

Ad hoc and Sensor Networks Lab	L	P	C
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Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	7	PCE	PCE-4	ECE-413P
EC-ACT	7	PC	PC	WMC-453P
EE-VDT	7	OAE-ECE-EA	OAE-2	WMC-453P
EAE	7	WMC-EAE	WMC-EAE-3A	WMC-453P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Ad hoc and Sensor Networks) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Create a sample wireless topology using Simulation Tool.
2. Create a mobile Ad-hoc networks using Simulation Tool.
3. Implement an Ad-hoc On-demand Distance Vector protocol using Simulation Tool.
4. Implement a Transmission Control Protocol using Simulation Tool.
5. Implement an User Datagram Protocol using Simulation Tool.
6. Implement a Low Energy Adaptive Hierarchy protocol using Simulation Tool.
7. Implement a Power Efficient Gathering in Sensor Information System using Simulation Tool.
8. Implement a Sensor Protocol for Information via Negotiation (SPIN) using Simulation Tool.
9. Implement a Proactive and Reactive based MAC protocol using Simulation Tool.
10. Implement a Scheduling based protocol for WSNs using Simulation Tool.
11. Implement a Predictive Wake-up MAC protocol using Simulation Tool.

Ad hoc and Sensor Networks	L	P	C
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Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	7	PCE	PCE-4	ECE-413T
EC-ACT	7	PC	PC	WMC-453T
EE-VDT	7	OAE-ECE-EA	OAE-2	WMC-453T
EAE	7	WMC-EAE	WMC-EAE-3A	WMC-453T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

- | | |
|----|--|
| 1. | To know the issues in Ad Hoc wireless networks and designing a MAC Protocol for the same and summarize and compare various types of MAC protocols. |
| 2. | To analyze and explain issues in designing, goals and classification of Routing algorithm |
| 3. | To know the sensor network architecture, data dissemination, data gathering, MAC protocols for sensor networks. |
| 4. | To know the basics of wireless geolocation architecture with technologies. |

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Identify the issues in Ad Hoc wireless networks and designing a MAC Protocol for the same and summarize and compare various types of MAC protocols |
| CO 2 | Analyze and explain issues in designing, goals and classification of Routing algorithm. |
| CO 3 | Develop an understanding of sensor network architecture and explain data dissemination, data gathering, MAC protocols for sensor networks. |
| CO 4 | Develop the knowledge about the basics of wireless geolocation architecture with technologies. |

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	1	2	2	3	2	2	-	2	2	3	3
CO 2	3	1	2	2	2	2	3	-	3	2	2	3
CO 3	3	2	1	2	3	2	3	-	2	2	3	2
CO 4	3	1	2	3	3	3	2	-	2	3	3	2

UNIT I

Ad Hoc Wireless Networks: Introduction. Issues in Ad Hoc Wireless Networks. Ad Hoc Wireless Internet.

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks. Design Goals of a MAC Protocol for Ad Hoc Wireless Networks. Classifications of MAC Protocols. Contention-Based Protocols. Contention-Based Protocols with Reservation Mechanisms. Different digital topology. MAC Protocols in Directional Antennas.

UNIT II

Routing Protocols for Ad Hoc Wireless Networks: Introduction to Routing algorithm, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks. Classifications of Routing Protocols. Table-Driven Routing Protocols. On-Demand Routing Protocol, Routing Protocols with Efficient Flooding Mechanisms. Hierarchical Routing Protocols.

Transport Layer and Security Protocols for Ad Hoc Wireless Networks: Introduction. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks. Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks. Classification of Transport Layer Solutions. TCP Over Ad Hoc Wireless Networks. Security in Ad Hoc Wireless Networks. Network Security Requirements. Issues and Challenges in Security Provisioning. Network Security Attacks. Key Management. Secure Routing in Ad Hoc Wireless Networks.

UNIT III

Wireless Sensor Networks: Introduction. Sensor Network Architecture. Data Dissemination. Data Gathering. MAC Protocols for Sensor Networks. Location Discovery. Quality of a Sensor Network. Evolving Standards. Other Issues.

Hybrid wireless Networks: Introduction. Next-Generation Hybrid Wireless Architectures. Routing in Hybrid Wireless Networks. Pricing in Multi-Hop Wireless Networks. Power Control Schemes in Hybrid Wireless Networks. Load Balancing in Hybrid Wireless Networks.

UNIT IV

Wireless Geolocation Systems: Introduction. What is wireless Geolocation? Wireless Geolocation System Architecture. Technologies for Wireless Geolocation. Geolocation Standards for E-911 Services. Performance Measures for Geolocation Systems.

Recent Advances in Wireless Networks: Introduction. Ultra-Wide-Band Radio Communication. Wireless Fidelity Systems. Optical Wireless Networks. The Meghadoot Architecture, introduction to vehicular sensor networks.

