Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR
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शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४. २६०९४८७
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SU/BOS/Sci & Tech/ 183 **Date: 10/06/2026**

The Principal / Director,
All Concerned Affiliated Colleges / Institutions,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech.** degree **Programme (Affiliated Colleges)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. degree programme under the Faculty of Science & Technology as per National Education Policy 2020 (NEP 2020).

Sr. No.	B. Tech Course Syllabus	
1	Civil Engineering	Part-III
2	Mechanical Engineering	Part-III
3	Mechanical and Mechatronic Engineering (Additive Manufacturing)	Part-III
4	Electrical Engineering	Part-III
5	Electrical and Computer Engineering	Part-III
6	Electronics and Telecommunication Engineering	Part-III
7	Electronics & Computer Science Engineering	Part-III
8	Computer Science and Engineering	Part-III
9	Computer Science and Engineering (Artificial Intelligence & Machine Learning) (AIML)	Part-III
10	Computer Science and Engineering (Data Science) (DS)	Part-III
11	Computer Science and Engineering (Artificial Intelligence & Data Science) (AIDS)	Part-III
12	Electronics and communication Engineering (Bio-Medical Engineering)	Part-II

This Syllabus, nature of question and equivalence shall be implemented from the academic year **2026-27** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in>Syllabus>Syllabus as per NEP-2020.**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2026 & March / April 2027. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	7	Appointment A & B Section
2	Director, Board of Examinations & Evaluation	8	Affiliation (T.1) (T.2) Section
3	The Chairperson, Respective Board of Studies	9	P.G.Admission Section,
4	Other Exam 4 Section,	10	P.G Seminar Section
5	Eligibility Section,	11	Computer Centre/ IT Cell
6	Internal Quality Assurance Cell (IQAC)		

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Shivaji University
Kolhapur

Revised Syllabus
as per
National Education Policy-2020
(NEP-2.0)

T. Y. B. Tech.

Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

To be Implemented from

Academic Year 2026-27

शिवाजी विद्यापीठ, कोल्हापूर
SHIVAJI UNIVERSITY, KOLHAPUR

SCHEME OF INSTRUCTIONS & SYLLABI

Exit Course for Computer Science and Engineering After 2nd Year

- **As part of the NEP 2020 Revised Syllabus, for the First Year B. Tech Exit, students must earn a total of 8 additional credits. This includes 6 credits from online SWAYAM NPTEL courses and 2 credits from Virtual Lab performance.**
- **Students must complete two SWAYAM NPTEL courses (12-week duration) from the provided list and successfully perform two Virtual Labs from the specified list.**
- **Each SWAYAM NPTEL course carries 3 credits, while each Virtual Lab is worth 1 credit.**

Sr. No.	Name of NPTEL Course
1	Artificial Intelligence: Knowledge Representation And Reasoning
2	Cryptography and Network Security
3	Computer Vision And Image Processing - Fundamentals And Applications

Sr. No.	Name of Virtual Lab
1	Data Analytics with Python
2	Programming In Java

SCHEME OF INSTRUCTION & SYLLABI

Programme Computer Science and Engineering (AIML)

Scheme of Instructions: Third Year B. Tech. Computer Science and Engineering (AIML)

Semester – V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	AIML3101	Computer Algorithms	3	--	--	3	3	30	10	60	100
2	PCC	AIML3102	Machine Learning using Advanced Python	2	--	--	2	2	30	10	60	100
3	PCC	AIML3103	Information Security	3	--	--	3	3	30	10	60	100
4	PEC	AIML3104	Elective-I	3	--	--	3	3	30	10	60	100
5	MDM	AIML3105	Multi-disciplinary Minor – 03	3	--	--	3	3	30	10	60	100
6	OE	AIML3106	Open Elective -03	2	--	--	2	2	30	10	60	100
7	PCC	AIML3107	Computer Algorithm Lab	--	1	--	1	1	-	25	25	50
8	PCC	AIML3108	Machine Learning using Advanced Python Lab	--	--	4	4	2	-	25	25	50
9	PEC	AIML3109	Elective-I Lab	--	--	2	2	1	-	25	--	25
10	MDM	AIML3110	Multi-disciplinary Minor– 03 Lab	--	--	2	2	1	-	50	--	50
11	EL	AIML3111	Business English	--	--	2	2	1	-	25	--	25
			Total	16	1	10	27	22	180	210	410	800

L- Lecture T-Tutorial P-Practical

MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous Assessment

ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular program (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**16**	**19**	**-**	**10**	**09**	**14**	**02**	**02**
Semester Credits	**-**	**-**	**11**	**04**	**06**	**-**	**-**	**01**	**-**
Cumulative Sum	**16**	**16**	**30**	**04**	**16**	**09**	**14**	**03**	**02**

PROGRESSIVE TOTAL CREDITS: 88+22=110

SCHEME OF INSTRUCTION & SYLLABI

Programme Computer Science and Engineering (AIML)

Scheme of Instructions: Third Year B. Tech. Computer Science and Engineering (AIML)

Semester – VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	AIML3201	Database Engineering	3	--	--	3	3	30	10	60	100
2	PCC	AIML3202	Feature Engineering	3	1	--	4	4	30	10	60	100
3	PCC	AIML3203	Image Processing & Computer Vision	3	--	--	3	3	30	10	60	100
4	PEC	AIML3204	Elective-II	3	--	--	3	3	30	10	60	100
5	PEC	AIML3205	Elective-III	3	--	--	3	3	30	10	60	100
6	MDM	AIML3206	Multi-disciplinary Minor – 04	2	--	--	2	2	30	10	60	100
7	PCC	AIML3207	Database Engineering Lab	--	--	2	2	1	-	50	25	75
8	PCC	AIML3208	IP & CV Lab	--	--	2	2	1	-	50	25	75
9	EL	AIML3209	Domain-Specific Mini Project	--	--	4	4	2	-	50	--	50
			Total	**17**	**1**	**8**	**26**	**22**	**180**	**210**	**410**	**800**

L- Lecture T-Tutorial P-Practical

MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous Assessment

ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**16**	**30**	**04**	**16**	**09**	**14**	**03**	**02**
Semester Credits	**-**	**-**	**12**	**06**	**02**	**--**	**-**	**02**	**-**
Cumulative Sum	**16**	**16**	**42**	**10**	**18**	**09**	**14**	**05**	**02**

PROGRESSIVE TOTAL CREDITS: 110+22 =132

[I] List of Electives: Verticals

Specialization	Hardware / Arch. / Network	Algorithms / Math's / ML	Image / Pattern / Security	Software / Data Management
Elective-I	Internet of Things	Compilers	Ethical Hacking	Project Management
Elective-II	Control Systems & Signal Processing	Applied Statistical Analysis with R	Cyber Security	Software Testing & Quality Assurance
Elective-III	Robotics Intelligent Systems	Data Mining	Speech Systems	Cloud Computing
Elective-IV	Adhoc Wireless Sensor Networks	Optimization Methods in AI and ML	Image and Video Processing	AI for Humanity
Elective-V	Blockchain Technology	Predictive Analysis	Surveillance Video Analytics	Business Intelligence Systems
Elective-VI	High Performance Computing	Game Theory	Cyber Forensics and Investigation	Augmented Reality & Virtual Reality

[II] List of Open Electives: List will be provided by University.

[III] Minor in Emerging Areas basket of additional 18-20 credits starting from Sem-III

Basket No -01

(Artificial Intelligence)

Sr. No.	Semester	Subject	Credit
1	III	AI Ethics and Responsible AI	3
2	IV	Human Computer Interaction	3
3	V	Recommendation Systems	3
4	VI	Enhanced Natural Language Processing	3
5	VII	Reinforcement Learning and Autonomous Systems	3
6	VIII	Search Engine Design and Optimization	3

Basket No -02

(Data Intelligence & AI Integration)

Sr. No.	Semester	Subject	Credit
1	III	Decision Intelligence (DI)	3
2	IV	AI-Powered Cybersecurity	3
3	V	Video Analytics	3
4	VI	Big Data Mining	3
5	VII	AI in Healthcare	3
6	VIII	Advanced AI Tools	3

[IV] Basket of Multidisciplinary minor of 14 credits starting from Sem-III

Semester	Course Offered	L	P	Hrs.	Credits
III	Object Oriented Programming	02	--	02	02
IV	Introduction to AI	02	--	02	02
V	Database Management	03	01	04	04
VI	Internet of Things	02	--	02	02
VII	Machine Learning	02	--	02	02
VIII	Data Science using Python	02	--	02	02

Instructions regarding Examinations:

1. Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %
2. Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).
3. No compulsory passing for **MSE.**
4. ESE paper setting weightage will be, **25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).**
5. Passing percentage for ESE practical examination 40%.

Year and Semester	**Third Year B. Tech - Semester V –CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Computer Algorithms**			**Course Code**	**AIML3101**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts	
Course Objective	1	To introduce fundamental algorithm design methods and techniques along with their analysis.
	2	Use greedy strategies to design efficient and optimal solutions.
	3	Apply dynamic programming for solving complex optimization problems.
	4	Implement traversal and backtracking methods for structured search problems.
	5	Explore the theory and classification of NP-Hard and NP-Complete problems.
	6	Introducing parallel algorithms.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand and demonstrate algorithm design methods with analysis.
	CO2	Analyze algorithm space and time complexity by using recurrence relation
	CO3	Devise algorithm for given problem statement using various methods
	CO4	Create solution using search and traversal techniques
	CO5	Categorize the problem to determine polynomial and non-polynomial based on its nature
	CO6	Understand and demonstrate basic concepts of parallel algorithms

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	1	1	1	2	1	2
CO2	3	3	2	2	2	1	1	1	1	2	1	2
CO3	3	3	3	2	2	1	1	1	1	2	2	2
CO4	3	3	3	2	2	1	1	1	2	2	2	2
CO5	3	2	2	2	1	1	1	2	1	1	1	1
CO6	3	2	2	2	3	1	1	1	2	1	2	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Divide and Conquer** What is algorithm, Algorithm Specification, Recurrence relations, Performance Analysis, Randomized Algorithms Divide and Conquer: The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, Shell sort, and Stassen's matrix multiplication.	7
2	**Design and Analysis of Greedy Algorithms** The general method, Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim's and Kruskal's Algorithms, Optimal storage on tapes, Optimal merge Patterns, Single source shortest paths The Bellman-Ford algorithm, Dijkstra's algorithm, The Floyd-Warshall algorithm	7
3	**Dynamic Programming and Applications** The general method, Multistage graphs, All pair shortest paths, 0/1 knapsack, Reliability design, Travelling Sales person problem	6
4	**Algorithmic Traversal and Backtracking Techniques** Techniques for Binary Trees, Game Tree, B+ Tree, RB Tree; Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, **Backtracking** - The general method, 8-queen problem, sum of subsets, Knapsack Problem, Hamiltonian Cycle, and Graph Coloring.	6
5	**Foundations of NP-Hard and NP-Complete Problems** Basic Concepts, Cook's Theorem, Introduction to NP Hard Graph Problems, NP Hard Scheduling Problems	5
6	**Parallel Algorithms and Computational Models** Computational Model and Fundamental Techniques and Algorithms – PRAM, MESH and HYPERCUBE	5

Textbooks			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran	Universities Press, Second Edition

Reference Books			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	Fundamentals of Algorithmics	Gilles Brassard, Paul Bratley	Pearson Education
02	Mastering Algorithms with C	Kyle Loudon	SPD O'Reilly
03	Computer Algorithms- Introduction to Design and Analysis	Sara Baase, Allen Van Gelder	Pearson Education

Year and Semester	**Third Year B. Tech - Semester V –CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Machine Learning using Advanced Python**			**Course Code**	**AIML3102**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Linear Algebra, Statistics, Probability Theory	
Course Objective	1	To understand the fundamental concepts and aspects of Machine Learning.
	2	To understand the learning process and primitives used by computers.
	3	To identify the nature and categories of problems solvable using Machine Learning.
	4	To apply regression and classification techniques for predictive modeling.
	5	To analyze supervised and unsupervised learning methods for data analysis.
	6	To understand neural network models and basic deep learning concepts.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain fundamental concepts of Machine Learning.
	CO2	Analyze Machine Learning models and their performance.
	CO3	Explain supervised learning algorithms for classification tasks.
	CO4	Design solutions using regression algorithms.
	CO5	Describe unsupervised learning techniques.
	CO6	Explain neural network models used in Machine Learning.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1								
CO2	3	3	3	3								
CO3	3	3	3	3								
CO4	3	3	2	3								
CO5	3	3	3	3								
CO6	3	3	2									
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Machine Learning:** **Machine Learning:** Definition, Terminology, Types of learning, Machine Learning Problem categories, Machine learning Process Lifecycle, Data visualization, Basic/Key concepts: Generalization, Overfitting, Under fitting Data and Dimensionality: Feature Sets, Feature Extraction and Subset Selection, Feature Transformation. Dimensionality reduction	4
2	**Supervised Learning: Classification** **Types of Supervised learning**: Regression and Classification, Difference between Classification and Regression Model **Evaluation and Validation**: Confusion Matrix, Accuracy, Precision, Recall, ROC Curve, F1- score, Cross-validation techniques (k-fold, stratified k-fold), Sub Sampling **Classification Algorithms**: **k-Nearest Neighbors (k-NN)** **Bayesian Learning** - Naive Bayes Classifier, Bayesian Network, Applications of Bayesian Network, **Decision Trees** - Introduction, Learning Decision Tree Using ID3 and Gini Index, CART, Overfitting, Ensemble Methods- Bagging (Random Forest) **Support Vector Machines (SVM)** - Support Vectors, Kernel Trick	6
3	**Supervised Learning: Regression** **Foundational Concepts:** Different types of regression models, distributions, hypothesis testing, and confidence intervals. **Univariate Regression** – Model Representation, Least-Square Method, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Optimizing Simple Linear Regression with Gradient Descent Algorithm. **Multivariate Regression** –Model Representation, Polynomial Regression. Performance enhancement with Regularization techniques. Generalization Issues- Overfitting Vs. Underfitting, Bias Vs. Variance, Maximum Likelihood Function **Logistic Regression** – Model, Cost Function	6
4	**Unsupervised Learning**	4

	Introduction of Unsupervised Learning, Application of unsupervised learning, Types of Unsupervised learning: Clustering algorithms - Partitioning Methods - k-means, Hierarchical Methods, Apriori algorithm for association rule learning **Machine Learning Tools**: Weka, Keel	
5	**Neural Networks and Introduction to ANN Algorithms**	4
	Neuron representation and model, Hypothesis for neuron, solution of a problem using single neuron. Gradient descent for a neuron. Neural network, ANN-Forward backward Propagation.	

