 4	**DRONE COMMERCIAL APPLICATIONS**						**9**
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.							
Unit 5	**FUTURE DRONES AND SAFETY**						**9**
The safety risks- Guidelines to fly safely - Specific aviation regulation and standardization- Drone							

license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.	
Total: 45	
TEXTBOOKS	
1	Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, Inc, 2021.
2	Terry Kilby and Belinda Kilby, "Make:Getting Started with Drones ",Maker Media, 1st Edition, 2016.
REFERENCES	
1	John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
2	Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Know about a various type of drone technology, drone fabrication and programming.	K2
CO2	Execute the suitable operating procedures for functioning a drone.	K3
CO3	Select appropriate sensors and actuators for Drones.	K3
CO4	Develop a drone mechanism for specific applications.	K4
CO5	Create the programs for various drones.	K6

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	2						1	2	1	3
CO2	1	2	3	1	3	2						1	2	1	3
CO3	1	2	3	1	3	2						1	2	1	3

CO4	1	2	3	1	3	2						1	2	1	3
CO5	1	2	3	1	3	2						1	2	1	3

AME702 - ADDITIVE MANUFACTURING

Programme &Branch	BE& MECH	Sem.	Category	L	T	P	C
			OE	3	0	0	3

Preamble	➢ To introduce the development, capabilities, applications, of Additive Manufacturing (AM), and its business opportunities. ➢ To be acquainted with vat polymerization and material extrusion processes ➢ To be familiar with powder bed fusion and binder jetting processes. ➢ To gain knowledge on applications of direct energy deposition, and material jetting processes. ➢ To impart knowledge on sheet lamination and direct write technologies.

Unit 1	INTRODUCTION	9

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping - Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain - ASTM/ISO 52900 Classification - Benefits - AM File formats: STL, AMF – Applications - Business Opportunities in AM.

Unit 2	VAT POLYMERIZATION AND MATERIAL EXTRUSION	9

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - top down and bottom-up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Material Extrusion: Fused Deposition Modeling (FDM) - Process-Materials -Applications and Limitations.

Unit 3	POWDER BED FUSION AND BINDER JETTING	9

Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism -Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits - Limitations -Applications.

Unit 4	MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION	9

Material Jetting: Multijet Modeling- Materials - Process - Benefits - Applications. Directed Energy Deposition: Laser Engineered Net Shaping (LENS) - Process – Material Delivery -Materials -Benefits - Applications.

Unit 5	SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY	9
Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding - Materials - Application and Limitation. Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.		
		Total: 45

TEXTBOOKS	
1	Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, "Additive manufacturing technologies", Springer Cham,3rd edition, 2021.
2	Andreas Gebhardt and Jan-Steffen Hotter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, 2016.
REFERENCES	
1	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, 1st Edition, 2012.
2	Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications", Woodhead Publishing, 1st Edition, 2016.
3	Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 2nd Edition, CRC Press, 2021.
4	Kamrani A.K. and Nasr E.A, "Rapid Prototyping: Theory and practice", Springer,2006.
5	Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A toolbox for prototype development", CRC Press, 2019.

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.	K2
CO2	Acquire knowledge on process vat polymerization and material extrusion processes and its applications.	K2
CO3	Elaborate the process and applications of powder bed fusion and binder jetting.	K2
CO4	Evaluate the advantages, limitations, applications of material jetting and directed energy deposition processes.	K2

CO5	Acquire knowledge on sheet lamination and direct write technology.	K2

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

AME703 - ELECTRIC AND HYBRID VEHICLE TECHNOLOGY

Programme &Branch	**BE& MECH**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**

Preamble

- To introduce the concept of hybrid and electric drive trains.
- To elaborate on the types and utilisation of hybrid and electric drive trains.
- To expose on different types of AC and DC drives for electric vehicles.
- To learn and utilise different types of energy storage systems.
- To introduce concept of energy management strategies and drive sizing.

Unit 1	**INTRODUCTION**	**9**

Basics of vehicle performance, vehicle power source characterization, transmission characteristics, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drivetrains on energy supplies.

Unit 2	**HYBRID ELECTRIC DRIVE TRAINS**	**9**

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drivetrains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit 3	CONTROL OF AC & DC DRIVES	9
Introduction to electric components used in hybrid and electric vehicles, Configuration, and control - DC Motor drives, Induction Motor drives, Permanent Magnet Motor drive, and Switch Reluctance Motor drives, drive system efficiency.		
Unit 4	**ENERGY STORAGE**	**9**
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Energy storage and its analysis - Battery based, Fuel Cell based, and Super Capacitor based, Hybridization of different energy storage devices.		
Unit 5	**DRIVE SIZING AND ENERGY MANAGEMENT STRATEGIES**	**9**
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selection of appropriate energy storage technology, Energy Management Strategies: Energy management strategies used in hybrid and electric vehicles, classification, and comparison of energy management strategies, Implementation issues.		
		Total: 45

TEXTBOOKS

1	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", Routledge publications, 3rdEdition, 2021
2	James Larminie and John Lowry, "Electric Vehicle Technology Explained", Wiley, 2nd Edition, 2012.

REFERENCES

1	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 3rd Edition 2018.
2	Rand D.A.J, Woods, R & Ronald Dell, "Batteries for Electric vehicles", John Wiley & Sons, 1998.
3	Jack Erjavec,"Hybrid, Electric and Fuel-Cell Vehicles", Delmar Cengage Learning, 2nd Edition, 2012.
4	Christian Paar,"Energy Management in Hybrid Electric Vehicles using Co-Simulation", VDM Verlag, 2011.
5	Yangsheng Xu,Jingyu Yan, Huihuan Qian andTin Lun Lam, "Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids", McGraw Hill Eductaion, 1st Edition, 2014.