Text Books:

1. Siva Ram Murthy, C. and Manoj, B. S., Adhoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, (2004) 2nd ed.
2. Perkins, Charles E., Ad hoc Networking, Addison Wesley, (2000) 3rd ed.

Reference Books:

1. Toh, C. K., Ad hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, PTR, (2001) 3rd Edition.
2. Pahlavan, Kaveh, Krishnamoorthy, Prashant, Principles of Wireless Networks, - A united approach, Pearson, (2002) 2nd ed.
3. Wang X. and Poor H.V., Wireless Communication Systems, Pearson education, (2004) 3rd ed.
4. Schiller Jochen, Mobile Communications, Person Education – 2003, 2nd ed.
5. Carlos De Morais Cordeiro and Dharam P Agrawal, "Adhoc and Sensor Networks- Theory & Applications", 2nd Ed, Cambridge Univ Press India Ltd.

Biometrics Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	IPCV-EAE	IPCV-EAE-4A	IPCV-453P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Biometrics) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Installation and working on various AI tools such as Python / MATLAB.
2. Implement a face recognition system based on Linear Discriminant Analysis Implementation of anyone classification technique.
3. Implement a face recognition system using Gabor filters to extract features
4. Implementation of different feature extraction methods.
5. Design and Apply Image Acquisition and Feature Extraction for different Iris features
6. Compute the Classification Accuracy of Support Vector Machine & Convolutional Neural Network for a given dataset
7. Employ morphological operators and enhancement methods to the fingerprint images
8. Implement a center point detection algorithm for fingerprint recognition
9. Design and Development of Biometric Recognition and Matching System
10. Design and Apply 3D Biometric palmprint detection and Mobile Biometrics.
11. Develop simple applications for privacy

Biometrics	L	P	C
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Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	IPCV-EAE	IPCV-EAE-4A	IPCV-453T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To introduce the general principles of design of biometric systems and the underlying trade-offs. Personal privacy and security implications of biometrics based identification technology.											
2.	To familiarize with Face recognition and Hand Geometry, feature extraction, pattern classification. Authentication Methods and their algorithms											
3.	To acquire knowledge about various parameters involved in Iris and Voice recognition. Authentication Methods and their algorithms											
4.	Introduction to multimodal Biometric system and its functional blocks and futuristic biometric systems.											
Course Outcomes (CO)												
CO 1	Demonstrate knowledge engineering principles underlying biometric systems and Finger print feature processing.											
CO 2	Face recognition, how to perform Feature Extraction, classification of features, training of algorithm using neural network.											
CO 3	To acquire knowledge about various parameters involved in Iris and Voice recognition. Authentication Methods and their algorithms											
CO 4	Demonstration of innovative multimodal Biometric system and Statistical Measures of Biometrics											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	3	2	2	1	2	1	1	2
CO 2	3	3	3	3	2	2	1	-	2	1	-	2
CO 3	3	3	3	3	2	2	1	-	2	1	-	2
CO 4	3	3	3	3	2	1	1	-	2	1	-	2
UNIT I												
Introduction to biometrics: Biometric technologies, Passive biometrics, Active biometrics, Biometric systems, Enrolment, Templates, Algorithm, Verification, Authentication technologies, Need for strong authentication, Protecting privacy and policy, Low level Feature Extraction: Edge Detection, phase congruency, localized feature extraction, describing image motion. High Level Extraction: Thresholding and subtraction, Template matching, feature extraction by low level features, Hough transformation.												
Fingerprint Technology: History of fingerprint pattern recognition, General description of fingerprints, Finger print feature processing techniques, Fingerprint sensors using RF imaging techniques, Fingerprint quality												

assessment, Computer enhancement and modelling of fingerprint images, Fingerprint enhancement, Feature extraction, Fingerprint classification, Fingerprint matching

UNIT II

Face recognition & Hand Geometry: Introduction to face recognition, Neural networks for face recognition, Hand geometry, Scanning, Feature Extraction, Adaptive Classifiers, Classification of 3D biometric imaging methods, 3D biometric Technologies, 3D palm print capturing systems, Biometric fusion.

Iris and Voice recognition: Iris scan – Features, Components, Operation (Steps), Competing iris Scan technologies Strength and weakness. Voice Scan – Features, Components, Operation (Steps), Competing voice Scan (facial) technologies–Strength and weakness

UNIT III

Physiological and Behavioural Biometrics: Retina scan – AFIS (Automatic Finger Print Identification Systems) Behavioral biometrics – Signature scan-Keystroke scan biometrics application, Biometric Solution Matrix, Bio privacy, Comparison of privacy factor in different biometrics technologies.