Textbooks			
Sr. no.	**Title**	**Author**	**Edition/Publication**
1	Machine Learning with Python- an approach t applied ML	Abhishek Vijayvargia	BPB Publications
2	Practical Machine Learning	Sunila Gollapudi	Packt Publishing Ltd
3	Machine Learning	Tom M. Mitchell	McGraw Hill Education; First Edition

Reference Books			
Sr. no.	**Title**	**Author**	**Edition/Publication**
1	Machine Learning for dummies	John Paul Muller	Willey Publication
2	Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition	Aurelien Geron	O'Reilly Media
3	Introduction to Machine Learning	Ethem Alpaydin	PHI 2nd Edition-2013

Year and Semester	**Third Year B. Tech - Semester V – CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Information Security**			**Course Code**	**AIML3103**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Computer Network, Modular Arithmetic & Number Theory, C / C++	
Course Objective	1	To understand fundamental information security principles and models.
	2	To analyse cryptographic techniques for secure communication.
	3	To analyse network security vulnerabilities and evaluate security mechanisms.
	4	To evaluate access control mechanisms, authentication systems, malware threats, and operating system security controls.
	5	To study risks by identifying threats and vulnerabilities and legal requirements.
	6	To design and develop secure solutions using digital signatures, PKI, cloud security concepts, and cyber forensic techniques.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Apply information security principles in real-world systems.
	CO2	Understand cryptographic algorithms and protocols to ensure data confidentiality, integrity, and authentication.
	CO3	Analyse network-based attacks and assess the effectiveness of network security solutions
	CO4	Analyse and evaluate access control models, authentication mechanisms, and operating system security techniques.
	CO5	Evaluate organizational security risks and compliance requirements
	CO6	Design and implement secure applications and systems

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2						1				
CO2	3	3	2									
CO3	2	3	2	2								
CO4	2	3	2	2	1							
CO5	1	2		2				3				2
CO6	2	2	3	3	3							3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Information Security** Need for security, Security Attacks, Services, Mechanisms, OSI security architecture , Principles: Confidentiality, Integrity, Availability (CIA), Authentication, Access Control, Legal, Ethical, and Professional Issues, A Model for Network Security.	6
2	**Cryptography Fundamentals** Cryptography Concepts Overview: Classical Ciphers, Symmetric Key Cryptography: Block and Stream Ciphers, Data Encryption Standard (DES), Multiple Encryption and Triple DES, Advanced Encryption Standard (AES), Block Cipher Design Principles, Asymmetric (Public-Key) Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography (ECC)	6
3	**Hash Functions and Message Authentication** Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security of Hash Functions, Cipher Block Chaining (CBC), Secure Hash Algorithm (SHA),Message Authentication Requirements, Requirements for MAC and Security of MACs, MACs Based on Hash Functions, MACs Based on Block Ciphers: Data Authentication Algorithm, Cipher-based MAC	6
4	**Network Security and Access Control** TCP/IP & Protocols (TLS, SSL), HTTPS, SSH, Email Security (PGP, S/MIME) & IP Security (IPSec). Authentication (Kerberos), Authorization, Accountability. Malware (Viruses, Worms, Ransom ware) & Controls. Operating System Security (Memory, File Protection).	6
5	**Risk Management & Security Planning** Threat, Vulnerability, Risk Analysis, Firewalls, VPNs, Intrusion Detection/Prevention Systems (IDS/IPS). Security Policies, Standards (ISO 27001), Compliance (GDPR). Physical Security & Business Continuity.	6
6	**Digital Signatures and Cloud Security** Digital Signatures: Concept and need, Working, Public and private keys, Digital certificates, Certificate Authorities (CA) and Registration Authorities (RA), Trust models in PKI, Applications and PKI. Cloud Security: Concepts and challenges, Cloud service models: IaaS, PaaS, SaaS, Data security and privacy in cloud, Identity and Access Management (IAM), Virtualization, Compliance and risk management in cloud computing	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Cryptography and Network Security: Principles and Practice	William Stallings	Pearson Education.
02	Network Security: Private Communication in a Public World	Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education.
03	Cryptography and Network Security	Behrouz A. Forouzan	McGraw-Hill Education

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives.	Nina Godbole & Sunit Belapure	Wiley India
02	Information Security Policies, Procedures, and Standards	Thomas R. Peltier	Auerbach Publications
03	CISSP Study Guide	Eric Conrad, Seth Misenar, Joshua Feldman	Syngress

Year and Semester	Third Year B. Tech - Semester V –CSE(AIML)				
Course Category	Program Elective Course				
Title of Course	Elective –I (Internet of Things)			Course Code	AIML3104
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Basic concepts of network	
Course Objective	1	Understand the fundamentals of IoT
	2	Explain IoT communication principles by studying RFID, ZigBee, Bluetooth, IP/MAC addressing, and IEEE 802 protocol standards
	3	Analyze sensing and actuation mechanisms used in IoT systems, including sensor characteristics, classification, and actuator types.
	4	Develop IoT applications using standard frameworks involving device integration, data acquisition
	5	Differentiate IoT and Industrial IoT (IIoT) and understand sensor calibration, validation, and deployment
	6	Introduce Internet of Robotic Things (IoRT)
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Describe the IoT Characteristics and Conceptual Framework
	CO2	Understand communication technologies such as RFID, ZigBee, Bluetooth, and IEEE 802 protocols to IoT-based system
	CO3	Classify sensors and actuators and analyze their role in data acquisition and control in IoT environments
	CO4	Apply design methodology and cloud platforms involved in IoT
	CO5	Understand key skills employed in the IIoT
	CO6	Understand IOT systems for robotics

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3											1
CO3	3	3										1
CO4	3		3		3							1
CO5	3											1
CO6	3		3		3							1
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to IoT** Introduction to Internet of Things (IoT), Functional Characteristics, Recent Trends in the Adoption of IoT, Role of cloud in IoT, Societal Benefits of IoT:- Health Care, Machine to Machine (M2M), Smart Transportation, Smart Living, Smart Cities, Smart Grid	6
2	**Communication Principles** RFID, ZigBEE, Bluetooth, Internet Communication- IP Addresses - MAC Addresses , IEEE 802 Family of Protocols , I/O interfaces Software Components	5
3	**Sensing and Actuation** Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors,Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT	5
4	**IoT Application Development** Frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices	6
5	**Introduction IIoT** Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, placement of IoT devices, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Embedded systems in the Automotive and Transportation market segment	7
6	**Internet of Robotic Things (IoRT)** Introduction to stationary and mobile robots, Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT.	7

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet Things"	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry	0Pearson Education
02	Internet of Things: Architecture and Design Principles"	Raj Kamal	McGraw Hill Education, 2017
03	Internet of Things A Hands-On-Approach",2014.	Vijay Madisetti, Arshdeep Bahga	Georgia Institute of Technology

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	"Industry 4.0: The Industrial Internet of Things"	Alasdair Gilchrist	Apress, 2016
02	"The Internet of Things in the Cloud: A Middleware Perspective" -	Honbo Zhou	CRC Press 2012
03	"Introduction to Industrial Internet of Things and Industry 4.0"	Sudip Misra,Chandana Roy,Anadarup Mukherjee	CRC Press,2021

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Programme Elective Course				
Title of Course	Elective-I (Compilers)			Course Code	AIML3104
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	--	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	• Programming in C/C++ or Python • Data Structures (stack, queue, tree, graph) • Discrete Mathematics & Automata Theory (DFA, NFA, CFG) • Basics of Computer Organization	
Course Objective	1	To provide fundamental knowledge of compiler structure, phases, and workflow of program translation.
	2	To develop understanding of lexical, syntactic, and semantic analysis techniques.
	3	To enable construction of intermediate representations and application of code optimization strategies.
	4	To familiarize students with code generation methods and runtime environment concepts.
	5	To introduce modern AI/ML-driven enhancements in compiler design, parsing, optimization, and analysis.
	6	To enable students to integrate traditional compiler techniques with modern AI/ML methods for intelligent and efficient compiler design.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain compiler phases and differentiate lexical, syntax, and semantic analysis.
	CO2	Construct finite automata, parse trees, and design basic syntax analyzers.
	CO3	Apply semantic rules, manage symbol tables, and generate intermediate code.
	CO4	Apply and analyze code optimization techniques for improved performance.
	CO5	Design simple code generation modules including register allocation and instruction selection.
	CO6	Evaluate and relate modern AI/ML-based compiler techniques with real-world applications.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	1	–	–	–	–	–	–	1
CO2	3	3	2	–	1	–	–	–	–	–	–	1
CO3	3	3	3	2	1	–	–	–	–	–	–	1
CO4	3	3	3	2	2	–	–	–	–	–	–	1
CO5	3	2	3	2	3	–	–	–	–	–	–	1
CO6	2	3	2	3	3	1	–	–	–	–	–	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Compilers** Introduction to compiler; Compiler phases; Front-end & Back-end structure; Error handling & recovery; Language processors – Assembler, Interpreter, Linker, Loader; Overview of AI-driven compiler optimization.	
2	**Lexical Analysis** Role of lexical analyzer; Tokens, lexemes, patterns; Regular expressions; Regular languages; Finite automata (NFA & DFA); NFA → DFA conversion; Lexical analyzer construction; Introduction to Lex tool; ML relevance: tokenization in code models.	
3	**Syntax Analysis** Parsing techniques – Top-down, Bottom-up; LL grammar, FIRST/FOLLOW; Predictive parsing; LR, SLR, LALR parsing; Parser table construction; YACC tool introduction; ML-based parsing and syntax error prediction.	
4	**Semantic Analysis & Intermediate Code Generation** Syntax-directed definitions; Semantic actions; Type checking & type inference; Symbol table management; Intermediate code forms – TAC, Quadruples, Triples; Boolean expressions; Control flow; AST & IR; ML for code quality prediction.	
5	**Code Optimization Techniques** Need for optimization; Machine-independent optimizations (constant folding, dead code elimination, loop optimizations); Machine-dependent optimizations; CFG & data flow analysis; Peephole optimization; AI-driven optimization: profile-guided, ML-based prediction, RL in compiler optimization.	
6	**Code Generation & Modern Compiler Trends** Issues in code generation; Register allocation; Instruction selection; Basic blocks; Runtime environments; Garbage collection; JIT compilers; ML in compilers: neural code generation, automatic error repair, LLMs in compiler design; Case studies: LLVM, GCC, TensorFlow XLA.	

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Compilers: Principles, Techniques, and Tools	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	2nd Edition, Pearson Education
02	Modern Compiler Implementation in C	Andrew W. Appel	2nd Edition, Cambridge University Press
03	Compiler Design	K. Muneeswaran	1st Edition, Oxford University Press

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Engineering a Compiler	Keith D. Cooper, Linda Torczon	2nd Edition, Morgan Kaufmann
02	Advanced Compiler Design and Implementation	Steven S. Muchnick	1st Edition, Morgan Kaufmann
03	Machine Learning for Compiler Optimization	Christophe Dubach et al.	Springer / Research Monographs

Year and Semester	**Third Year B. Tech - Semester V – CSE(AIML)**				
Course Category	**Programme Elective Course**				
Title of Course	**Elective-I (Ethical Hacking)**			**Course Code:**	**AIML3104**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Computer Networks, Data Communications, Operating Systems	
Course Objective	1	To develop foundational knowledge of information security concepts
	2	To understand ethical hacking methodologies and penetration-testing phases
	3	To equip students with hands-on skills in security assessment
	4	To analyze weaknesses in computer networks, systems, web applications, and wireless security
	5	To encourage ethical and legal consciousness in cybersecurity practice
	6	To prepare students for real-world cybersecurity roles, certifications
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain security principles, cyber threats, vulnerabilities, and legal/ethical issues related to hacking
	CO2	Apply information gathering and reconnaissance using open-source intelligence and basic scanning techniques.
	CO3	Analyze network services and system weaknesses through enumeration and vulnerability assessment.
	CO4	Demonstrate password-cracking, exploitation, and post-exploitation procedures in a controlled environment.
	CO5	Analyze and evaluate security weaknesses in web and wireless networks and propose suitable defensive measures.
	CO6	Prepare security assessment documentation and penetration-testing reports.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	3	3	-	2	-	2
CO2	3	3	2	-	2	-	-	-	-	2	-	-
CO3	3	3	2	2	2	-	-	-	-	2	-	2
CO4	3	2	3	3	2	-	-	-	-	2	-	-
CO5	3	3	3	3	3	-	2	2	-	3	-	2
CO6	3	3	3	3	3	-	-	-	-	2	-	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Principles of Hacking & Legal Parameters** Introduction of Ethical Hacking, Need of Ethical hacking, Principles of Ethical hacking, Types of Hacking, Phases of Ethical Hacking, Types of hackers, Hacking Technique, Types of Attacks on a System, Introduction to Malware, Viruses ,Worms & Trojan Concepts, Information Security control	6
2	**System Hacking and & Exploitation** Introduction to Footprinting & Reconnaissance, Types of Footprinting, Footprinting through Web Services, Password Attacks Enumeration: Techniques for Enumeration, Information Gathering Using Groups, Forums and Blogs. Network Scanning Concepts. Vulnerability Scanning, System Hacking, Malware Threats, Session Hijacking	6
3	**Sniffing And Social Engineering** What is Sniffing , MAC Spoofing & Flooding, Active Scanning Techniques, DHCP Flooding, Types of Sniffing, Setup DHCP Rouge (MITM Attack), Protocols Vulnerable to Sniffing, Sniffing with Wireshark Social Engineering Concepts :Social Engineering Techniques ,Insider Threat / Insider Attack, Social Engineering Countermeasures	6
4	**Network & Wireless Security** Packet Sniffing, Wireless Hacking, Attacks on Voice over IP systems such as eavesdropping, call hijacking, and denial of service attacks. Firewall & Examples ,What is IDS & examples ,What is Honeypots & examples , SQL Injection methodology	6
5	**Mobile & Wireless Networks Hacking** Introduction to the Mobile architecture ,Working principle for mobile OS, Security of the application used in Mobiles ,Hacking Methodology for mobile with Metasploit Introduction to Wireless Terminology, Networks, Standards Types of Wireless Authentication and Encryption , Wireless Hacking Methodology, Bluetooth Hacking, ,GPS Mapping, Traffic analysing, Launch Wireless attacks, Crack Wi-Fi Encryption	6
6	**IoT and Cloud Attacks** IOT Concept and Attacks, Technology and Protocols, Challenges, Opportunity in IOT, OWASP Top 10 IOT Vulnerabilities and Obstacles , Hacking IOT Devices, Cloud Computing Overview , Introduction to Cloud & Virtualization, Cloud Deployment and responsibilities, Threats and attack in Cloud.	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	CEH V10: EC-Council Certified Ethical Hacker Complete Training Guide by IPSpecialist	Ric Messier	CEH v11 Wiley
02	The Complete Ethical Hacking Book	Thirumalesh	1st Edition
03	Hands-On Ethical Hacking and Network Defense	Michael T. Simpson, Nicholas D. Antill &Robert S. Wilson	4th Edition