COURSEOUTCOMES: **At the end of the course, learners will be able to**	**Bloom's Taxonomy Level**

CO1	Discuss,categorize and configure hybrid drivetrains requirement for a vehicle.	K2
CO2	Design and apply appropriate hybrid and electric drive trains in a vehicle.	K5
CO3	Design and install suitable AC and DC drives for electric vehicles.	K5
CO4	Discuss arrive at a suitable energy storage system for a hybrid / electric vehicle.	K2
CO5	Apply energy management strategies to ensure better economy and efficiency.	K3

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

AEC701 - SENSORS AND ACTUATORS

Programme&Branch	**BE& ECE**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
		-	**OE**	**3**	**0**	**0**	**3**

Preamble	The course is to make the students to list common types of sensor and actuators used in automotive vehicles.	
Unit–I	**INTRODUCTION TO MEASUREMENTS AND SENSORS**	**9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers Dynamic characteristics of first and second order transducers for standard test

Unit–II	**VARIABLE RESISTANCE AND INDUTANCE**	**9**

	SENSORS	
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers: - EI pick up and LVDT		
Unit–III	**VARIABLE AND OTHER SPECIAL SENSORS**	**9**
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magneto strictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.		
Unit–IV	**AUTOMOTIVE ACTUATORS**	**9**
Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.		
Unit–V	**AUTOMATIC TEMPERATURE CONTROL ACTUATORS**	**9**
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.		
		Total:45

TEXTBOOK:

1.	Doebelin's Measurement Systems: 7th Edition (SIE), Ernest O. DoebelinDhaneshN.Manik McGraw Hill Publishers, 2019.
2.	Robert Brandy, "Automotive Electronics and Computer System", Prentice Hall,2001
3.	William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004.
4.	Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978-3-658-01783-5

REFERENCES:

1.	James D Halderman, "Automotive Electrical and Electronics" , Prentice Hall, USA, 2013
2.	Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International.
3.	Patranabis.D, "Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd,2003
4.	William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	List common types of sensor and actuators used in vehicles	K2
CO2	Design measuring equipment's for the measurement of pressure force, temperature and flow	K4

CO3	Generate new ideas in designing the sensors and actuators for automotive application.	K3
CO4	Understand the operation of the sensors, actuators and electronic control.	K2
CO5	Design temperature control actuators for vehicles.	K4

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	1	-	-	-	-	1	1
CO2	3	3	3	2	2	-	-	1	-	-	-	-	1	1
CO3	3	3	2	2	2	-	-	1	-	-	-	-	2	2
CO4	3	3	3	3	2	-	-	1	-	-	-	-	3	2
CO5	3	2	3	3	2	-	-	1	-	-	-	-	2	2

AEC702 - APPLIED DESIGN THINKING

Programme& Branch	BE& ECE	Sem.	Category	L	T	P	C
		-	OE	3	0	0	3

Preamble	➢ This course aims to provide to make the students Introduce tools & techniques of design thinking for innovative product, development. ➢ Illustrate customer-centric product innovation using simple, use cases. ➢ Demonstrate development of Minimum usable Prototypes, Outline principles of solution concepts & their evaluation. ➢ Describe system thinking principles as applied to complex systems

Unit–I	**DESIGN THINKING PRINCIPLES**	**9**
Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] - Case studies		
Unit–II	**ENDUSER-CENTRIC INNOVATION**	**9**
Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit		
Unit–III	**APPLIED DESIGN THINKING TOOLS**	**9**
Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design		
Unit–IV	**CONCEPT GENERATION**	**9**
Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts		
Unit–V	**SYSTEM THINKING**	**9**

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems.	
Total:45	
TEXTBOOK:	
1.	Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
2.	Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
3.	Proposition Design: How to Create Products and Services Customers Want, Wiley
4.	Donella H. Meadows, (2015), "Thinking in Systems -A Primer", Sustainability Institute
5.	Tim Brown,(2012) "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business.
REFERENCES:	
1.	https://www.ideou.com/pages/design-thinking#process
2.	https://blog.forgeforward.in/valuation-risk-versus-validation-risk-in-product-innovations49f253ca86 24
3.	https://blog.forgefor ward.in/product-innovation-rubric-adf5ebdfd356 4. https
4.	https://blog.forgefor ward.in/evaluating-product-innovations-e8178e58b86e
5.	https://blog.forgeforward.in/user-guide-for-product-innovation-rubric-857181b253dd
6.	https://blog.forgeforward.in/startup-failure-is-like-true-lie-7812cdfe9b85

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Define & test various hypotheses to mitigate the inherent risks in product innovations	K2
CO2	Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.	K4
CO3	Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching	K4
CO4	Develop skills in storytelling & pitching	K3
CO5	Apply system thinking in a real-world scenario	K3

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	1	-	-	-	-	1	1
CO2	3	3	3	2	2	-	-	1	-	-	-	-	1	1
CO3	3	3	2	2	2	-	-	1	-	-	-	-	2	2
CO4	3	3	3	3	2	-	-	1	-	-	-	-	3	2
CO5	3	2	3	3	2	-	-	1	-	-	-	-	2	2

AEC703 - PROJECT REPORT WRITING

Programme&Branch	BE& ECE	Sem.	Category	L	T	P	C
		-	OE	3	0	0	3

Preamble	➢ This course aims to provide essentials of project writing, Perceive the difference between general writing and technical writing. ➢ Assimilate the fundamental features of report writing, Learn the structure of a technical and project report.

Unit–I	**9**
Writing Skills – Essential Grammar and Vocabulary – Passive Voice, Reported Speech, Concord, Signpost words, Cohesive Devices – Paragraph writing - Technical Writing vs. General Writing.	
Unit–II	**9**
Project Report – Definition, Structure, Types of Reports, Purpose – Intended Audience – Plagiarism – Report Writing in STEM fields – Experiment – Statistical Analysis.	
Unit–III	**9**
Structure of the Project Report: (Part 1) Framing a Title – Content – Acknowledgement – Funding Details -Abstract – Introduction – Aim of the Study – Background - Writing the research question - Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework.	
Unit–IV	**9**
Structure of the Project Report: (Part 2) – Literature Review, Research Design, Methods of Data Collection - Tools and Procedures - Data Analysis - Interpretation - Findings –Limitations - Recommendations – Conclusion – Bibliography.	
Unit–V	**9**
Proof reading a report – Avoiding Typographical Errors – Bibliography in required Format – Font – Spacing – Checking Tables and Illustrations – Presenting a Report Orally – Techniques.	
	Total:45

REFERENCES:

1.	Gerson and Gerson - Technical Communication: Process and Product, 7th Edition, Prentice Hall(2012)
2.	Virendra K. Pamecha - Guide to Project Reports, Project Appraisals and Project Finance(2012)
3.	Daniel Riordan - Technical Report Writing Today (1998) Darla-Jean Weatherford - Technical Writing for Engineering Professionals (2016) Penwell Publishers.