Multimodal Biometrics: Introduction to multimodal Biometric system, Integration strategies – Architecture, Level of fusion –Combination strategy –Training and adaptability – Examples of multimodal biometric systems, Performance evaluation- Statistical Measures of Biometrics: FAR – FRR – FTE – EER – Memory requirement and Allocation

UNIT IV

Biometric Authentication: Biometric Authentication Methods, Biometric Authentication Systems, Biometric authentication by fingerprint, Biometric Authentication by Face Recognition - Expectation-Maximization theory – Support Vector Machines. Biometric authentication by fingerprint –Biometric authentication by hand geometry- Securing and trusting a Biometric transaction – Matching location – local host - authentication server – Match On Card (MOC) – Multi-Biometrics and Two-Factor authentication

Textbook(s):

1. James wayman, Anil k.Jain , Arun A.Ross , Karthik Nandakumar, Introduction to Biometrics, Springer, 2011
2. John Vacca "Biometrics Technologies and Verification Systems" Elsevier 2007
3. James Wayman, Anil Jain, David MALtoni, DasioMaio(Eds) "Biometrics Systems Technology", Design and Performance Evaluation.Springer 2005

Reference Books:

1. Haizhou Li, Liyuan Li, Kar-Ann Toh, Advanced Topics in Biometrics, 2012, 1st edition, World Scientific Publisher, Singapore
2. Amine Nail -Ali and Regis Fournier "Signal and Image Processing for Biometrics" John wiley and sons,2012

Fuzzy Logic and Neural Networks Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	7	PCE	PCE-4	ECE-411P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Fuzzy Logic and Neural Networks) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Plot the correlation plot on some suitable dataset and visualize giving an overview of relationships among data.
2. Create a perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights
3. Write a program to implement artificial neural network without back propagation.
4. Write a program to implement artificial neural network with back propagation.
5. Implement crisp partitions for real-life iris dataset.
6. Write a program to implement logic gates.
7. Implement SVM classification by fuzzy concepts.
8. Implement linear regression and multi-regression for a set of data points
9. Implement Union, Intersection, Complement and Difference operations on fuzzy sets.
10. Create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.

Fuzzy Logic and Neural Networks	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	7	PCE	PCE-4	ECE-411T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	Introduce students to the various neural network and fuzzy systems models.											
2.	Reveal different applications of these models to solve engineering and other problems.											
3.	Introduce the theory and applications of artificial neural network and fuzzy systems to engineering applications with emphasis on image processing and control.											
4.	Discuss neural networks and fuzzy systems, architectures, algorithms and applications, including Back-propagation, BAM, Hopfield network, Competitive Learning, ART, SOFM, Fuzzy inference methods and expert systems.											
Course Outcomes (CO)												
CO 1	Comprehend the concepts of feed forward neural networks											
CO 2	Analyze the various feedback networks.											
CO 3	Understand the concept of fuzziness involved in various systems and fuzzy set theory.											
CO 4	Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	3	3	-	2	-	-	1	3	2
CO 2	3	3	1	1	1	-	1	1	-	2	2	1
CO 3	3	2	3	3	2	-	2	-	-	2	3	1
CO 4	1	2	3	2	2	-	1	-	-	1	2	2
UNIT-I												
Artificial Neural Network:History, Overview Of Biological Neuro-System, Mathematical Models Of Neurons, ANN architecture, Learning Rules, Learning Paradigms-Supervised, Unsupervised and Reinforcement Learning, ANN training Algorithms-perceptions, Training rules, , Back Propagation Algorithm, K Means clustering, Probabilistic Neural Network, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.												
UNIT-II												
Fuzzy Logic: Introduction to fuzzy logic, Classical and fuzzy sets: Overview of Classical Sets, Membership Function and Fuzzy rule Generation. Operation on Fuzzy Sets: Compliment, Intersection, Unions, Combinations												

of Operations, Aggregation Operations Fuzzy Arithmetic: Fuzzy numbers, Linguistic variables, arithmetic operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT-III

Fuzzy Logic: Classical Logic, Multivalued logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, and Fuzziness of Fuzzy Sets.

UNIT - IV

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks. Application of Fuzzy Logic & Neural Networks in Intelligent Machine Design.

Textbook(s):

1. Haykins S., Neural Networks, Pearson Education, 2009
2. Yen J. & Langari R., Fuzzy Logic—Intelligence Control & Information, Pearson Education Asia, 1999.

References:

1. Lee H.H., First Course on Fuzzy Theory & Application, Springer Publications, 2005.
2. Ross T.J., Fuzzy Logic with Engineering Applications, Wiley India, 2011
3. Kumar S., Neural Networks, Tata Mc GrawHill Publications, 2004.