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	CEH v10 Certified Ethical Hacker Study Guide	Ric Messier	Wiley
02	Gray Hat Hacking: The Ethical Hacker's Handbook	Allen Harper, Daniel Regalado, et al.	6th Edition McGraw-Hill
03	Ethical Hacking: Techniques, Tools, and Countermeasures	Michael G. Solomon & Sean-Philip Oriyano	4th Edition

Year and Semester	**Third Year B. Tech - Semester V –CSE(AIML)**				
Course Category	**Programme Elective Course**				
Title of Course	**Elective-I (Project Management)**			**Course Code**	**AIML3104**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3		**--**	**3**	**3**
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Software Engineering Concepts	
Course Objective	1	Provide students with a basic understanding of project management principles and practices.
	2	Demonstrate competency in the creation and management of a project plan.
	3	Understanding impact of Scope, Time and Cost management.
	4	Understanding the software quality metrics and quality assurance.
	5	Develop strategies to calculate risk factors involved in IT projects.
	6	Understand the Agile development practices and driving forces for taking an Agile approach to software development.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand project characteristics and various stages of a project.
	CO2	Understand the conceptual clarity about project organization and feasibility analyses.
	CO3	Analyse the learning and understand techniques for Project planning, project risk, scheduling and Execution.
	CO4	Resolve IT related crises using project management.
	CO5	Manage the phases and infrastructure of IT projects.
	CO6	Describe fundamental concepts of agile methodology and agile development practices.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1								1	2	1
CO2	2	2	1	1		1				1	3	2
CO3	2	3	2	2	2	1			1	2	3	2
CO4	1	3	2	2	3	1			1	2	2	2
CO5	1	2	2		1				3	3	3	2
CO6	1	3	1	2	2	1			3	3	2	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Project Management** Project and Project Management(PM),Role of project Manager, System view of PM, Organization, Stake holders, Project phases and life cycle, Context of IT projects, process groups, mapping groups to Knowledge areas	5
2	**Project Integration Management** Strategic planning and project selection, Developing a Project Management Plan, Directing and Managing Project Work, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases	6
3	**Project Scope, Time and Cost management** **Project Scope:** Planning Scope Management, Collecting Requirements, Defining Scope, Creating the Work Breakdown Structure, Validating Scope, Controlling Scope. **Project Schedule:** Planning Schedule Management, Defining Activities, Sequencing and Estimating Activity, Resources &Duration, Developing & Controlling Schedule **Cost Management:** Basic Principles of Cost Management, Planning Cost Management, Estimating Costs, Determining the Budget, Controlling Costs.	9
4	**Quality Management** Quality Concepts and Terminology, Quality Standards and Models, Roles and Responsibilities of Quality Manager/QA team, Planning Quality Management, Performing Quality Assurance, Controlling Quality, root cause analysis, Quality Audits and Reviews-Internal and external, Tools and Techniques for Quality Control.	5
5	**Human Resource management** Definition and Importance of HRM, Roles and Responsibilities in Project HR Manager, Leadership Styles, human resource planning, Motivation Theories and Their Application, Conflict Management in Project Teams, Performance Management and Appraisal, Ethics, Diversity, and Professional Behaviour. Case Studies: Current Trends in HR Management(Remote teams and virtual collaboration, Agile teams and self-organizing teams, Use of HR software tools)	6
6	**Risk management** Definition and Importance of RM, risk management planning, sources of risk, risk identification, qualitative and quantitative risk analysis, risk response planning, risk monitoring and control.	5

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Information Technology Project Management	Kathy Schwalbe	Cengage Learning 7E
02	Software Project Management	Bob Huges, Mike Cotterell, Rajib Mall	McGraw Hill Edu

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Effective Project Management	Robert K.Wysocki	Wiley India 7 Edition
02	Project Management Core Textbook	Mantel Jr., Meredith, Shafer, Sutton, Gopalan	Wiley India Edition
03	IT Project Management	Joseph Phillips 3E	McGraw Hill Edu

Year and Semester	Third Year B. Tech - Semester V –CSE(AIML)				
Course Category	Multi-disciplinary Minor – 03				
Title of Course	Database Management System			Course Code	AIML3105
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Database Fundamentals, Data Modeling, Proficiency in Python or Java, Basics of SQL and Operating Systems	
Course Objective	1	To understand fundamental concepts of database systems and ER data modeling.
	2	To learn relational database concepts and SQL for database creation and manipulation.
	3	To comprehend functional dependencies and normalization techniques for good database design.
	4	To explore database storage structures and indexing techniques for efficient data access.
	5	To learn & understand transaction processing and concurrency control mechanisms in DBMS.
	6	To describe and analyze database failures and recovery mechanisms used in DBMS.
Course Outcomes	After competition of this course students will be able to ….	
	CO1	Design ER diagrams representing real-world database systems.
	CO2	Construct and execute SQL queries to create and manipulate relational databases.
	CO3	Apply normalization methods to develop efficient and consistent database schemas.
	CO4	Analyze and implement appropriate indexing techniques to improve query performance.
	CO5	Evaluate transaction schedules and apply concurrency control protocols.
	CO6	Apply database recovery techniques to maintain data consistency after failures.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								3		
CO2	3	3	2		3					3	3	1
CO3	3	3	3	2						3	2	
CO4	3	2		2	3					3	3	
CO5	3	3	2	2						3	2	
CO6	3	2		2						3	2	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to databases, E-R model and Relational Model** **Introduction:** Purpose of Database Systems, View of data, Database architecture, Database users and administrator. **E-R Model:** Entity sets, Entity types, attributes, Notations, Relationship set, Relationship types, Keys- Super keys, candidate key, primary key, Extended features of ER Model- Generalization, Specialization and aggregation **Relational Model:** Structure of relational database, Reduction of ER model into Relational schemas, Schema-instance distinction, Referential integrity and foreign keys, Relational Algebra and Example queries.	08
2	**Fundamentals of SQL** **SQL:** Introduction to SQL, Data definition statements with constraints, Insert, Update, Delete, Set Operations, Aggregate functions group by and having clauses, Nested Queries, Views, Complex queries, Joins **PLSQL:** Triggers, Stored Procedures, PL/SQL Processing with Cursors, PL/SQL Stored Functions	06
3	**Functional Dependency and Normalization** Importance of good schema design, Motivation for normal form, Atomic domains and 1NF, Dependency Theory: Functional dependencies, Closure of set of FD's, Properties of them, Multivalued dependencies and 4NF, Join dependencies and 5NF, Temporal functional dependencies	06
4	**Data Storage and Indexing** File organization, organization of records in files, Data Dictionary, Database Buffer **Indexing:** Concept, Ordered Indices-Primary, Secondary, Multilevel, B+ Tree index, Hashing, Hash Indices, Dynamic hashing, Multiple Key access, Bitmap Indices	06
5	**Transaction Management and Concurrency Control** **Transaction Processing:** Concept, ACID properties, Transaction states, Storage structure, Implementations of atomicity, isolation and durability, Serializability, Testing of Serializability. **Concurrency Control:** Lock based protocols, Timestamp based Protocols, Validation based Protocols, Multiple Granularities, Deadlock handling	06
6	**Recovery System** Failure Classification, Storage structure, Implementation of stable storage, Recovery and Atomicity, Log based recovery, Checkpoints, Shadow Paging, buffer Management in crash recovery	04

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Database System Concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	6th Edition, McGraw Hill Education.
02	Database Systems – Design, Implementation and Management	Rob & Coronel	5th Edition, Cengage Learning

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Database Systems - A practical approach to Design, Implementation and Management	Thomos Connolly, Carolyn Beg	3rd Edition, Pearson Education
02	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	4th Edition, Pearson Education

Year and Semester	**Third Year B. Tech - Semester V – CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Computer Algorithm Lab**			**Course Code**	**AIML 3107**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	01	--	01	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	25	50	

Course Pre-Requisite	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts	
Course Objective	1	To introduce fundamental algorithm design methods and techniques along with their analysis.
	2	Use greedy strategies to design efficient and optimal solutions.
	3	Apply dynamic programming for solving complex optimization problems.
	4	Implement traversal and backtracking methods for structured search problems.
	5	Explore the theory and classification of NP-Hard and NP-Complete problems.
	6	Introducing parallel algorithms.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand and demonstrate algorithm design methods with analysis.
	CO2	Analyze algorithm space and time complexity by using recurrence relation
	CO3	Devise algorithm for given problem statement using various methods
	CO4	Create solution using search and traversal techniques
	CO5	Categorize the problem to determine polynomial and non-polynomial based on its nature
	CO6	Understand and demonstrate basic concepts of parallel algorithms

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	1	1	1	2	1	2
CO2	3	3	2	2	2	1	1	1	1	2	1	2
CO3	3	3	3	2	2	1	1	1	1	2	2	2
CO4	3	3	3	2	2	1	1	1	2	2	2	2
CO5	3	2	2	2	1	1	1	2	1	1	1	1
CO6	3	2	2	2	3	1	1	1	2	1	2	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
<u>In Semester Evaluation/ Continuous Assessment has 25 Marks</u> Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. <u>End Semester Evaluation has 25 Marks</u>

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Tutorial. No.	Title of Experiment/ Problem Statement
1	Fundamentals of Algorithms and Performance Analysis
2	Divide-and-Conquer Techniques: Sorting and Matrix Multiplication
3	Greedy Strategy Applications in Optimization Problems
4	Greedy Algorithms for Shortest Path and Spanning Tree Problems
5	Dynamic Programming Formulation and Multistage Graph Problems
6	Dynamic Programming Applications: Knapsack and Traveling Salesperson
7	Tree and Graph Traversal Algorithms
8	Backtracking Techniques for Constraint Satisfaction Problems
9	Introduction to Computational Complexity and Cook's Theorem
10	NP-Hard and NP-Complete Problems in Graphs and Scheduling
11	Parallel Computing Models: PRAM, Mesh, and Hypercube
12	Fundamental Parallel Algorithms and Performance Considerations

Textbooks			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran	Universities Press, Second Edition

Reference Books			
Sr. no.	**Title**	**Author**	**Edition/Publication**
01	Fundamentals of Algorithmics	Gilles Brassard, Paul Bratley	Pearson Education
02	Mastering Algorithms with C	Kyle Loudon	SPD O'Reilly
03	Computer Algorithms-Introduction to Design and Analysis	Sara Baase, Allen Van Gelder	Pearson Education

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Program Core Course				
Title of Course	Machine Learning using Advanced Python Lab			Course Code	AIML3108
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	04	04	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	25	25	50	

Course Pre-Requisite	Data Structures, Discrete Mathematics, Engineering Mathematics, Programming Concepts	
Course Objective	1	To understand the fundamental concepts and aspects of Machine Learning.
	2	To understand the learning process and primitives used by computers.
	3	To identify the nature and categories of problems solvable using Machine Learning.
	4	To apply regression and classification techniques for predictive modelling.
	5	To analyze supervised and unsupervised learning methods for data analysis.
	6	To understand neural network models and basic deep learning concepts.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain fundamental concepts of Machine Learning.
	CO2	Analyze Machine Learning models and their performance.
	CO3	Design solutions using classification and decision tree algorithms.
	CO4	Explain supervised learning algorithms for classification tasks.
	CO5	Describe unsupervised learning techniques.
	CO6	Explain neural network models used in Machine Learning.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1								
CO2	3	3	3	3								
CO3	3	3	3	3								
CO4	3	3	2	3								
CO5	3	3	3	3								
CO6	3	3	2									
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 25 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. End Semester Evaluation has 25 Marks

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Tutorial. No.	Title of Experiment/ Problem Statement
1	Study and Installation of Python. Explore Python IDEs such as Jupyter Notebook, PyCharm, and Visual Studio Code. Introduction to ML libraries (NumPy, Pandas, Matplotlib, Scikit-learn).
2	Study of different types of datasets. Data visualization and Data Pre-processing techniques (handling missing values, encoding, feature scaling).
3	Study and Implementation of Linear Regression.
4	Study and Implementation of Logistic Regression for Classification.
5	Study and Implementation of Regularization Techniques: Ridge (L2) and Lasso (L1) Regression.
6	Study and Implementation of Decision Tree and Random Forest Algorithms for Classification.
7	Study and Implementation of Support Vector Machine (SVM) and Naïve Bayes Classifier.
8	Study and Implementation of K-Nearest Neighbors (KNN) Classifier and Elbow Method.
9	Study and Implementation of Unsupervised Learning Techniques: K-Means Clustering and Hierarchical Clustering.
10	Study and Implementation of Neural Network using Artificial Neural Network (ANN) with Forward and Backward Propagation.
11	PBL Application Project : Implement one problem statement using various ML algorithm and Evaluate the result.

PROGRAM BASED LEARNING (PBL) :

1. Maximum **4 students per team**.
2. Project must apply **Machine Learning concepts** studied in the course.
3. Focus on a **real-world, innovative, and industry-oriented application**.
4. **Digital report** with implementation, analysis, and evaluation to be submitted.

Assessment on a continuous basis with a minimum of 3 reviews.