COURSEOUTCOMES: At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Write effective project reports.	K2
CO2	Use statistical tools with confidence	K2
CO3	Explain the purpose and intension of the proposed project coherently and with clarity.	K2
CO4	Create writing texts to suit achieve the intended purpose.	K2
CO5	Master the art of writing winning proposals and projects.	K2

POs/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PO12	PSO1	PSO2	PSO

COs										0					3
CO1	2	1	1	1	1	3	2	2	3	3	3	3	-	-	
CO2	2	2	2	1	1	1	2	1	2	3	2	3	-	-	
CO3	2	2	2	2	2	3	2	2	2	3	2	3	-	-	
CO4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	
CO5	3	2	3	3	3	3	3	3	3	3	3	3	-	-	

ACS701 - SYSTEMS ENGINEERING							
Programme &Branch	**B.E &CSE**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			PE	**3**	**0**	**0**	**3**
Preamble	To introduce system engineering concepts to design the manufacturing system for optimum utilization of source for effective functioning.						
UNIT I	**INTRODUCTION**					**9**	
Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cyclephases, logical steps of systems engineering, Frame works for systems engineering.							
Unit 2	**SYSTEMS ENGINEERING PROCESSES**					**9**	
Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.							
Unit 3	**ANALYSIS OF ALTERNATIVES- I**					**9**	
Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure.							
Unit 4	**ANALYSIS OF ALTERNATIVES–II**					**9**	
Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models.							
Unit 5	**DECISION ASSESSMENT**					**9**	
Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management.							
						Total: 45	
TEXTBOOKS							
1	Andrew P. Sage, James E. Armstrong Jr. “Introduction to Systems Engineering”,						

	John Wiley and Sons, Inc,2000.

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	The Student must be able to apply systems engineering principles to make decision for optimization.	K2
CO2	Hence an understanding of the systems engineering discipline and be able to use the core principles and processes for designing effective system.	K2
CO3	Analyze the various method to impact on system engineering	K2
CO4	Decision capabilities identified with various analysis.	K2
CO5	Management the system based on decision results.	K2

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	-	-	-	3	2	2	2	2	2	2
CO2	2	3	2	1	1	-	-	-	3	2	3	2	2	2	2
CO3	2	3	2	2	2	-	-	-	-	-	-	2	2	3	2
CO4	2	-	-	2	3	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	3	3	-	1	2	3	2	1	3	2	3	-

ACS702- GREEN COMPUTING

Programme &Branch	**B.E & CSE**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**

Preamble	➢ To learn the fundamentals of Green Computing. ➢ To analyze the Green computing Grid Framework. ➢ To understand the issues related with Green compliance. ➢ To study and develop various case studies.

UNIT I	**FUNDAMENTALS**	**9**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Unit 2	GREEN ASSETS AND MODELING	9
Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models		
Unit 3	**GRID FRAMEWORK**	**9**
Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.		
Unit 4	**GREEN COMPLIANCE**	**9**
Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future. .		
Unit 5	**CASE STUDIES**	**9**
The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.		
		Total: 45

TEXTBOOKS	
1	Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2014
2	Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.
REFERENCES	
1	Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011.
2	John Lamb, "The Greening of IT", Pearson Education, 2009.
3	Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008
4	.Carlspeshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010. 5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment	K2
CO2	Enhance the skill in energy saving practices in their use of hardware.	K2

CO3	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.	K2
CO4	Understand the ways to minimize equipment disposal requirements.	K2
CO5	Discuss briefly about the use cases in various applications.	K2

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2						2		2			2	2	
CO2		2		2	2	2							3	2	
CO3				2		2							3	2	3
CO4	3	2			2			2	2	2	2		3	2	3
CO5		2	3	2			1					1		2	

ACS703 - FINTECH REGULATION							
Programme &Branch	**B.E & CSE**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**
Preamble	➢ To learn about Laws and Regulation ➢ To acquire the knowledge of Regulations of Fintech firm and their role in Market						
UNIT I	**INTRODUCTION**						**9**
The Role of the Regulators, Equal Treatment and Competition, Need for a regulatory assessment of Fintech, India Regulations, The Risks to Consider, Regtech and SupTech, The rise of TechFins, Regulatory sandboxes, compliance and whistle blowing							
Unit 2	**INNOVATION AND REGULATION**						**9**
The technology, market and the law, Regulation and Innovation in Banking and Finance, Regulations of Fintech Firms and their role in Market-Based Chains, Current Regulatory Approach, Fintech Innovations in Banking, Asset Management, Insurance, Pensions and Healthcare Schemes, Patentability of FinTech inventions.							
Unit 3	**CROWDFUNDING AND DIGITAL ASSETS**						**9**
Types of crowd funding, The Jobs Act, Regulation crowd funding, Regulation A+, Regulation D crowd funding, Intrastate offerings, Digital Assets – Three uses of Digital Assets, A world of Altcoins, Stablecoins, Digital Asset Forks, Initial Coin Offerings, Regulatory Framework for Digital and Crypto							

Assets, Central Bank Digital Currencies		
Unit 4	**MARKETPLACE LENDING AND MOBILE PAYMENTS**	**9**
Online Lending Business Models, Payday Loans, Consumer Protection Laws, Debt Collection, Equal Credit Opportunity Act, Contract Formation and the E-Sign Act, Military Lending Act, Securities Laws Considerations, Mobile Devices, Payment Cards and the Law, Truth in Lending Act and Regulation Z, Card Act, Electronic Fund Transfer Act and Regulation E, Fair Credit Reporting Act, Federal Bank Secrecy Act, State Money Transmitter Laws.		
Unit 5	**ANTI-MONEY LAUNDERING AND CYBERSECURITY**	**9**
Reporting requirements under the Bank Secrecy Act, Patriot Act, Panalties for violating the BSA, Virtual currencies and the Bank Secrecy Act, Cybersecurity Frameworks, Cybersecurity Act of 2015, Contractual and Self Regulatory obligations		
		Total: 45