Sample project domains:

- Intelligent Healthcare
- Smart Cities & IoT Analytics
- Cybersecurity & Intrusion Detection
- Financial Analytics & Fraud Detection

Textbooks

Sr. no.	Title	Author	Edition/Publication
1	Machine Learning with Python-an approach t applied ML	Abhishek Vijayvargia	BPB Publications
2	Practical Machine Learning	Sunila Gollapudi	Packt Publishing Ltd
3	Machine Learning	Tom M. Mitchell	McGraw Hill Education; First Edition

Reference Books			
Sr. no.	**Title**	**Author**	**Edition/Publication**
1	Machine Learning for dummies	John Paul Muller	Willey Publication
2	Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition	Aurelien Geron	O'Reilly Media
3	Introduction to Machine Learning	Ethem Alpaydin	PHI 2nd Edition-2013

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Program Elective Course				
Title of Course	Elective –I Lab (Internet of Things)			Course Code	AIML3109
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	--	25	

Course Pre-Requisite	Basic concepts of network	
Course Objective	1	Understand the fundamentals of IoT
	2	Explain IoT communication principles by studying RFID, ZigBee, Bluetooth, IP/MAC addressing, and IEEE 802 protocol standards
	3	Analyze sensing and actuation mechanisms used in IoT systems, including sensor characteristics, classification, and actuator types.
	4	Develop IoT applications using standard frameworks involving device integration, data acquisition
	5	Differentiate IoT and Industrial IoT (IIoT) and understand sensor calibration, validation, and deployment
	6	Introduce Internet of Robotic Things (IoRT)
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Describe the IoT Characteristics and Conceptual Framework
	CO2	Understand communication technologies such as RFID, ZigBee, Bluetooth, and IEEE 802 protocols to IoT-based system
	CO3	Classify sensors and actuators and analyze their role in data acquisition and control in IoT environments
	CO4	Apply design methodology and cloud platforms involved in IoT
	CO5	Understand key skills employed in the IIoT
	CO6	Understand IOT systems for robotics

Marking Scheme
<u>In Semester Evaluation/ Continuous Assessment has 25 Marks</u> Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.

Guidelines for Lab Performance	
All Experiments should get performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Understand the connection of Arduino board
2	Identification of sensors, actuators, communication module
3	IoT based control of an LED using Arduino
4	Web-based home automation using Arduino Uno and Bluetooth
5	Read and display sensor data using serial monitor
6	Understand control logic for actuators
7	Understand the connection of Raspberry Pi board
8	Understand and establish device-to-device communication
9	IIoT Use Case – Smart Industrial Monitoring Monitor temperature, vibration, or gas levels
10	Study of Send sensor data to cloud platform (ThingSpeak / Blynk / Firebase)
11	Understand and implement RFID Based Identification System
12	Develop a program to demonstrate weather station readings using Arduino with Hadoop

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet Things"	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry	0Pearson Education
02	Internet of Things: Architecture and Design Principles"	Raj Kamal	McGraw Hill Education, 2017
03	Internet of Things A Hands-On-Approach",2014.	Vijay Madisetti, Arshdeep Bahga	Georgia Institute of Technology

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	"Industry 4.0: The Industrial Internet of Things"	Alasdair Gilchrist	Apress, 2016
02	"The Internet of Things in the Cloud: A Middleware Perspective" -	Honbo Zhou	CRC Press 2012
03	"Introduction to Industrial Internet of Things and Industry 4.0"	Sudip Misra,Chandana Roy,Anadarup Mukherjee	CRC Press,2021

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Program Elective Course				
Title of Course	Elective-I Lab (Compilers)			Course Code	AIML3109
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	2	2	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	25	-	25	

Course Pre-Requisite	• Programming in C/C++ or Python • Data Structures (stack, queue, tree, graph) • Discrete Mathematics & Automata Theory (DFA, NFA, CFG) • Basics of Computer Organization	
Course Objective	1	To understand the structure and phases of a compiler through hands-on experiments.
	2	To develop the ability to design lexical analyzers using manual methods and LEX tool.
	3	To apply grammar analysis techniques such as FIRST, FOLLOW, and parsing methods.
	4	To implement semantic analysis concepts including symbol table management and intermediate code generation.
	5	To understand and apply basic code optimization techniques for performance improvement.
	6	To gain practical exposure to code generation techniques and modern compiler tools.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain and demonstrate different phases of a compiler using sample programs.
	CO2	Design and implement lexical analyzers using regular expressions, NFA, DFA, and LEX.
	CO3	Construct FIRST and FOLLOW sets and develop syntax analyzers using LL(1) and YACC.
	CO4	Implement symbol tables and generate intermediate code representations.
	CO5	Apply basic code optimization techniques such as constant folding and dead code elimination.
	CO6	Generate simple target code and relate practical compiler experiments to real-world compiler tools.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	1	–	–	–	–	–	–	1
CO2	3	3	2	–	2	–	–	–	–	–	–	1
CO3	3	3	2	1	2	–	–	–	–	–	–	1
CO4	3	3	3	2	2	–	–	–	–	–	–	1
CO5	3	2	3	2	3	–	–	–	–	–	–	1
CO6	2	2	3	2	3	–	–	–	–	–	–	3
Level of Mapping as: Low 1, Moderate 2, High 3												
Marking Scheme												

<u>In Semester Evaluation/ Continuous Assessment has 50 Marks</u> Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. <u>End Semester Evaluation has 25 Marks</u> External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Study of Compiler Phases-Study the structure and phases of a compiler using sample programs
2	Lexical Analyzer (Manual)-Design a lexical analyzer to identify keywords, identifiers, operators, and constants.
3	Regular Expression Processing-Convert regular expressions into NFA and DFA.
4	LEX Program for Tokenization-Write a LEX program to recognize tokens from source code.
5	FIRST and FOLLOW Sets-Compute FIRST and FOLLOW sets for a given grammar.
6	Predictive Parsing (LL(1))-Construct LL(1) parsing table and validate input strings.
7	YACC Program for Expression Parsing-Implement arithmetic expression parsing using YACC.
8	Symbol Table Implementation-Implement a symbol table using arrays or hash tables.
9	Intermediate Code Generation-Generate three-address code for arithmetic expressions.
10	Code Optimization-Perform basic optimization such as constant folding or dead code elimination.
11	Simple Code Generation- Generate simple target code for arithmetic expressions.

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Compilers: Principles, Techniques, and Tools	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	2nd Edition, Pearson Education
02	Modern Compiler Implementation in C	Andrew W. Appel	2nd Edition, Cambridge University Press
03	Compiler Design	K. Muneeswaran	1st Edition, Oxford University Press

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Engineering a Compiler	Keith D. Cooper, Linda Torczon	2nd Edition, Morgan Kaufmann
02	Advanced Compiler Design and Implementation	Steven S. Muchnick	1st Edition, Morgan Kaufmann
03	Compilers and Compiler Generators	P. D. Terry	CRC Press
04	Programming Language Pragmatics	Programming Language Pragmatics	Programming Language Pragmatics

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Program Elective Course				
Title of Course	Elective-I Lab (Ethical hacking)			Course Code	AIML3109
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	2	2	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	25	-	25	

Course Pre-Requisite	operating systems (Windows and Kali Linux), Nmap, Wireshark, Metasploit	
Course Objective	1	Understand ethical, legal, and professional responsibilities while complying with cyber laws and institutional policies.
	2	Apply information gathering, scanning, and reconnaissance techniques to analyze system.
	3	Use industry-standard tools to identify vulnerabilities in operating systems, networks, and web applications.
	4	Perform controlled exploitation and post-exploitation to understand system weaknesses and security risks.
	5	Analyze common web attacks such as SQL injection and XSS and evaluate appropriate mitigation techniques.
	6	Develop professional penetration testing reports documenting vulnerabilities, risks, and recommended countermeasures.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Apply ethical hacking methodologies to conduct reconnaissance and footprinting on target systems using standard security tools.
	CO2	Analyze network, system, and application vulnerabilities using scanning and enumeration techniques.
	CO3	Implement penetration testing techniques to exploit identified vulnerabilities in operating systems, networks, and web applications.
	CO4	Evaluate system security by performing password attacks, privilege escalation, and malware analysis.
	CO5	Design and execute ethical hacking experiments and document results in the form of professional penetration-testing reports.
	CO6	Propose and implement suitable security controls and countermeasures to mitigate identified cyber threats and vulnerabilities.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	2	1	-	3	-	-	-	1
CO2	2	3	-	2	3	-	-	2	-	-	-	1
CO3	2	2	3	2	3	-	-	2	-	-	-	1
CO4	2	3		3	3	-	-	3	-	-	-	1
CO5	1	2	3	3	2	-	-	2	2	3	1	2
CO6	2	3	3	2	2	2	-	3	2	2	-	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 25 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	To learn about hacking tools and skills.
2	To understand ethical hacking principles and explore Kali Linux
3	To study about Footprinting and Reconnaissance.
4	To discover live hosts, open ports, and services.
5	To study about Fingerprinting
6	To identify vulnerabilities in a target system.
7	To understand password security and cracking methods.
8	To learn & study about Sniffing & their tools
9	To demonstrate SQL Injection vulnerability.
10	To study and exploit **Cross-Site Scripting (XSS)** vulnerabilities in a web application and understand the risks posed by client-side attacks.
11	To study about Wireless Hacking.
12	To prepare a professional penetration testing report.

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	CEH v11 Certified Ethical Hacker Study Guide	Ric Messier	Wiley
02	The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy	Patrick Engebretson	Syngress
03	Hacking: The Art of Exploitation	Jon “Smibbs” Erickson	2nd Edition

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Ethical Hacking and Countermeasures: Attack Phases	EC-Council	Cengage Learning
02	Hands-On Ethical Hacking and Network Defense	Michael T. Simpson, Kent Backman	4th Edition
03	The Ethical Hack: A Framework for Business-Value Penetration Testing	James S. Tiller	CRC Press

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Program Elective Course				
Title of Course	Elective-I Lab (Project Management)			Course Code	AIML3109
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25			

Course Pre-Requisite	Basic understanding of Project Management concepts and terminology.	
Course Objective	1	To understand the fundamental concepts of project management through analysis of real-life IT and non-IT projects.
	2	To develop the ability to initiate and plan projects by preparing project charter, life cycle models, and project management plans.
	3	. To enable students to define and manage project scope, schedule, and cost using industry-standard tools and techniques
	4	To provide practical exposure to quality planning and quality control techniques for ensuring project deliverables meet required standards.
	5	To enhance skills in human resource planning, team management, and virtual collaboration in project environments.
	6	To inculcate the capability to identify, analyse, and manage project risks using qualitative and quantitative risk analysis methods.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Analyse real-world projects and identify project characteristics, stakeholders, and life cycle phases
	CO2	Prepare project initiation and planning documents such as project charter and comprehensive project management plans.
	CO3	Apply scope, schedule, and cost management techniques including WBS, network diagrams, and cost estimation methods.
	CO4	Implement quality management practices using quality planning and quality control tools to improve project performance.
	CO5	Plan and manage project human resources, addressing leadership, team coordination, and challenges of remote and virtual teams.
	CO6	Perform qualitative and quantitative risk analysis and recommend appropriate risk response strategies for effective project execution

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3										
CO2			3								3	
CO3		3	3								3	
CO4				3								
CO5									3	3		
CO6		3		3							3	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. End Semester Evaluation has 25 Marks External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Study and analysis of real-life IT and non-IT projects and identify project characteristics.
2	Preparation of Project Life Cycle diagram for an IT project.
3	Preparation of Project Charter for a selected project
4	Development of a Project Management Plan (PMP)
5	Study of Change Request and Change Control Process using a sample project.
6	Creation of Work Breakdown Structure (WBS) for a project.
7	Identification and sequencing of activities using Network Diagram (PERT/CPM)
8	Prepare Cost estimation using Bottom-up and Analogous estimation techniques
9	Preparation of Quality Management Plan
10	Study Application of Quality Control tools (Pareto chart, Fishbone diagram, Control chart).
11	Preparation of Human Resource Management Plan
12	Case study on Remote teams and virtual collaboration challenges
13	Performing Qualitative Risk Analysis using probability–impact matrix
14	Performing Quantitative Risk Analysis (EMV / Decision tree).

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Information Technology Project Management	Kathy Schwalbe	Cengage Learning 7E
02	Software Project Management	Bob Huges, Mike Cotterell, Rajib Mall	McGraw Hill Edu

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Effective Project Management	Robert K.Wysocki	Wiley India 7 Edition
02	Project Management Core Textbook	Mantel Jr., Meredith, Shafer, Sutton, Gopalan	Wiley India Edition
03	IT Project Management	Joseph Phillips 3E	McGraw Hill Edu

Year and Semester	Third Year B. Tech - Semester V –CSE(AIML)				
Course Category	Multi-disciplinary Minor - 03				
Title of Course	MDM 03 Lab Database Management System			Course Code	AIML3110
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	--	50	

Course Pre-Requisite	Database Fundamentals, Data Modeling, Proficiency in Python or Java, Basics of SQL and Operating Systems	
Course Objective	1	To understand fundamental concepts of database systems and ER data modeling.
	2	To learn relational database concepts and SQL for database creation and manipulation.
	3	To comprehend functional dependencies and normalization techniques for good database design.
	4	To explore database storage structures and indexing techniques for efficient data access.
	5	To learn & understand transaction processing and concurrency control mechanisms in DBMS.
	6	To describe and analyze database failures and recovery mechanisms used in DBMS.
Course Outcomes	After competition of this course students will be able to ….	
	CO1	Design ER diagrams representing real-world database systems.
	CO2	Construct and execute SQL queries to create and manipulate relational databases.
	CO3	Apply normalization methods to develop efficient and consistent database schemas.
	CO4	Analyze and implement appropriate indexing techniques to improve query performance.
	CO5	Evaluate transaction schedules and apply concurrency control protocols.
	CO6	Apply database recovery techniques to maintain data consistency after failures.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								3		
CO2	3	3	2		3					3	3	1
CO3	3	3	3	2						3	2	
CO4	3	2		2	3					3	3	
CO5	3	3	2	2						3	2	
CO6	3	2		2						3	2	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Practical and Oral Performance, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. End Semester Evaluation has 25 Marks External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance	
Faculty can create experiment list based on following listed topics. Minimum 10 to 12 Experiments should be performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Draw an E-R Diagram of any organization
2	Converting E-R Diagram into Relational Table
3	Installation and Demonstration of DBMS Oracle/MySQL/SQL Server/PostgreSQL etc.
4	Study and Implementation of Data Definition Language(DDL) Queries (e.g. create, alter and drop tables)
5	Study and Implementation of Data Manipulation Language(DML) Queries. (e.g. Insert, delete, update and select statements)
6	Implementation of Basic SQL SELECT statement for displaying/Extracting data from single multiple tables
7	Implementation of SQL constructs for aggregating data, use of group by, having clause.
8	Implementation of nested sub queries, complex sub queries
9	Display the results of Join Operations like cross join, self-join, inner join, natural join, left outer join, right outer join and full outer join
10	Create & Update views for any created table
11	Write a program of Database connectivity with any object oriented language
12	Study and Implementation of Triggers
13	Study and Implementation of functions
14	Study and Implementation of Stored Procedures

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Database System Concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	6th Edition, McGraw Hill Education.
02	Database Systems – Design, Implementation and Management	Rob & Coronel	5th Edition, Cengage Learning

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Database Systems - A practical approach to Design, Implementation and Management	Thomos Connolly, Carolyn Beg	3rd Edition, Pearson Education
02	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	4th Edition, Pearson Education

Year and Semester	Third Year B. Tech - Semester V – CSE(AIML)				
Course Category	Experiential Learning				
Title of Course	Business English			Course Code	AIML3111
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	2	--	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	25	--	25	

Course Pre-Requisite	Basic knowledge of English language, Ability to read and understand simple texts in English.	
Course Objective	1	To familiarize students with professional culture, workplace hierarchy, and appropriate business behaviour.
	2	To develop business vocabulary and reading comprehension skills for understanding professional texts.
	3	To enhance vocal communication skills for effective meetings, telephonic, and virtual communication.
	4	To enable students to write clear and professional business documents.
	5	To build confidence in public speaking, presentations, and interview situations.
	6	To develop interpersonal skills such as group discussion, negotiation, complaint handling, and business etiquette.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Communicate effectively in practical, business-oriented situations.
	CO2	Express ideas in English with improved fluency, accuracy, and confidence.
	CO3	Use English appropriately in various business contexts such as meetings, negotiations, telephone conversations, presentations, and social interactions.
	CO4	Demonstrate enhanced listening, speaking, pronunciation, and business vocabulary skills.
	CO5	Apply communicative competencies essential for professional workplace behaviour.
	CO6	Participate effectively in group discussions and handle complaints in business situations.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	1	2	2	-	1
CO2	2	1	-	-	-	-	-	-	-	3	-	1
CO3	1	2	2	-	-	-	-	-	2	3	-	1
CO4	1	2	2	-	-	-	-	-	-	3	-	1
CO5	-	1	2	-	-	-	-	-	3	3	-	1
CO6	-	2	2	-	-	-	-	2	3	2	-	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 25 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.

Unit No.	Title and Content of Unit	Hours
1	**Getting acquainted with professional culture:** First day at work Induction program Company hierarchy Behaviour pruning	6
2	**Vocabulary building and Reading comprehension:** Reading techniques and comprehension skills Synonyms and antonyms One-word substitution Prefixes and Suffixes Idioms and phrases Homonyms and homographs Irregular verbs like (write, wrote, written) Situational vocabulary	6
3	**Effective vocal Communication:** Effective Meetings Video Conferencing Effective Telephonic Communication Breaking Bad news	6
4	**Effective written Communication:** Business letters Resume Writing E-mail writing Report writing Minutes of meeting Memo writing	6
5	**Public speaking and Presentation Skills:** Preparing and conducting presentation Body language Overcoming stage fear Best practices Interviewing and being interviewed	6
6	**Miscellaneous:** Group Discussion Handling Complains Negotiation Skills Business Etiquettes	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Technical Communication	Ashraf Rizvi	Tata McGraw Hill, 2005
02	Effective Business Communication	M. V Rodriques	Concept Publishing Company Pvt. Ltd. 2013

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	English for Technical Communication	K. R. Laxminarayan	SCITECH 2nd Edition 2014
02	Technical English	Dr. M. Hemamalini	Wiley, 2014

Semester-VI

Year and Semester	**Third Year B. Tech - Semester VI –CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Database Engineering**			**Course Code**	**AIML3201**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Database Fundamentals, Data Modeling, Proficiency in Python or Java, Basics of SQL and Operating Systems	
Course Objective	1	To understand fundamental concepts of database systems and ER data modeling.
	2	To learn relational database concepts and SQL for database creation and manipulation.
	3	To comprehend functional dependencies and normalization techniques for good database design.
	4	To explore database storage structures and indexing techniques for efficient data access.
	5	To learn & understand transaction processing and concurrency control mechanisms in DBMS.
	6	To describe and analyze database failures and recovery mechanisms used in DBMS.
Course Outcomes	After competition of this course students will be able to ….	
	CO1	Design ER diagrams representing real-world database systems.
	CO2	Construct and execute SQL queries to create and manipulate relational databases.
	CO3	Apply normalization methods to develop efficient and consistent database schemas.
	CO4	Analyze and implement appropriate indexing techniques to improve query performance.
	CO5	Evaluate transaction schedules and apply concurrency control protocols.
	CO6	Apply database recovery techniques to maintain data consistency after failures.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								3		
CO2	3	3	2		3					3	3	1
CO3	3	3	3	2						3	2	
CO4	3	2		2	3					3	3	
CO5	3	3	2	2						3	2	
CO6	3	2		2						3	2	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to databases, E-R model and Relational Model** **Introduction:** Purpose of Database Systems, View of data, Database architecture, Database users and administrator. **E-R Model:** Entity sets, Entity types, attributes, Notations, Relationship set, Relationship types, Keys- Super keys, candidate key, primary key, Extended features of ER Model- Generalization, Specialization and aggregation **Relational Model:** Structure of relational database, Reduction of ER model into Relational schemas, Schema-instance distinction, Referential integrity and foreign keys, Relational Algebra and Example queries.	08
2	**Fundamentals of SQL** **SQL:** Introduction to SQL, Data definition statements with constraints, Insert, Update, Delete, Set Operations, Aggregate functions group by and having clauses, Nested Queries, Views, Complex queries, Joins **PLSQL:** Triggers, Stored Procedures, PL/SQL Processing with Cursors, PL/SQL Stored Functions	06
3	**Functional Dependency and Normalization** Importance of good schema design, Motivation for normal form, Atomic domains and 1NF, Dependency Theory: Functional dependencies, Closure of set of FD's, Properties of them, Multivalued dependencies and 4NF, Join dependencies and 5NF, Temporal functional dependencies	06
4	**Data Storage and Indexing** File organization, organization of records in files, Data Dictionary, Database Buffer **Indexing:** Concept, Ordered Indices-Primary, Secondary, Multilevel, B+ Tree index, Hashing, Hash Indices, Dynamic hashing, Multiple Key access, Bitmap Indices	06
5	**Transaction Management and Concurrency Control** **Transaction Processing:** Concept, ACID properties, Transaction states, Storage structure, Implementations of atomicity, isolation and durability, Serializability, Testing of Serializability. **Concurrency Control:** Lock based protocols, Timestamp based Protocols, Validation based Protocols, Multiple Granularities, Deadlock handling	06
6	**Recovery System** Failure Classification, Storage structure, Implementation of stable storage, Recovery and Atomicity, Log based recovery, Checkpoints, Shadow Paging, buffer Management in crash recovery	04

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Database System Concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	6th Edition, McGraw Hill Education.
02	Database Systems – Design, Implementation and Management	Rob & Coronel	5th Edition, Cengage Learning

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Database Systems - A practical approach to Design, Implementation and Management	Thomos Connolly, Carolyn Beg	3rd Edition, Pearson Education
02	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	4th Edition, Pearson Education

Year and Semester	**Third Year B. Tech - Semester VI –CSE(AIML)**				
Course Category	**Program Core Course**				
Title of Course	**Feature Engineering**			**Course Code**	**AIML3202**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	1	--	4	4
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Probability and Statistics	
Course Objective	1	Provide students with a **strong foundation** in feature engineering and the importance of feature understanding in machine learning.
	2	Enable students to **represent data** effectively using appropriate feature representation and pre-processing techniques.
	3	Introduce students to **feature extraction techniques for text data**
	4	Develop the ability to **encode categorical variables** using suitable techniques
	5	Familiarize students with **feature selection methodologies**
	6	Enable students to apply dimensionality reduction and feature construction techniques
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain basics of feature engineering
	CO2	Apply basic feature representation techniques
	CO3	Analyze and construct meaningful features from text data
	CO4	Implement appropriate encoding techniques for categorical data
	CO5	Analyze and apply feature selection techniques,
	CO6	Transform and reduce feature space using dimensionality reduction and feature construction techniques

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									1
CO2	2	2	1		3							
CO3	2	3	2	2	3							
CO4	2	2	2		3							
CO5	2	3	2	2	3							
CO6	3	3	2	2	3							
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Feature Engineering** Introduction to feature engineering, Importance of feature engineering, , Types of data, Data levels, The types of features, Evaluation of machine learning algorithms and feature engineering procedures, Feature understanding	6
2	**Basics of Feature Representation** Scalars, Vectors, and Spaces, Dealing with Counts: Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization: Min-Max Scaling, Standardization (Variance Scaling), ℓ2 Normalization, Feature Selection	5
3	**Features of Text Data** Bag-of-X: Turning Natural Text into Flat Vectors, Filtering for Cleaner Features: Stopwords, Frequency-Based Filtering, Stemming, Atoms of Meaning: From Words to n-Grams to Phrases, Parsing and Tokenization, Collocation Extraction for Phrase Detection Tf-Idf: A Simple Twist on Bag-of-Words	6
4	**Features of Categorical Data** Encoding Categorical Variables: One-Hot Encoding, Dummy Coding, Effect Coding , Pros and Cons of Categorical Variable Encodings, Dealing with Large Categorical: Variables, Feature Hashing, Bin Counting	6
5	**Feature Selection** Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies, Effect of Irrelevant Feature, Overfitting to Predictors and External Validation, Greedy Search Methods- Simple Filters, Recursive Feature Elimination, Stepwise Selection	7
6	**Feature Transformation** Feature transformation Techniques, Dimensionality Reduction: Curse of dimensionality Principal Component Analysis (PCA), Benefits of dimensionality reduction, Feature Construction	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Feature Engineering for Machine Learning: Principles and Techniques for data scientist	Alice Zheng & Amanda Casari	Oreilly
02	Feature Engineering Made Easy	Sinan Ozdemir, Divya Susarla	Packt Publishing
03	The Art of Feature Engineering Essentials for Machine Learning	Pablo Duboue	Cambridge University Press is part of the University of Cambridge.

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Feature Engineering and Selection: A Practical Approach for Predictive Models	Max Kuhn, Kjell Johnson	CRC Press

Year and Semester	Third Year B. Tech - Semester V I–CSE(AIML)				
Course Category	Program Core Course				
Title of Course	Image Processing and Computer Vision			Course Code:	AIML3203
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Signals and Systems, Python, MATLAB, Computer Graphics and Image Processing	
Course Objective	1	To build foundational understanding of digital image formation.
	2	To develop analytical and problem-solving skills
	3	To enable learners to apply and evaluate computer-vision techniques such as object detection, motion analysis, stereo vision, and 3D reconstruction for real-world scenarios.
	4	To promote computational thinking and innovation by using programming libraries
	5	To encourage multidisciplinary learning by integrating image processing with AI
	6	To inculcate research orientation and project-based learning and explore emerging trends like CNNs, transformers, and visual analytics.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Apply fundamental image-processing operations (image enhancement, filtering, segmentation) to real-world visual data using modern tools and software.
	CO2	Analyze image acquisition models, sampling/quantization effects, camera geometry, and visual perception to evaluate image quality and representation.
	CO3	Design and implement algorithms for feature extraction
	CO4	Evaluate object-recognition and classification approaches
	CO5	Apply and integrate computer-vision methods like stereo vision, optical flow, motion tracking, and 3D reconstruction for practical applications.
	CO6	Develop and demonstrate ethical use of visual data with awareness of privacy, surveillance issues

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3					1		2
CO2	3	3	2	2	3					1		2
CO3	3	3	3	2	3	1				1		3
CO4	2	2	2	1	2	2	1	1				2
CO5	2	3	3	3	3	1		1	2	3	1	3
CO6												
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Basic Concepts of Image Formation**	6
	Introduction, Goals of Image Processing, Image Sensing and acquisition, Image Formation Concepts, Digital Image Fundamentals, Image representation – Gray scale and Colour images, image sampling and quantization.	
2	**Image Enhancement and Processing**	6
	Image Transforms, Image Enhancement, Image Filtering, Color Image Processing, Image Segmentation, Geometric primitives and transformations, Plotting images, points and lines, Image contours and Histogram equalization, Interactive annotation	
3	**Morphological Processing**	6
	Erosion, dilation, opening, closing, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons, Edge linking and boundary detection	
4	**Introduction to Computer Vision**	6
	Definition of Computer Vision, Components of a vision system, Applications of Computer vision, Image Sources for computer Vision, Image structure and Pixels, Frameworks for Computer Vision.	
5	**Object Recognition and Motion Estimation:**	6
	Object Recognition techniques: Viola-Jones, Yolo, Deep learning algorithms for object Recognition, Optical Flow, Gaussian Mixture Model (GMM), Structure of Motion, Motion Estimation and Object Tracking, Scale-Invariant Feature Transform, Speeded-Up Robust Features, Histogram of Oriented Gradients Line Detection-Hough Transforms, Harris corner detector, Edge Detection.	
6	**Intelligent Vision Systems**	6
	Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, CNN applications and Advantages, Layers and Training CNNs, Autoencoders, Gesture Recognition, Face detection and Face recognition.	