REFERENCES

1	JelenaMadir, FinTech – Law and Regulation, Edward Elgar Publishing Limited, 2019
2	Valerio Lemma, Fintech Regulation: Exploring New Challenges of the Capital Markets Union, Palgrave Macmillan, 2020
3	Chris Brummer, Fintech Law in a Nutshell, West Academic Publishing, 2020
4	Bernardo Nicoletti, The Future of Fintech, Integrating Finance and Technology in Financial Services, Springer Nature, 2017
5	Kevin C. Taylor, FinTech Law: A Guide to Technology Law in the Financial Services Industry, BNA Books, 2014
6	Lee Reiners, FinTech Law and Policy, 2018

COURSEOUTCOMES: **At the end of the course, learners will be able to**		**Bloom's Taxonomy Level**
CO1	Understand the role that financial regulation plays in key FinTech developments such as mobile payments, crowdfunding, crypto assets, private digital currencies, and decentralized finance.	K2
CO2	Know the role that law and technology play in facilitating international transactions such as syndicated lending and international bond issues.	K2
CO3	Be able to critically engage with the major theoretical legal debates surrounding international financing,	K2

	financial markets and financial technology.	
CO4	Be able to deal with policy arguments on international financing, financial markets and financial technology law	K2
CO5	Demonstrate ability to apply critical and contextual approaches to the developing legal issues emanating from international financing, regulation of financial markets and financial technology.	K2

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2						2		2			2	2	
CO2		2		2	2	2							3	2	
CO3				2		2							3	2	3
CO4	3	2			2			2	2	2	2		3	2	3
CO5		2	3	2			1					1		2	

AMB701-CORPORATE GOVERNANCE							
Programme& Branch	**MBA**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OEC	**3**	**0**	**0**	**3**
Preamble	➢ To understand the concepts, need and importance of Corporate Governance. ➢ To understand the relationship between Business, government and Society. ➢ To provide the learners with different organization structures. ➢ To provide the learners to integrate with business and society. ➢ To formulate and execute the plans at various levels of management.						
Unit 1	**CORPORATE GOVERNANCE**						**9**
Corporate governance: The concept, need and importance of corporate governance, The role and purpose of the corporation, separation of ownership and control, benefits of good corporate governance, OECD (Organization for economic co-operation and development) on corporate governance, Theoretical basis for corporate governance, environmental Concerns and Corporations, environmental preservation-role of stakeholders, sustainable development, industrial pollution, role of corporate in environmental management, waste management, pollution control and environmental audit.							
Unit 2	**BUSINESS, GOVERNMENT AND SOCIETY**						**9**

An introduction to Business, Government, and Society: The Connect between Business, Government, and Society, Importance of BGS relationship in management, models of BGS relationships-Market capitalism model, dominance model, countervailing forcer's model and stakeholder model.		
Unit 3	**BUSINESS STRUCTURES**	**9**
Business structures: Meaning and nature of business structures, types, nature, advantages, limitations and applicability of - single ownership, partnerships, private limited companies, public limited companies, co-operative societies.		
Unit 4	**BUSINESS ETHICS AND CSR**	**9**
Business Ethics and Corporate Social Responsibility: Meaning of business ethics, need and purpose, importance, approaches to business ethics, roots of unethical behavior, ethical decision making some unethical issues, benefits from managing ethics at workplace. Nature of CSR, arguments for and against CSR, models of CSR, best practices of CSR-Indian examples.		
Unit 5	**BOARD OF DIRECTORS**	**9**
Roleof Board of Directors in Corporate Governance, Corporate board of Management, structure and composition of the board, Types of board and directors,Size of theboard,Powers of the board of directors, responsibilities,functionsof the board, code of conduct for board members,trainingfor the board of directors, effectiveness of theboard members, effectiveness and powers of the board.		
		Total: 45

REFERENCE BOOK

1	Corporate Governance: Principles, policies and Practices by Fernando A.c. Pub: Pearson, 2014.
2	Business and Government by Francis Cherunilam, Pub: Himalayan Publishing House.
3	Corporate Governance, Ethics & Social Responsibility by Balachandran C.H, Pub: PHI Pvt Ltd, 2015.
4	Business Ethics and Corporate Governance: Ghosh B.N., TMH, 2015

COURSE OUTCOMES: At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Understand to connect between the corporate, ethics and society.	K1
CO2	Decide about the appropriateness of various business structures.	K2
CO3	Understand the need for and importance of corporate governance with reference to Environment protection	K3
CO4	Make the students to understand the essence of business and how business could be mutually beneficial to the businessman and the society.	K4
CO5	Decide on the role and functions of Board of Directors in an Organization.	K5

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

AMB702- DIGITAL MARKETING

Programme& Branch	**MBA**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**

Preamble	➢ To understand the concepts of Digital Marketing. ➢ To understand the Online Advertising and SEO. ➢ To analyse the Social media and email Marketing. ➢ To evaluate the concepts of email marketing. ➢ To formulate mobile marketing and e-marketing strategies.

Unit 1	**OVERVIEW OF DIGITAL MARKETING**	**9**

Digital marketing overview and meaning- benefits – platform & strategies- comparing digital with traditional marketing- latest digital marketing trends- case studies of digital marketing trends. Content Marketing, Handling Traffic.

Unit 2	**ONLINE ADVERTISING AND SEO**	**9**

Internet and Search Engine Basics, online Advertising, Importance of online Advertising, Types of online Marketing and advertising Methods. Importance of Search Engines, How the search engine works, Understanding the SERP, Using Search Operators, Search Engine Algorithms.