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Digital Image Processing	Rafael C. Gonzalez & Richard E. Woods	Pearson
02	Computer Vision: A Modern Approach	David A. Forsyth, Jean Ponce	Prentice Hall
03	Fundamental of Digital Image Processing	A. K. Jain	PHI

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Digital Image Processing	Rafael C. Gonzalez & Richard E. Woods	Wesley
02	Computer Vision	D. H. Ballard	Prentice-Hall, Englewood Cliffs
03	NPTEL Courses: https://onlinecourses.nptel.ac.in/noc19_cs58/preview		

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Programme Elective Course-II				
Title of Course	Elective-II (Control Systems & Signal Processing)			Course Code	AIML3204
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	• **Engineering Mathematics** (basic calculus, differential equations) • **Linear Algebra** (matrices, vectors) • **Basic Signals & Systems concepts** • Fundamentals of **Programming**	
Course Objective	1	To introduce students to basic concepts of control systems and feedback.
	2	To understand time-domain and frequency-domain analysis of control systems.
	3	To learn basic principles of signals, systems, and digital signal processing.
	4	To introduce mathematical tools such as Fourier, Laplace, and Z-Transforms
	5	To help students understand digital filters and signal transformations
	6	To relate control systems and signal processing with AI/ML applications.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Students will explain basic concepts of control systems and feedback mechanisms.
	CO2	Students will analyze system behavior using time-domain and stability techniques.
	CO3	Students will interpret frequency response and understand the importance of system stability
	CO4	Students will describe different types of signals and LTI system behavior.
	CO5	Students will apply Fourier, Laplace, and Z-Transform tools for signal analysis
	CO6	Students will understand digital filtering and apply signal processing concepts in AI/ML tasks.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	1	1	1	1	2
CO2	3	3	2	2	2	1	1	1	1	1	1	2
CO3	2	2	3	3	3	1	1	1	2	2	2	2
CO4	2	3	2	2	2	1	2	2	1	1	2	2
CO5	2	2	3	3	3	1	1	1	2	2	2	3
CO6	2	3	3	3	3	1	1	1	2	2	2	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Basics of Control Systems** Introduction to control systems; Open-loop & closed-loop systems; Feedback; Transfer function; Block diagrams; Signal flow graphs.	6
2	**Time-Domain Analysis** Time response of first-order & second-order systems; Transient and steady-state response; Errors; Stability concepts; Routh–Hurwitz stability test.	6
3	**Frequency-Domain Analysis** Frequency response; Bode plots (basics); Nyquist plot (concept); Gain & phase margin; Importance of frequency response in AI-based control.	6
4	**Basics of Signal Processing** Types of signals; Continuous vs. Discrete signals; Sampling; Quantization; LTI systems; Impulse response; Convolution (easy examples).	6
5	**Transforms in Signal Processing** Fourier Series; Fourier Transform; Laplace Transform; Z-Transform (basic formulas and simple problems); Use of transforms in filtering & feature extraction.	6
	Digital Signal Processing & Modern Applications Digital filters (FIR, IIR basics); DFT & FFT (concept); Noise removal; AI/ML applications in signal processing; Speech, image & sensor data processing.	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
1	Modern Control Engineering	Katsuhiko Ogata	5th Edition, Pearson Education
2	Control Systems Engineering	I. J. Nagrath, M. Gopal	5th Edition, New Age International
3	Signals and Systems	Alan V. Oppenheim, Alan S. Willsky	2nd Edition, Pearson Education

Reference Books			
Sr. no.	Title	Author	Edition/Publication
1	Digital Signal Processing: Principles, Algorithms and Applications	John G. Proakis, Dimitris G. Manolakis	4th Edition, Pearson Education
2	Linear Control System Analysis and Design	G. F. Franklin, J. D. Powell, A. Emami-Naeini	6th Edition, Pearson
3	Signal Processing and Linear Systems	B. P. Lathi	2nd Edition, Oxford University Press

Year and Semester	Third Year B. Tech – Semester VI CSE(AIML)				
Course Category	Programme Elective Course-II				
Title of Course	Elective-II (Applied Statistical Analysis with R)			Course Code	AIML3204
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Basic knowledge of statistics, Basic mathematics, Introductory programming concepts.	
Course Objective	1	To understand the fundamentals of R programming and statistical computing.
	2	To develop skills in handling and manipulating data using R data structures and control flow.
	3	To learn modular programming using functions and packages in R.
	4	To apply data visualization techniques for effective statistical analysis.
	5	To gain proficiency in importing, exporting, and interfacing R with external data sources.
	6	To apply statistical modelling and basic machine learning techniques using R for real-world problems.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Use the R environment to write basic programs and perform statistical computations.
	CO2	Manipulate and process datasets using appropriate R data structures and programming constructs.
	CO3	Create reusable functions and use R packages for structured and reproducible analysis.
	CO4	Generate meaningful statistical graphs and visualizations to interpret data.
	CO5	Import, export, and manage data from various external sources using R.
	CO6	Perform applied statistical analysis and build basic predictive models using R.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	2
CO2	2	3	2	-	2	-	-	-	-	-	-	2
CO3	2	2	3	-	3	-	-	-	-	-	-	2
CO4	2	2	2	2	3	-	-	-	-	2	-	2
CO5	2	2	-	-	3	-	-	-	-	-	-	2
CO6	3	3	3	2	3	-	-	-	-	-	-	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme

- Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 %
- Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units).
- No compulsory passing for MSE.
  ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to R and Statistical Computing** Overview of R and its applications Installation of R and R Studio R environment and workspace Basic syntax, variables, data types, operators Working with vectors and objects Executing scripts and help system	6
2	**Data Structures and Control Flow in R** Vectors, Lists, Matrices, Arrays, Data Frames and Factors Data indexing, sorting, merging Conditional statements and loops	6
3	**Functions, Packages, and Reproducible Analysis** User-defined functions Function arguments and scope Built-in functions R packages and package management Reproducible coding practices	6
4	**Data Visualization for Statistical Analysis** Importance of visualization Histograms, box plots, bar charts Line plots and scatter plots Customization and saving plots	6
5	**Data Import, Export, and External Interfaces** Reading data from files CSV, Excel, XML, JSON Exporting data Introduction to database connectivity	6
6	**Applied Statistical Modelling and Machine Learning with R** Descriptive statistics Probability distributions Hypothesis testing Regression and ANOVA Logistic regression Introduction to supervised and unsupervised learning	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Big Data (Black Book)	DT Editorial Services	Dreamtech Press
02	R for Everyone: Advanced Analytics and Graphics (Second edition)	Jared P. Lander	Addison-Wesley Data & Analytics Series

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	The Art of R Programming	Norman Matloff	William Pollock
02	The Book of R	Tilman M. Davies	William Pollock
03	Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R	Robert Knell,	Amazon Digital South Asia Services Inc, 2013
04	Beginning R – The Statistical Programming Language	Mark Gardener	Wiley, 2013
05	Probability & Statistics with R for Engineers and Scientists	Michael Akritas	2nd Edition on, CRC Press, 2016

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Programme Elective Course-II				
Title of Course	Elective-II (Cyber Security)			Course Code	AIML3204
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Computer Network, Operating System	
Course Objective	1	To understand core cybersecurity concept and and risks in digital systems.
	2	To apply security policies, authentication, access control, and cryptography to protect data and communications.
	3	Analyze cyber-attack techniques, malware behavior, social engineering, and network exploits to assess risk exposure.
	4	Evaluate network security mechanisms to protect enterprise infrastructure.
	5	Demonstrate incident-response processes including threat detection, log analysis, basic forensics, and security monitoring.
	6	To design secure solutions by integrating cybersecurity frameworks
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Utilize secure setups, access-control methods, and information-security concepts to safeguard data and networked systems.
	CO2	Use cryptographic methods to assess non-repudiation, confidentiality, integrity, and authentication.
	CO3	Analyze vulnerabilities using security tools to detect threats, intrusions, and misconfigurations
	CO4	Apply risk-assessment and threat-modelling approaches and analyze cyber risks
	CO5	Evaluate security technologies and architectures
	CO6	Design a secure solution or pen-testing project demonstrating cybersecurity tools and professional reporting.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	3							
CO2		3	1	2	3							
CO3	3		3	2	3	2						1
CO4		3	3	3	3		1	2		2	2	1
CO5		3	3	1	3	2	2	2	2	1	2	2
CO6		3	3	1	3	2	1	2	2	1	3	2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Cybersecurity** **Overview to Computer Security:** Meaning, importance in the digital world, core concepts, and major issues and challenges. **Threat Fundamentals:** Threats, vulnerabilities, attacks, risks, and common cyber-threat types—malware (viruses, worms, ransomware), phishing and social-engineering, and DoS/DDoS attacks. **Basic Cyber Hygiene:** Strong passwords and two-factor authentication, regular software updates and patching, securing personal devices and networks, Online Security Resources **Networks and the Internet:** Introduction, Network Basics, How the Internet Works, Basic Network Utilities	7
2	**Cybersecurity Vulnerabilities and Protections** **Cyber Security Safeguards:** Overview of security controls, access control, authentication, biometrics, cryptography, auditing, deception, and DoS protection. **Authentication & Remote Access:** User/group/role management, password policies, Single Sign-On, permissions, and data-loss prevention. Remote-access process and methods. **Intrusion Detection & Prevention:** IDS overview, network-based and host-based IDS, IPS, honeypots, and honeynets, Imporatanats of HTTPS . **Firewalls & Threat Management:** Firewall types, policies, and threat-management mechanisms.	6
3	**Frauds and Cyber crime** **Cyber Stalking, Fraud and Abuse:** How internet fraud works, identity theft, cyberstalking, and personal protection against cybercrime. **Cybercrime Classification:** Cybercrimes targeting computers and mobile devices, including password attacks, financial fraud, social-engineering, malware and ransomware, zero-day/zero-click exploits, reporting procedures, mitigation strategies, and legal perspectives.	6
4	**IT Act** Introduction to Cyber Laws E-Commerce and E-Governance, Need of Cyber laws- The Indian context, Certiffing Authority and Controller, Offences under IT Act 2000, Digital signature and the Indian IT Act, Computer Offences and its penalty under IT Act 2000, Amendments in Indian IT Act 2008, Intellectual Property Rights .	6

5	**Ethical hacking** Types of hacking technologies, phases of ethical hacking, Foot Printing, Social Engineering, Scanning and enumeration, Understanding the password hacking techniques, Session hijacking, Google Hacking, Windows Hacking, Linux Hacking, Email hacking, Proxy & Packet Filtering, Sniffer, Incident handling and response	6
6	**Overview of Computer Forensics** Introduction to Digital Forensics, General Guidelines in Forensics, Finding Evidence on the PC, Finding Evidence in System Logs, Recovering Deleted Files, Operating System Utilities in Forensics, Mobile Forensics	5

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Cyber Security: With Cryptography Essentials	Shishir Kumar Shandilya, Agni Datta	1st Edition McGraw Hill
02	CyberSpace and Cyber Security	George K.Kostopoulous	1st Edition CRC Press
03	Computer Forensics and Investigations	Nelson Phillips and Enfinger Steuart	1st Edition Cengage Learning, New Delhi

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Cyber Security Essential	J. Graham, R. Howard, Ryan Olson	CRC Press(2010)
02	Computer Forensics and Cyber Crime	Marjie T.Bitz	Pearson(2013)
03	Cryptography and Security	CK Shyamala	Wiley India Pvt. Ltd

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Program Elective Course-II				
Title of Course	Elective-II (Software Testing & Quality Assurance)			Course Code	AIML3204
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--		3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Working knowledge of C programming language.	
Course Objective	1	To understand fundamental concepts of Software Engineering, software processes, SDLC models, and Agile methodologies.
	2	To explain the software testing process, STLC, test case design techniques and testing principles.
	3	To differentiate between Verification and Validation, QA and QC, and understand V&V techniques.
	4	To understand various types and levels of testing.
	5	To apply specialized testing techniques such as regression, smoke, sanity, exploratory testing, and Agile testing practices.
	6	To make the students aware of the importance of Quality Assurance
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand systematic methodology of SDLC and agile software development model.
	CO2	Understand software testing process, testing principles, STLC, and evaluate the effectiveness and limitations of testing.
	CO3	Understand difference between verification and validation, QA and QC, and V&V techniques as per IEEE standards.
	CO4	Understand functional and non-functional testing, levels of testing, and different integration testing strategies
	CO5	Understand specialized testing techniques and testing practices in agile development using agile testing quadrants
	CO6	Understand the importance of Quality Assurance and Software security.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2							2
CO2	3	3	2	2	2							2
CO3	3	2		2				2				2
CO4	3	3	2	2	2							2
CO5	2	2	3	2	2				2	2		3
CO6	2	2	2		2	2	2	2			2	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Software Engineering** Software Engineering and its importance Software Process and Project Component Software Processes, SDLC, Software Development Process Models: Waterfall , Prototype, Time Boxing, Spiral, Iterative, Project Management Process, Agile Development, XP (Extreme Programming).	7
2	**Introduction to Software Testing** Testing Process, Selection of Good Test Cases, Measurement of Testing, Incremental Testing Approach, Basic Terminology Related to Software Testing, Software Testing Life Cycle (STLC),Principles of Testing, Limitations of Testing	5
3	**Software Verification and Validation** Differences between Verification and Validation, Differences between QA and QC, V&V Limitations, Categorizing V&V Techniques, Role of V&V in SDLC– Tabular Form (IEEE Std. 1012), Software V&V Planning (SVVP), Software Technical Reviews (STRs)	6
4	**Types of Testing and Levels of Testing** Functional and Non-Functional Testing, Introduction to: Unit Testing, Integration Testing, System Testing, Acceptance Testing, Testing Relationships, Integration Testing: Classification of Integration Testing, Decomposition-Based Integration, Call Graph-Based Integration, Path-Based Integration with its Pros and Cons	7
5	**Specialized Testing Types** Regression Testing, Smoke Testing, Sanity Testing, Exploratory Testing, Ad-hoc Testing, Testing in Agile Development, Introduction to Agile Development, Agile Testing Quadrants.	5
6	**Software Quality Assurance & Security** Project Scheduling: Basic principles, Work Breakdown Structure (WBS), Project Tracking: Timeline charts, Phases of Software Quality Assurance, Quality Evaluation Standards: Six Sigma, ISO for Software, CMMI: Levels, Process areas, Software Security, Introduction to DevOps, Secure Software Engineering	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Software Engineering – A Precise Approach	Pankaj Jalote	Wiley India, 2010 (Unit 1, 3, 4)
02	Software Testing – A Self Teaching Introduction	Rajiv Chopra	Mercury Learning and Information, 2018 (Unit 2, 3, 4, 5)
03	Software Testing: Principles, Techniques and Tools	Limaye, M. G.	Tata McGraw Hill Education, New Delhi, 2007(Unit 2, 3, 4, 5)
04	Software Testing and Quality Assurance – Theory and Practices	Kshirasagar Naik, Priyadarshi Tripathi	Wiley, 2008 (Unit 6)

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Software Engineering: Principles and Practice	Hans van Vliet	Wiley-India Edition, 2006
02	Software Engineering	P. Fleeger	Pearson Education, India, 2009
03	Software Testing	Yogesh Singh	Cambridge, 2012

Year and Semester	**Third Year B. Tech - Semester VI –CSE(AIML)**				
Course Category	**Programme Elective Course - III**				
Title of Course	**Elective-III (Robotics Intelligent Systems)**			**Course Code**	**AIML3205**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Types Of Sensor and Robot Type	
Course Objective	1	Understand fundamental knowledge of **robotics concepts**
	2	Understand various **robot sensors, actuators, and control techniques**
	3	Develop understanding of **robotic vision systems**, image processing steps
	4	Study the principles of **robot localization, mapping, and navigation** in structured and unstructured environments.
	5	Familiarizes with **path planning and obstacle avoidance algorithms**
	6	To understand the implications of AI and other trending concepts of robotics
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	**Understand basic concepts of robotics**, including robot types, configurations, end effectors
	CO2	Classify and analyze **robot sensors and actuators**
	CO3	Apply **control strategies** such as On–Off control, PID control etc.
	CO4	Apply **robotic vision techniques**
	CO5	Analyze **robot localization and mapping techniques**
	CO6	Describe the impact and progress in AI and other research trends in the field of robotic

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3											1
CO3	3	3										1
CO4	3		3									1
CO5	3			3								1
CO6	3		3		3							1
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to robotics** Degrees of freedom, Robot types- Manipulators- Anatomy of a robotic manipulator- links, joints, actuators, sensors, controllers. Robot configurations-PPP, RPP, RRP, RRR. Mobile robots- wheeled, legged, aerial robots, underwater robots, surface water robots. Dynamic characteristics- speed of motion, load carrying capacity & speed of response. Introduction to End effectors mechanical grippers, special tools, Magnetic grippers, Vacuum grippers, adhesive grippers, Active and Passive grippers. Ethics in robotics - 3 laws - applications of robots.	7
2	**Sensors, Actuators and Control** Sensor classification- touch, force, proximity, vision sensors. Internal sensors- Position sensors, velocity sensors, acceleration sensors, Force sensors; External sensors-contact type, non contact type; Digital Camera - CCD camera - CMOS camera - Omnidirectional cameras Sensor characteristics. Actuators DC Motors H-Bridge Pulse Width Modulation - Stepper Motors Servos, Hydraulic & pneumatic actuators. Control On-Off Control PID Control -Velocity Control and Position Control	6
3	**Robotic vision** Robotic Vision: Sensing, Pre-processing, Segmentation, Description, Recognition, Interpretation, Feature extraction -Camera sensor hardware interfacing. Representation of Transformations Representation of a Pure Translation - - Pure Rotation about an Axis - Combined Transformations - Transformations Relative to the Rotating Frame.	5
4	**Localization and Mapping** Position and Orientation Representing robot position. Basics of reactive navigation; Robot Localization, Challenges in localization - An error model for odometric position estimation, Current Map Representation Continuous representations Decomposition strategies challenges in map representation. Probabilistic map-based localization	6
5	**Path Planning and Navigation** Path Planning- Graph search, deterministic graph search, breadth first search depth first search- Dijkstra' s algorithm, A*, D* algorithms, Potential field based path planning. Obstacle avoidance Bug algorithm	7
6	**AI And Other Research Trends In Robotics** Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids	5

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Introduction to Autonomous Mobile Robots	Siegwart, IR Nourbakhsh, D Scaramuzza	MIT Press, USA
02	Embedded Robotics, Mobile Robot Design and Applications with Embedded Systems	Thomas Bräunl	Springer
03	Introduction to Mobile Robot Control	S.G. Tzafestas	Elsevier

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Introduction to Robotics	John J. Craig	Pearson Education Inc., Asia, 3rd Edition, 2005
02	Introduction to Robotics 2e	S. K. Saha	TATA McGraw Hills Education (2014)
03	Robotics, Vision and Control_ Fundamental Algorithms in MATLAB	Peter Corke	Springer-Verlag Berlin Heidelberg (2021)

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Programme Elective Course - III				
Title of Course	Elective-III (Data Mining)			Course Code	AIML3205
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	03	--	--	03	03
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Database Management Systems, Data Structures and Algorithms, Probability and Statistics, SQL and Database Query Processing, Fundamentals of Data Warehousing Python Programming Basics	
Course Objective	1	Understand the principles, architecture and knowledge discovery process of Data Mining.
	2	Apply pattern discovery techniques for extracting useful knowledge from large datasets.
	3	Analyze association, sequential and clustering techniques for solving real-world problems.
	4	Explore advanced data mining methods including web, text, graph and stream mining.
	5	Study privacy, security and ethical issues in data mining.
	6	Design data mining solutions for modern industrial applications.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Explain the concepts, architecture, tasks and applications of Data Mining.
	CO2	Discover frequent patterns and association rules using suitable mining algorithms.
	CO3	Analyze clustering and outlier detection techniques for knowledge discovery.
	CO4	Apply sequential, web and text mining techniques for extracting useful information.
	CO5	Evaluate advanced data mining techniques including graph mining, stream mining and privacy-preserving mining.
	CO6	Design data mining solutions for real-world applications by considering ethical and societal issues.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	1	2	–	–	–	–	–	–	2
CO2	2	3	2	2	3	–	–	–	–	–	–	2
CO3	2	3	2	3	3	–	–	–	–	–	1	2
CO4	2	3	2	3	3	–	–	–	–	–	1	3
CO5	2	3	2	3	3	1	–	2	–	–	–	3
CO6	2	2	3	2	3	2	1	3	2	1	1	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Data Mining** Evolution of Data Mining, Knowledge Discovery in Databases (KDD), Data Mining Architecture, Data Mining Functionalities, Data Mining Tasks, Data Mining Process Models (KDD and CRISP-DM), Data Warehousing and OLAP, Types of Data Data Mining Applications, Introduction to Open-source Data Mining Tools (WEKA, Orange, RapidMiner, KNIME), Challenges and Future Directions	6
2	**Frequent Pattern and Association Rule Mining** Frequent Pattern Mining, Association Rules, Interestingness Measures, Support Confidence, Lift, Conviction, Apriori Algorithm, FP-Growth Algorithm, Closed Frequent Itemsets, Maximal Frequent Itemsets, Constraint-Based Association Mining Market Basket Analysis, Applications of Association Mining	6
3	**Cluster Analysis and Outlier Detection** **Cluster Analysis:** Introduction to Clustering, Types of Clustering Methods, Partitioning Methods Hierarchical Clustering, Density-Based Clustering, Grid-Based Clustering Cluster Validation Techniques **Outlier Detection:** Types of Outliers, Statistical Methods, Distance-Based Methods, Density-Based Methods, Applications in Fraud Detection and Intrusion Detection	6
4	**Sequential Pattern Mining and Advanced Pattern Discovery** Sequential Pattern Mining, Generalized Sequential Pattern (GSP) Algorithm, PrefixSpan Algorithm, Episode Discovery, Temporal Data Mining, Time-Series Pattern Mining (Concepts), Utility Pattern Mining, High Utility Itemset Mining, Applications in Business and Healthcare	6
5	**Advanced Data Mining Techniques** Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Text Mining, Opinion Mining and Sentiment Analysis, Graph Mining, Social Network Mining, Stream Data Mining, Spatial and Spatio-temporal Data Mining, Multimedia Data Mining	6
6	**Modern Trends and Applications in Data Mining** Privacy-Preserving Data Mining, Explainable Data Mining, Federated Data Mining Big Data Mining (Concepts), Data Mining on Cloud Platforms, Ethical and Legal Issues, Responsible AI in Data Mining **Industrial Applications:** Healthcare Analytics, Financial Analytics, Cybersecurity Analytics, Smart Manufacturing, Agriculture Analytics, Smart Cities, Recent Research Trends in Data Mining	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Data Mining: Introductory and Advanced Topics	Margaret H. Dunham	Pearson Education
02	Data Mining: Concepts and Techniques	Jiawei Han, Micheline Kamber, Jian Pei	Morgan Kaufmann, 4th Edition
03	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar	Pearson, 2nd Edition

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Data Mining Techniques	Michael Berry & Gordon Linoff	Wiley
02	Data Mining: Practical Machine Learning Tools and Techniques	Ian H. Witten, Eibe Frank & Mark Hall	Morgan Kaufmann
03	Principles of Data Mining	David Hand, Heikki Mannila & Padhraic Smyth	MIT Press

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Programme Elective Course - III				
Title of Course	Elective-III (Speech Systems)			Course Code	AIML3205
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Basic Calculus, Probability Statistics, Linear Algebra, Digital Signal Processing and Machine Learning	
Course Objective	1	Introduce the fundamentals of human speech production and perception,
	2	Develop an understanding of speech signal analysis techniques in the time and frequency domains
	3	Provide knowledge of statistical and machine learning models used in speech processing.
	4	Familiarize students with the architecture and functioning of speech recognition systems
	5	Expose students to speech enhancement and noise reduction techniques.
	6	Introduce speech synthesis techniques and real-world applications
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand the fundamentals of speech.
	CO2	Extract various speech features for speech related applications
	CO3	Model speech statistically using stochastic and machine learning approaches
	CO4	Design and analyze automatic speech recognition systems
	CO5	Build a speech enhancement system
	CO6	Build a text-to-speech synthesis system for various applications

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3		2	2							
CO3	3	3	2	3	2							
CO4	3	3	3	2	3				2			
CO5	3	3	3	3	3	1	2		2			
CO6	3	2	3	2	3	2	2	1	2			
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Speech Systems – Introduction** The Human speech production mechanism, Discrete-Time model of speech production, Speech perception – human auditory system, Phonetics – articulatory phonetics, acoustic phonetics, and auditory phonetics, Categorization of speech sounds, Spectrographic analysis of speech sounds, Pitch frequency, Pitch period measurement using spectral and cepstral domain, Formants, Evaluation of Formants for voiced and unvoiced speech.	6
2	**Speech Signal Analysis and Feature Extraction** Time Domain Processing: Introduction to short-time speech analysis, including windowing, short-time energy/magnitude, and zero-crossing rates for speech vs. silence discrimination**.** Frequency Domain Processing: Short-Time Fourier Transform (STFT), spectral displays (spectrograms), and filter-bank methods. Feature Extraction Techniques: LPC (Linear Predictive Coding), Cepstral Analysis, Pattern Comparison	5
3	**Speech Modeling** Stochastic Processes: Introduction to Markov processes. Hidden Markov Models (HMMs): Components of an HMM, training and building HMMs, Viterbi search for optimal state sequence, and Baum-Welch parameter re-estimation. Other Models: Gaussian Mixture Models (GMM), Support Vector Machines (SVM), and an overview of neural network approaches. Vector Quantization: Data compression, codebook design using algorithms like K-means and LBG.	6
4	**Speech Recognition Systems** Architecture of ASR: Components of an automatic speech recognition system, including acoustic and language models. Recognition Types: Isolated word recognition, connected word recognition, and large vocabulary continuous speech recognition (LVCSR). Language Modeling: N-grams and context-dependent sub-word units. Deep Learning ASR: Introduction to end-to-end deep learning pipelines for modern speech recognition systems.	6
5	**Speech Enhancement** Classes of Speech Enhancement Algorithms, Spectral-Subtractive Algorithms - Multiband Spectral Subtraction, MMSE Spectral Subtraction Algorithm, Spectral Subtraction Based on Perceptual Properties, Wiener Filtering - Wiener Filters in the Time Domain, Wiener Filters in the Frequency Domain, Wiener Filters for Noise Reduction, Maximum-Likelihood Estimators, Bayesian Estimators, MMSE and Log-MMSE Estimator, Subspace Algorithms	7

6	**Speech Synthesis and Application** A Text-to-Speech systems (TTS), Synthesizers technologies - Concatenative synthesis, Use of Formants for concatenative synthesis, Use of LPC for concatenative synthesis, HMM-based synthesis, Sinewave synthesis, Speech transformations, Watermarking for authentication of a speech, Emotion recognition from speech.	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Speech and Audio Processing	Shaila D. Apte	Wiley India (P) Ltd, New Delhi
02	Speech Enhancement Theory and Practice,	Philipos C. Loizou	Second Edition, CRC Press, Inc., United States
03	Text-to-Speech Synthesis	Paul Taylor	Cambridge University Press

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Fundamentals of speech recognition	Rabiner L. R. and Juang B. H	Pearson Education
02	Discrete-time speech signal processing - Principles and practice	Thomas F. Quatieri	Pearson
03	Pattern Recognition and Machine Learning,	CM Bishop	Springer

Year and Semester	**Third Year B. Tech - Semester V –CSE(AIML)**				
Course Category	**Program Elective Course - III**				
Title of Course	**Elective-III (Cloud Computing)**			**Course Code**	**AIML3205**
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	3	--	--	3	3
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite		
Course Objective	1	To introduce basic concepts and uses of cloud computing.
	2	To explain virtualization and cloud infrastructure in a simple way.
	3	To make students familiar with popular cloud platforms like AWS, Azure, GCP.
	4	To provide understanding of basic cloud security needs.
	5	To teach simple cloud management and monitoring methods.
	6	To show how AI and ML can be done using cloud services.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Understand what cloud computing is and why it is used.
	CO2	Explain virtualization, VMs, and cloud infrastructure
	CO3	Identify and use basic services from AWS/Azure/GCP
	CO4	Understand simple cloud security concepts
	CO5	Apply basic cloud management and monitoring techniques
	CO6	Use cloud tools for simple AI/ML tasks and model deployment.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	1	1	1	1	2
CO2	3	3	2	2	2	1	1	1	1	1	1	2
CO3	2	2	3	3	3	1	1	1	2	2	2	2
CO4	2	3	2	2	2	1	2	2	1	1	2	2
CO5	2	2	3	3	3	1	1	1	2	2	2	3
CO6	2	3	3	3	3	1	1	1	2	2	2	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to Cloud Computing** Basics of cloud computing, Evolution of cloud computing, Key characteristics and benefits, Cloud computing use cases and real-world applications, Cloud computing vs. Cluster computing vs. Grid computing	6
2	**Cloud Architecture and Models** Cloud computing stack - Comparison with traditional computing architecture , How Cloud Computing Works, Data centers, Role of Networks in Cloud computing, protocols used, Role of Web services ,Cloud computing service models (IaaS, PaaS, SaaS), Deployment models (Public, Private, Hybrid, Community), Comparative analysis of cloud service providers	6
3	**Virtualization in Cloud Computing** Introduction and benefits, Virtualization Structure , Types of virtualization, Hypervisors, Virtual machines, Virtualization at the OS Level, Virtualization of CPU, Memory and I/O Devices, , Resource allocation and management, Performance optimization through virtualization, Open-Source Virtualization Technology	6
4	**Cloud Management & Security** Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Managing Data, Load balancing, Auto scaling,Cloud monitoring, Security issues in cloud computing, Identity and access management, Compliance and legal issues, Jurisdictional issues raised by Data location , Encryption techniques for cloud data security, Cloud Security: Infrastructure Security - Network level security, Host level security, Application-level security	6
5	**Cloud Storage and Databases** Cloud storage architectures, Database services in cloud, Big data management in cloud, Data replication and consistency models,Green Computing	6
6	**Cloud Computing Platforms , Applications & AI** Overview of AWS, Google Cloud, Microsoft Azure, Cloud-based application development, Serverless computing, Edge computing and its impact on cloud services, Cloud ML tools, Cloud for AI & Machine Learning	6