Unit 3	**SOCIAL MEDIA AND EMAIL MARKETING**	**9**

What is Social Media, SMM Vs. SMO, Benefits of using SMM, Social Media Strategy, and Impact of Social Media on SEO. Marketing strategy, Benefits, Promotional tools for- Facebook, YouTube, Twitter, Google, Linkedn.Email Marketing- Email Marketing concept, Importance, Popular Email Marketing Softwares, Email Marketing Goals and strategies, Types of Email marketing campaigns, Creating an Email Campaign, What is Newsletter, Design a Newsletter. Micro Blogging.

Unit 4	**E COMMERCE**	**9**

Ecommerce Business Planning, eCommerce Website, Product Placements, Product Grouping, Promoting eCommerce Website, Remarketing Products: Re-Marketing Flow, Email, Facebook Re-Marketing. Understanding Coupon System, Appointing Affiliates for Products, Cross/Up/Down Selling, Introduction to payment gateway- Application and Documentation.

Unit 5	**MOBILE MARKETING AND REMARKETING**	**9**

Overview of the B2B and B2C Mobile Marketing, Mobile Sites, Apps (Applications) and Widgets and their relevant to marketing, opportunities and pitfalls of Mobile Marketing, user interfaces and architectures. Trends in Mobile social media, Mobile Commerce, Mobile Payments and Billing, integration of mobile marketing into marketing plan.

	Total: 45
REFERENCE BOOK	
1	Digital Marketing: Strategy, Implementation & Practice, Dave Chaffey & Fiona Ellis-Chadwick, 2019
2	Convert!: Designing Websites For Traffic and Conversions, Ben Hunt, 2020
3	The Social Media Bible: Tactics, Tools, & Strategies for Business Success, Lon Safko, 2018
4	Digital Marketing: Strategies for Online Success ,Godfrey Parkin, 2015
5	Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Damian Ryan, 2018

COURSE OUTCOMES: At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.	K1
CO2	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, email and social media.	K2
CO3	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan.	K3
CO4	Explore the concepts of Remarketing strategies	K4
CO5	Develop various payment and billing gateways in digital marketing.	K5

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

AMB703- RURAL MARKETING							
Programme& Branch	**MBA**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**

Preamble	➢ To understand the concepts of Rural Marketing ➢ To understand the types of Agricultural products for marketing. ➢ To analyse the issues in Rural Marketing. ➢ To evaluate the Rural Marketing Regulations. ➢ To formulate the strategies to satisfy rural consumers.	
Unit 1	**INTRODUCTION TO RURAL MARKETING**	**9**
Concept- Nature- Scope- Significance of Rural Marketing- Factors contributing to Growth of rural markets -Components and classification of Rural markets- Rural Market VS Urban Market- e.rural marketing.		
Unit 2	**AGRICULTURAL MARKETING**	**9**
Concept-Nature and Types of Agriculture produce- concept and types of Agricultural Markets-Marketing channels -Methods of Sales - Market functions		
Unit 3	**ISSUES IN RURAL MARKETING**	**9**
Rural Consumer behaviour- features- factors influencing- Lifestyle of rural consumer - FMCG sector in Rural India- concept and classification of consumer goods- Marketing Channels for FMCG – Fast growing FMCG -Marketing of consumer durables- The role of Advertising.		
Unit 4	**RURAL MARKETING AND MARKETING REGULATION**	**9**
Regulated Market- APMC Act 1963- Model bill Standardization and Grading - Inspection of quality control -Inspection of AGMARK - Indian Standers and Grade Specifications- Food Products order (FPO) 1955 –Consumer Protection Act 1986. The National Council for State Marketing Boards (NCOSAMB) State Trading corporation (STC), Public Distribution System (PDS).		
Unit 5	**INSTITUIONAL SUPPORT TO RURAL MARKETING**	**9**
Commission on Agriculture Costs and Prices (CACP), National Agriculture Co-operative Marketing Federation (NAFED), Agriculture and Processed Food Exports Development Authority (APEDA)		
		Total: 45

REFERENCE BOOK

1	Badi R.V. Badi N.V.Rural MarketingHimalaya Publishing House – 2010
2	Rural Marketing- GopalaswamyVikas Publishing House, 2020.
3	Kashyp Pradeep, Rant Siddhartha The Rural Marketing,Biztantra, 2015.
4	Mishra and Puri Development Issues of Indian EconomyHimalaya Publishing House, 2018

COURSE OUTCOMES: At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Understand the concepts of Rural Marketing	K1
CO2	Understand the nature of Rural Consumer Behaviour	K2
CO3	Analyse the nature of marketing rural products	K3
CO4	**Identify the problems and issues in Rural Marketing**	K4
CO5	**Formulate the marketing strategies to satisfy the rural consumers.**	K5

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

AIT701 -NETWORKING ESSENTIALS							
Programme &Branch	**B.Tech&IT**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
			OE	**3**	**0**	**0**	**3**
Preamble	➢ Understand the division of network functionalities into layers. ➢ Be familiar with the components required to build different types of networks ➢ Be exposed to the required functionality at each layer ➢ Learn the flow control and congestion control algorithms. ➢ Learn the Classifythevarioussoftcomputingframeworks						
UNIT I	**FUNDAMENTALS & LINK LAYER**						**9**
Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control							
Unit 2	**MEDIA ACCESS & INTERNETWORKING**						**9**
Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)							
Unit 3	**ROUTING**						**9**
Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM), Unicast Routing Algorithms							
Unit 4	**TRANSPORT LAYER**						**9**
Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements							
Unit 5	**APPLICATION LAYER**						**9**
Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP, Telnet –SSH							
							Total: 45
TEXTBOOKS							

1	Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2	Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCES

1	James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009
2	Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010
3	Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”,McGraw Hill Publisher, 2011
4	Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.