Textbooks			
Sr. no.	Title	Author	Edition/Publication
1	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej Goscinski,	Wiley, 2024 Edition.
2	Cloud Computing Black Book	Jayaswal , Kallakurchi, Houde , Shah	Dreamtech Press
3	Cloud Security	Ronald Krutz and Russell Dean Vines	Wiley-India

Reference Books			
Sr. no.	Title	Author	Edition/Publication
1	Cloud Computing Bible	Barrie Sosinsky	Wiley India
2	Cloud Computing: A Practical Approach	Anthony T.Velte, et.al	McGraw Hill
3	Cloud Security & Privacy	Tim Mather, S.Kumaraswammy, S.Latif SPD	O'REILLY

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Multi-Disciplinary Minor - 04				
Title of Course	Internet of Things			Course Code	AIML3206
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	02	--	--	02	02
Examination Scheme	MSE	ISE/CA	ESE	Total	
	30	10	60	100	

Course Pre-Requisite	Basics Concepts of Network	
Course Objective	1	Understand the fundamentals of IoT
	2	Explain IoT communication principles by studying RFID, ZigBee, Bluetooth, IP/MAC addressing, and IEEE 802 protocol standards
	3	Analyze sensing and actuation mechanisms used in IoT systems, including sensor characteristics, classification, and actuator types.
	4	Develop IoT applications using standard frameworks involving device integration, data acquisition
	5	Explore diverse applications of IoT
	6	Understand web of Things and Cloud of Things
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Describe the IoT Characteristics and Conceptual Framework
	CO2	Understand communication technologies such as RFID, ZigBee, Bluetooth, and IEEE 802 protocols to IoT-based system
	CO3	Classify sensors and actuators and analyze their role in data acquisition and control in IoT environments
	CO4	Apply design methodology and cloud platforms involved in IoT
	CO5	Identify and analyse IoT applications in domains such as smart homes, smart cities, healthcare
	CO6	Understand the principles of Web of Things and Cloud of Things and their role

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											1
CO2	3											1
CO3	3	3										1
CO4	3		3									1
CO5	3											1
CO6	3		3		3							1
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
• Compulsory passing with 40% marks is mandatory in ESE examinations and combined passing marks (MSE+ISE/CA+ESE) for theory course is 40 % • Mid sem. examination will be based on 50 % syllabus from beginning (First Three Units). • No compulsory passing for MSE. • ESE paper setting weightage will be, 25 % on syllabus covered for MSE (First Three Units) and 75 % on remaining syllabus (Last Three Units).

Unit No.	Title and Content of Unit	Hours
1	**Introduction to IoT** Introduction to Internet of Things (IoT), Functional Characteristics, Recent Trends in the Adoption of IoT, Role of cloud in IoT, Societal Benefits of IoT:- Health Care, Machine to Machine (M2M), Smart Transportation, Smart Living, Smart Cities, Smart Grid	4
2	**Communication Principles** RFID, ZigBEE, Bluetooth, Internet Communication- IP Addresses - MAC Addresses , IEEE 802 Family of Protocols , I/O interfaces Software Components	3
3	**Sensing and Actuation** Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors,Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT	3
4	**IoT Application Development** Frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices	4
5	**Applications of IoT** Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection	5
6	**Web of Things and Cloud of Things** Web of Things versus Internet of Things, Two pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers	5

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet Things"	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry	0Pearson Education
02	Internet of Things: Architecture and Design Principles"	Raj Kamal	McGraw Hill Education, 2017
03	Internet of Things A Hands-On-Approach",2014.	Vijay Madisetti, Arshdeep Bahga	Georgia Institute of Technology

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	"Industry 4.0: The Industrial Internet of Things"	Alasdair Gilchrist	Apress, 2016
02	"The Internet of Things in the Cloud: A Middleware Perspective" -	Honbo Zhou	CRC Press 2012
03	"Introduction to Industrial Internet of Things and Industry 4.0"	Sudip Misra,Chandana Roy,Anadarup Mukherjee	CRC Press,2021

Year and Semester	Third Year B. Tech - Semester VI –CSE(AIML)				
Course Category	Program Core Course				
Title of Course	Database Engineering Lab			Course Code	AIML3207
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	02	02	01
Examination Scheme	MSE	ISE/CA	ESE	Total	
	--	50	25	75	

Course Pre-Requisite	Database Fundamentals, Data Modeling, Proficiency in Python or Java, Basics of SQL and Operating Systems	
Course Objective	1	To understand fundamental concepts of database systems and ER data modeling.
	2	To learn relational database concepts and SQL for database creation and manipulation.
	3	To comprehend functional dependencies and normalization techniques for good database design.
	4	To explore database storage structures and indexing techniques for efficient data access.
	5	To learn & understand transaction processing and concurrency control mechanisms in DBMS.
	6	To describe and analyze database failures and recovery mechanisms used in DBMS.
Course Outcomes	After competition of this course students will be able to ….	
	CO1	Design ER diagrams representing real-world database systems.
	CO2	Construct and execute SQL queries to create and manipulate relational databases.
	CO3	Apply normalization methods to develop efficient and consistent database schemas.
	CO4	Analyze and implement appropriate indexing techniques to improve query performance.
	CO5	Evaluate transaction schedules and apply concurrency control protocols.
	CO6	Apply database recovery techniques to maintain data consistency after failures.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								3		
CO2	3	3	2		3					3	3	1
CO3	3	3	3	2						3	2	
CO4	3	2		2	3					3	3	
CO5	3	3	2	2						3	2	
CO6	3	2		2						3	2	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Practical and Oral Performance, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. End Semester Evaluation has 25 Marks External Practical Examination with Performance and Oral Examination

Guidelines for Lab Performance	
Faculty can create experiment list based on following listed topics. Minimum 10 to 12 Experiments should be performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Draw an E-R Diagram of any organization
2	Converting E-R Diagram into Relational Table
3	Installation and Demonstration of DBMS Oracle/MySQL/SQL Server/PostgreSQL etc.
4	Study and Implementation of Data Definition Language(DDL) Queries (e.g. create, alter and drop tables)
5	Study and Implementation of Data Manipulation Language(DML) Queries. (e.g. Insert, delete, update and select statements)
6	Implementation of Basic SQL SELECT statement for displaying/Extracting data from single multiple tables
7	Implementation of SQL constructs for aggregating data, use of group by, having clause.
8	Implementation of nested sub queries, complex sub queries
9	Display the results of Join Operations like cross join, self-join, inner join, natural join, left outer join, right outer join and full outer join
10	Create & Update views for any created table
11	Write a program of Database connectivity with any object oriented language
12	Study and Implementation of Triggers
13	Study and Implementation of functions
14	Study and Implementation of Stored Procedures

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Database System Concepts	A. Silberschatz, H.F. Korth, S. Sudarshan	6th Edition, McGraw Hill Education.
02	Database Systems – Design, Implementation and Management	Rob & Coronel	5th Edition, Cengage Learning

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Database Systems - A practical approach to Design, Implementation and Management	Thomos Connolly, Carolyn Beg	3rd Edition, Pearson Education
02	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B. Navathe	4th Edition, Pearson Education

Year and Semester	Third Year B. Tech - Semester VI – CSE(AIML)				
Course Category	Program Core Course				
Title of Course	IP & CV Lab			Course Code	AIML3208
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	2	2	1
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	50	25	75	

Course Pre-Requisite	Python / C / C++, Machine Learning and Deep Learning Basics, Digital Image Processing.	
Course Objective	1	To develop practical skills in implementing digital image processing techniques using modern programming tools.
	2	Provide hands-on experience with computer vision algorithms for object detection, recognition, motion analysis, and video processing.
	3	Apply mathematical and statistical concepts to analyze images and reduce dimensionality using PCA and histogram-based methods.
	4	To design and implement vision-based solutions using machine learning and deep learning models
	5	To promote experiential, project-based learning for solving real-world problems in healthcare, surveillance, automation, and smart systems.”
	6	To encourage multidisciplinary thinking, creativity, and ethical use of vision technologies
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Apply fundamental digital image processing techniques using modern programming tools.
	CO2	Implement feature extraction methods like HOG, SIFT, and PCA to analyze and represent images effectively
	CO3	Design and develop computer vision techniques for object detection, recognition, motion analysis, and video processing
	CO4	Apply machine learning and deep learning models such as YOLO and R-CNN for practical vision-based applications.
	CO5	Develop experiential and project-based solutions addressing real-world problems
	CO6	Demonstrate ethical, multidisciplinary, and creative use of image processing and computer vision

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2	3							
CO2	3	3		2	3							
CO3	2	3	3	2	3				2			
CO4	2	3	3	2	3							2
CO5	2	2	3		2	2	2		3	2	2	
CO6			2			3	2	3	2	2		2
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic. End Semester Evaluation has 25 Marks

Guidelines for Lab Performance	
Faculty can create Experiment list based on following listed topics. Minimum 10 to 12 Experiments should get performed.	
Exp. No.	Title of Experiment/ Problem Statement
1	Implement various grey level transformations for Image Enhancement.
2	Implement Histogram Equalization technique.
3	Write a Program to apply convolution processes on an input image for image smoothing.
4	Implement Histogram of Oriented Gradient (HOG) for Feature extraction.
5	Write a Program to apply Scale Invariant Feature Transform on input image.
6	Implement frame differencing technique for background subtraction from video.
7	Implement Principal Component Analysis for the computation of Eigenvector to reduce the dimensionality.
8	Implement object detection algorithm YOLO.
9	Implement R-CNN algorithms for object detection.
10	Implement motion estimation using optical flow technique.
11	Implement Object recognition.
12	Implement Facial Expression Recognition.

Textbooks			
Sr. no.	Title	Author	Edition/Publication
01	Digital Image Processing and Analysis: Computer Vision and Image Analysis	Scott E. Umbaugh	4th Edition
02	Handbook of Image Processing and Computer Vision	Arcangelo Distante & Cosimo Distante	1st Edition
03	Digital Image Processing (Illustration using Python)	S. Esakkirajan et al.	1st Edition

Reference Books			
Sr. no.	Title	Author	Edition/Publication
01	Image Processing Techniques and its Applications in Computer Vision and Artificial Intelligence	Shafqat Alauddin, Mrutyunjaya S Yalawar	Rademics
02	Image Processing and Computer Vision Masterclass with Python	Sandipan Dey	2nd Edition
03	Computer Vision and Image Processing: Fundamentals and Applications	CRC Press	1st Edition

Year and Semester	Third Year B. Tech - Semester VI – CSE(AIML)				
Course Category	Experiential Learning				
Title of Course	Domain-Specific Mini Project			Course Code	AIML3209
Teaching Scheme	L	T	P	Contact Hrs/Week	Credits
	--	--	4	4	2
Examination Scheme	MSE	ISE/CA	ESE	Total	
	-	50	-	50	

Course Pre-Requisite	Basic Programming Skills (Python/R) , Fundamentals of Data Structures and algorithms , Basic Statistics and Probability Concepts , Introduction to Data Science and Machine Learning Concepts , Database Management Systems (DBMS) , Familiarity with tools such as Jupyter Notebook, RStudio, or similar platforms	
Course Objective	1	Enable students to understand real-world problems in Data Science and Machine Learning domains.
	2	Develop the ability to select appropriate tools and techniques for data analysis and model building.
	3	Encourage students to apply data preprocessing, visualization, and feature engineering techniques.
	4	Train students to design and implement machine learning models for practical applications.
	5	Enhance teamwork, communication, and project management skills.
	6	Develop the ability to document, present, and demonstrate project outcomes effectively.
Course Outcomes	After competition of this course Students will be able to ….	
	CO1	Identify and define real-world problems suitable for Data Science and Machine Learning solutions.
	CO2	Apply data preprocessing and exploratory data analysis techniques on datasets.
	CO3	Develop and implement machine learning models using appropriate algorithms.
	CO4	Evaluate and interpret model performance using suitable metrics.
	CO5	Work effectively in teams and demonstrate professional communication skills.
	CO6	Prepare technical documentation and present project work effectively.

CO PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	1	–	–	1	1	–	2
CO2	3	2	1	2	3	1	–	–	1	1	–	2
CO3	3	2	3	2	3	1	–	–	2	1	–	2
CO4	2	3	2	3	2	1	–	–	2	1	–	2
CO5	1	1	1	1	2	2	–	1	3	3	2	2
CO6	1	1	1	1	2	2	–	1	2	3	1	3
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
In Semester Evaluation/ Continuous Assessment has 50 Marks Parameters for In Semester Evaluation could be: Attendance, Assignments, Unit Tests, Presentation, Online Activities like (Virtual Labs, NPTEL) etc. Lab File should be prepared and should be assessed continuously during academic.

Guidelines for Lab Performance
The students should form group of 4-5 students and every group is supposed to choose a specific domain for the mini project. Further the group should identify the relevant problem in the selected domain and propose the solution, which can be implemented as a mini-project using suitable technology. The synopsis for the same should be submitted by students to their respective guide. The mini-project work should be evaluated by a team of teachers appointed by the department. The evaluation and marking should include Continuous assessment during which the group should give presentation and demonstration of their work done. The Project Report should be submitted by students as a part of Term Work.