COURSEOUTCOMES:

At the end of the course, learners will be able to		**Bloom’s Taxonomy Level**
CO1	Identify the components required to build different types of networks	K2
CO2	Choose the required functionality at each layer for given application	K3
CO3	Identify solution for each functionality a t each layer	K1
CO4	Trace the flow of information from one node to another node in the network.	K2
CO5	Design protocols for various functions in the network and understand the working of various application layer protocols	K2

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

AIT702 -SOFTCOMPUTINGMETHODOLOGIES

Programme &Branch	B.Tech& IT	Sem.	Category	L	T	P	C
			OE	3	0	0	3

Preamble	➢ Classifythevarioussoftcomputingframeworks ➢ Befamiliarwiththedesignofneuralnetworks,fuzzylogicandfuzzy systems ➢ Learnmathematicalbackgroundforoptimizedgeneticprogramming ➢ Beexposedtoneuro-fuzzyhybridsystemsanditsapplications

UNIT I	INTRODUCTIONTOSOFTCOMPUTING	9

Soft Computing Constituents-From Conventional AI To Computational Intelligence- Artificial Neural Network: Introduction, Characteristics- Evolution Of Neural Networks - Basic Models - Important Technologies - Applications. Fuzzy Logic: Introduction - Crisp Sets- Fuzzy Sets - Crisp Relations And Fuzzy Relations: Cartesian Product Of Relation - Classical Relation, Fuzzy Relations, Tolerance And Equivalence Relations. Genetic Algorithm-Introduction - Biological Background - Traditional Optimization And Search Techniques – Genetic Basic Concepts.

Unit 2	NEURALNETWORKS	9

Mcculloch-Pitts Neuron - Linear Separability - Hebb Network - Supervised LearningNetwork:PerceptronNetworks-AdaptiveLinearNeuron,Multiple Adaptive Linear Neuron, BPN, RBF - Associative Memory Network: Auto- Associative Memory Network, Hetero-Associative Memory Network, Hopfield Networks, Iterative Auto Associative Memory Network – Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps, LVQ – CP Networks,ARTNetwork.

Unit 3	FUZZYLOGIC	9

Membership Functions: Features, Fuzzification, Methods Of Membership Value Assignments- Defuzzification: Lambda Cuts - Methods - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Arithmetic - Extension Principle - Fuzzy Measures - Measures Of Fuzziness -Fuzzy Integrals - Fuzzy Rule Base And Approximate Reasoning : Truth Values And Tables, Fuzzy Propositions, Formation Of Rules-Decomposition Of Rules, Aggregation Of Fuzzy Rules, Fuzzy Reasoning-Fuzzy Inference Systems Overview Of Fuzzy Expert System- FuzzyDecisionMaking

Unit 4	GENETIC ALGORITHM	9

Genetic Algorithm- Operators – Encoding Scheme – Fitness Evaluation –Crossover - Mutation – Classification Of Gnetic Algorithms- Genetic Programming –Advances In GA .

Unit 5	HYBRIDSOFTCOMPUTINGTECHNIQUES&APPLICATIONS	9

Neuro-FuzzyHybridSystems-GeneticNeuroHybridSystems-GeneticFuzzy Hybrid And Fuzzy Genetic Hybrid Systems - Simplified Fuzzy ARTMAP - Applications: A Fusion Approach Of Multispectral Images With SAR, Optimization Of Traveling Salesman Problem Using Genetic Algorithm Approach, Soft Computing Based Hybrid Fuzzy Controllers.

	Total: 45
TEXTBOOKS	
1	S.N.SivanandamandS.N.Deepa,"PrinciplesofSoftComputing",Wiley IndiaPvt.Ltd,2011
2	J.S.R.Jang,C.T.SunandE.Mizutani,"Neuro-FuzzyandSoftComputing",PHI
REFERENCES	
1	S.RajasekaranandG.A.VijayalakshmiPai,"NeuralNetworks,FuzzyLogic andGeneticAlgorithm:Synthesis&Applications",Prentice-HallofIndia Pvt.Ltd.,2006.
2	GeorgeJ.Klir,UteSt.Clair,BoYuan,"FuzzySetTheory:Foundationsand Applications"PrenticeHall,1997.
3	David E. Goldberg, "Genetic Algorithm in Search Optimization and MachineLearning"PearsonEducationIndia,2013.
4	James A. Freeman, David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.

COURSEOUTCOMES:

At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Applyvarioussoftcomputingconceptsforpracticalapplications	K2
CO2	Chooseanddesignsuitableneuralnetworkforrealtimeproblems	K2
CO3	Usefuzzyrulesandreasoningtodevelopdecisionmakingandexpert system	K2
CO4	Explaintheimportanceofoptimizationtechniquesandgeneticprogramming	K2
CO5	Review the various hybrid soft computing techniques and apply in real timeproblems	K2

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

AIT703 -KNOWLEDGEENGINEERING

Programme &Branch	B.Tech& IT	Sem.	Category	L	T	P	C
			OE	3	0	0	3

Preamble	➢ To understand the basics of Knowledge Engineering. ➢ To discuss methodologies and modeling for Agent Design and Development. ➢ To design and develop ontologies. ➢ To apply reasoning with ontologies and rules. ➢ To understand learning and rule learning

UNIT I	REASONING UNDER UNCERTAINTY	9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning-Knowledge Engineering.

Unit 2	METHODOLOGY AND MODELING	9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

Unit 3	ONTOLOGIES – DESIGN AND DEVELOPMENT	9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.

Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

Unit 4	REASONING WITH ONTOLOGIES AND RULES	9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

Unit 5	LEARNING AND RULE LEARNING	9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning

Total: 45

TEXTBOOKS

1	Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5

	Chapter 8, 9)
2	JiaweiHanandMichelineKamber,"DataMiningConceptsandTechniques",ThirdEdition, Elsevier,2012.
REFERENCES	
1	Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2	Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3	Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.
4	Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001

COURSEOUTCOMES:

At the end of the course, learners will be able to		**Bloom's Taxonomy Level**
CO1	Understandthebasics of KnowledgeEngineering.	K2
CO2	ApplymethodologiesandmodellingforAgent DesignandDevelopment.	K3
CO3	Designanddevelopontologies.	K3
CO4	Applyreasoning withontologiesandrules.	K3
CO5	Understandlearningandrulelearning.	K2

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

ACB701 - BUSINESS RESEARCH METHODS							
Programme &Branch	**B.TECH& CSBS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
Prerequisites			**OE**	**3**	**0**	**0**	**3**
Preamble	➢ To make the students of tourism understand the principles of scientific methodology in business enquiry, develop analytical skills of business research and to prepare scientific business reports.						
UNITI	**INTRODUCTION**						**9**
Business Research – Definition and Significance – the research process – Types ofResearch – Exploratory and causal Research – Theoretical and empirical Research –Cross–Sectional and time – series Research – Research questions / Problems – Researchobjectives – Research hypotheses – characteristics – Research in an evolutionaryperspective – the role of theory in research.							
UNITII	**RESEARCH DESIGN AND MEASUREMENT**						**9**

Research design – Definition – types of research design – exploratory and causalresearchdesign – Descriptive and experimental design – different types of experimentaldesign – Validity of findings – internal and external validity – Variables in Research –Measurement and scaling – Different scales – Construction of instrument – Validity andReliability of instrument.		
UNITIII	**DATA COLLECTION**	**9**
Types of data – Primary Vs Secondary data – Methods of primary data collection –Survey Vs Observation – Experiments – Construction of questionnaire and instrument –Types of Validity – Sampling plan – Sample size – determinants optimal sample size –sampling techniques – Sampling methods		
UNITIV	**DATA PREPARATION AND ANALYSIS**	**9**
Data Preparation – editing – Coding –Data entry – Validity of data – Qualitative VsQuantitative data analyses – Applications of Bivariate and Multivariate statisticaltechniques, Factor analysis, Discriminant analysis, Cluster analysis, Multiple regressionand Correlation, Multidimensional scaling – Conjoint Analysis – Application of statisticalsoftware for data analysis.		
UNITV	**REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH**	**9**
Research report –Types – Contents of report – need for executive summary –chapterization – contents of chapter – report writing – the role of audience – readability –comprehension –tone – final proof – report format – title of the report – ethics in research– Ethics in research Subjectivity and Objectivity in research.		
		Total:45Periods

TEXTBOOK:

1.	Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods,11th Edition, Tata Mc Graw Hill, New Delhi, 2012.

REFERENCES:

1.	Alan Bryman and Emma Bell, Business Research methods, 3rd Edition, Oxford University Press, New Delhi, 2011.
2.	Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, WileyIndia, New Delhi, 2012.
3	William G Zikmund, Barry J Babin, Jon C.Carr, AtanuAdhikari,Mitch Griffin, BusinessResearch methods, A South Asian Perspective, 8th Edition, Cengage Learning, NewDelhi, 2012.
4	Panneerselvam. R, Research Methodology, 2nd Edition, PHI Learning, 2014.

COURSEOUTCOMES: Uponsuccessfulcompletion ofthecoursethestudentwillbeableto		**Bloom'sTaxonomy Level**
CO1	Understand and appreciate the scientific inquiry	K2
CO2	Undertake a systematic outlook towards business situations for the purpose of objective decision making.	K3
CO3	Ability to conduct a scientific inquiry to solve organizational problems	K3
CO4	Analyze data and find solutions to the problems.	K3
CO5	Prepare research reports	K4

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

ACB702 - AUTOMATION TESTING TOOLS

Programme &Branch	B.TECH& CSBS	Sem.	Category	L	T	P	C
Prerequisites			OE	3	0	0	3

Preamble

- To understand the basics of software testing and test planning
- To build test cases and execute them
- To focus on automation testing using selenium
- To automate the testing using TestNG
- To get an insight about test automation using Cucumber

UNITI **INTRODUCTION TO SOFTWARE TESTING AND TEST PLANNING** **9**

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing-Performance Testing-The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNITII **TEST DESIGN AND EXECUTION** **9**

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

UNITIII **SELENIUM** **9**

me browsers, Identifying WebElements using id, name, linkname, class, xpath, tagname- Handling Input box/buttons, list/selection/drop down boxes, radio buttons, check boxes- Extracting links and other Web-Elements-Extracting Data from WebTable-Capturing screenshots-Handling pop-ups, frames, and windows- Exceptions in Selenium -Data driving from csv and excel using Java APIs-Debugging Tests-Page Object Model

UNITIV **TESTNG** **9**

Introduction to TestNg-Advantages over Junit-Annotations in TestNg-Understand and Read TestNg Reports-Testng and its configuration-Grouping the testcases, Exclusion of groups, Partial Groups -TestSuite.xml/Suite creation-Types of parameterization-Parameter from TestNg.xml (pass value at Suite and Test level)-Assertion,Verification

UNITV **CUCUMBER** **9**

Introduction to Behavior Driven Development(BDD)-BDD framework using Cucumber-Preparing selenium and cucumber environment -creating a feature files using Gherkins and Gherkin syntax-writing features and scenario, Given – When -Then structure -Writing glue code -Cucumber and Java step definitions-writing step definition/ implementing scenarios steps-Cucumber data driven testing

Total:45Periods

TEXTBOOK:	
1.	Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2.	Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018
REFERENCES:	
1.	Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2.	Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3	Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4	Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing

COURSEOUTCOMES: Uponsuccessfulcompletion ofthecoursethestudentwillbeableto		**Bloom’sTaxonomy Level**
CO1	Understand the basic concepts of software testing and test planning. Understand	K2
CO2	Design effective test cases that can uncover critical defects in the application.	K3
CO3	Automate the software testing using Selenium Apply	K3
CO4	Automate the software testing using TestNG Apply	K3
CO5	Automate the software testing using Cucumber	K3

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

ACB703 - SOCIAL NETWORK ANALYSIS

Programme &Branch	**B.TECH& CSBS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
Prerequisites		**-**	**OE**	**3**	**0**	**0**	**3**

Preamble	➢ To understand the concept of semantic web and related applications. ➢ To learn knowledge representation using ontology. ➢ To understand human behaviour in social web and related communities. ➢ To learn visualization of social networks.	
UNITI	**INTRODUCTION**	**9**
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic		

discussion networks, Blogs and online communities - Web-based networks -Applications of Social Network Analysis.		
UNITII	**MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION**	**9**
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation -Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations		
UNITIII	**EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS**	**9**
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detectingcommunities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.		
UNITIV	**PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES**	**9**
Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context -Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.		
UNITV	**VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS**	**9**
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.		
		Total:45Periods

TEXTBOOK:

1.	Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

REFERENCES:

1.	GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.
2.	Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4.	John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009

COURSEOUTCOMES: Uponsuccessfulcompletion ofthecoursethestudentwillbeableto		**Bloom'sTaxonomy Level**
CO1	Develop semantic web related applications.	K4

CO2	Represent knowledge using ontology.	K3
CO3	Predict human behaviour in social web and related communities.	K4
CO4	Visualize social networks.	K3

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

AAI701 - DRINKING WATER SUPPLY AND TREATMENT							
Programme &Branch	**B.TECH& AIDS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
Prerequisites			**OE**	**3**	**0**	**0**	**3**

Preamble	To equip the students with the principles and design of water treatment units and distribution system.	
UNIT I	**SOURCES OF WATER**	**9**
Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.		
UNIT II	**CONVEYANCE FROM THE SOURCE**	**9**
Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.		
UNIT III	**WATER TREATMENT**	**9**
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –- sand filters - Disinfection -– Construction, Operation and Maintenance aspects		
UNIT IV	**ADVANCED WATER TREATMENT**	**9**
Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects.		
UNIT V	**WATER DISTRIBUTION AND SUPPLY**	**9**
Requirements of water distribution – Components – Selection of pipe material – Service reservoirs - Functions – Network design – Economics - Computer applications – Appurtenances – Leak detection - Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.		
		Total:45Periods

TEXTBOOK:	
1.	Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2008.
2.	Punmia B.C, Arun K.Jain, Ashok K.Jain, " Water supply Engineering" Lakshmi publication private limited, New Delhi, 2016
3.	Rangwala "Water Supply and Sanitary Engineering", February 2022 4. Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 2018
REFERENCES:	
1.	Fair. G.M., Geyer.J.C., "Water Supply and Wastewater Disposal", John Wiley and Sons, 1954.
2.	Babbit.H.E, and Donald.J.J, "Water Supply Engineering" , McGraw Hill book Co, 1984.
3	Steel. E.W.et al., "Water Supply Engineering" , Mc Graw Hill International book Co, 1984.
4	Duggal. K.N., "Elememts of public Health Engineering", S.Chand and Company Ltd, New Delhi, 1998.

COURSEOUTCOMES: **Upon successful completion of the course the student will be able to**		**Bloom'sTaxonomy Level**
CO1	An understanding of water quality criteria and standards, and their relation to public health	K2
CO2	The ability to design the water conveyance system 247	K3
CO3	The knowledge in various unit operations and processes in water treatment	K3
CO4	An ability to understand the various systems for advanced water treatment	K3
CO5	An insight into the structure of drinking water distribution system	K4

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

AAI702 -GEOGRAPHICAL INFORMATION SYSTEM							
Programme &Branch	**B.TECH& AIDS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
Prerequisites			**OE**	**3**	**0**	**0**	**3**

Preamble	➢ To impart the knowledge on basic components, data preparation and implementation of Geographical Information System. To build test cases and execute them	
UNIT I	**FUNDAMENTALS OF GIS**	**9**
Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.		
UNIT II	**SPATIAL DATA MODELS**	**9**
Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.		
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitizer – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration		
UNIT IV	**DATA QUALITY AND STANDARDS**	**9**
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructur		
UNIT V	**DATA MANAGEMENT AND OUTPUT**	**9**
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GISdistributed GIS.		
		Total:45Periods

TEXTBOOK:

1.	Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2.	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCES:

1.	Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

COURSEOUTCOMES: On completion of the course, the student is expected to		**Bloom’sTaxonomy Level**
CO1	Have basic idea about the fundamentals of GIS.	K2
CO2	Understand the types of data models..	K3
CO3	Get knowledge about data input and topology	K3
CO4	Gain knowledge on data quality and standards	K3
CO5	Understand data management functions and data output	K3

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

AAI703 -IT IN AGRICULTURAL SYSTEM							
Programme &Branch	**B.TECH& AIDS**	**Sem.**	**Category**	**L**	**T**	**P**	**C**
Prerequisites			**OE**	**3**	**0**	**0**	**3**

Preamble	➢ To introduce the students to areas of agricultural systems in which IT and computers play a major role. ➢ To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models	
UNIT I	**PRECISION FARMING**	**9**
Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.		
UNIT II	**ENVIRONMENT CONTROL SYSTEMS**	**9**
Artificial light systems, management of crop growth in greenhouses, simulation of CO_2 consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.		
UNIT III	**AGRICULTURAL SYSTEMS MANAGEMENT**	**9**
Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.		
UNIT IV	**WEATHER PREDICTION MODELS**	**9**
Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.		
UNIT V	**E-GOVERNANCE IN AGRICULTURAL SYSTEMS**	**9**
Expert systems, decision support systems, Agricultural and biological databases, e-commerce, business systems & applications, Technology enhanced learning systems and solutions, eLearning, Rural development and information society		
		Total:45 Periods

TEXTBOOK:

1.	National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2.	H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.

REFERENCES:

1.	Peart, R.M., and Shoup, W. D., "Agricultural Systems Management", Marcel Dekker, New York, 2004.

2.	Hammer, G.L., Nicholls, N., and Mitchell, C., “Applications of Seasonal Climate”, Springer, Germany, 2000.

COURSEOUTCOMES: Uponsuccessfulcompletion ofthecoursethestudentwillbeableto		**Bloom’sTaxonomy Level**
CO1	The students shall be able to understand the applications of IT in remote sensing applications such as Drones etc	K1
CO2	The students will be able to get a clear understanding of how a greenhouse can be automated and its advantages.	K2
CO3	The students will be able to apply IT principles and concepts for management of field operations	K4
CO4	The students will get an understanding about weather models, their inputs and applications.	K1
CO5	The students will get an understanding of how IT can be used for e-governance in agriculture	K4

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