Introduction to Database Management Systems Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
OAE	6	SD-OAE	SD-OAE-2B	OSD-336P
EE-VDT/EC-ACT	7	OAE-ECE-EA	OAE-2	OCSE-407P
OAE	7	CSE-OAE	CSE-OAE-3	OCSE-407P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Introduction to Database Management Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

13. Experiments based on DDL commands – CREATE, ALTER, DROP and TRUNCATE.
14. Apply the integrity constraints like Primary Key, Foreign key, Check, NOT NULL, etc. to the tables.
15. Experiments based on basic DML commands – SELECT, INSERT, UPDATE and DELETE.
16. Write the queries for implementing Built-in functions, GROUP BY, HAVING and ORDER BY.
17. Write the queries to implement the joins.
18. Write the queries to implement the subqueries.
19. Write the queries to implement the set operations.
20. Write the queries to create the views and queries based on views.
21. Demonstrate the concept of Control Structures.
22. Demonstrate the concept of Exception Handling.
23. Demonstrate the concept of Functions and Procedures.
24. Demonstrate the concept of Triggers.

Introduction to Database Management Systems	L	P	C
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Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
OAE	6	SD-OAE	SD-OAE-2B	OSD-336T
EE-VDT/EC-ACT	7	OAE-ECE-EA	OAE-2	OCSE-407T
OAE	7	CSE-OAE	CSE-OAE-3	OCSE-407T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1. To introduce basic concepts, architecture and characteristics of database systems.
2. To introduce relational model concepts and PL/SQL programming.
3. To introduce relational database design and Normal forms based on functional dependencies.
4. To introduce concepts of object oriented & distributed databases.

Course Outcomes (CO)

- CO 1** Ability to understand advantages of database systems.
- CO 2** Ability to use SQL as DDL, DCL and DML.
- CO 3** Ability to design database and manage transaction processing.
- CO 4** Understand object oriented & distributed databases systems and use them.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	2	2	2	-	-	-	3	2	2	3
CO 2	3	3	2	2	2	-	-	-	3	2	2	3
CO 3	3	3	2	3	3	-	-	-	3	2	2	3
CO 4	3	3	2	3	3	-	-	-	3	2	2	3

UNIT – I

Basic concepts: database & database users, characteristics of the database systems, concepts and architecture, data models, schemas & instances, DBMS architecture & data independence, data modelling using the entity-relationship approach.

SQL – DDL, DCL & DML views and indexes in SQL. Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator.

UNIT - II

Enhanced ER Concepts: Specialization/Generalization, Aggregation, Mapping of ER model to Relational Model.

SQL – Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. Transaction control commands – Commit, Rollback, Save point.

UNIT - III

Relational Model: Concepts, relational model constraints, relational algebra.

Relational Database Design: functional dependencies & normalization for relational databases, normal forms based on functional dependencies, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Database Programming – control structures, exception handling, stored procedures, Triggers.

UNIT - IV

Properties of Transaction, Transaction states, Transaction Schedule, Serializability, Concurrency control techniques, locking techniques, Recoverable schedules, Deadlock detection and Recovery, recovery techniques: recovery concepts.

Concepts of Object Oriented Database Management systems & Distributed Database Management Systems

Textbooks:

1. R. Elmsari and S. B. Navathe, "Fundamentals of database systems", Pearson Education, 7th Edition, 2018
2. V. M. Grippa and S. Kumichev, "Learning MySQL", O'Reilly, 2021.
3. SQL/ PL/SQL, The programming language of Oracle, Ivan Bayross, 4th Edition BPB Publications

References:

1. A. Silberschatz, H. F. Korth and S. Sudershan, "Database System Concept", McGraw Hill, 6th Edition, 2013.
2. Date, C. J., "An introduction to database systems", 8th Edition, Pearson Education, 2008.
3. Desai, B., "An introduction to database concepts", Galgotia publications, 2010
4. H. Garcia-Molina, J. D. Ullman, J. Widom, "Database System: The Complete Book", PH.
5. Oracle and MySQL manuals.

Introduction to Internet of Things Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-2	CIE-330P
ICE	6	PCE	PCE-3	ICE-328P
CSE-IoT/CSE-ICB	6	PC	PC	IOT-324P
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IOT-324P
EAE	6	IOT-EAE	IOT-EAE-1A	IOT-324P
EAE	6	ICB-EAE	ICB-EAE-1A	IOT-324P
ECE	7	PCE	PCE-5	ECE-429P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Introduction to Internet of Things) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc
2. Run some python programs on Pi like: a) Read your name and print Hello message with name b) Read two numbers and print their sum, difference, product and division. c) Word and character count of a given string. d) Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.
3. Run some python programs on Pi like: a) Print a name 'n' times, where name and n are read from standard input, using for and while loops. b) Handle Divided by Zero Exception. c) Print current time for 10 times with an interval of 10 seconds. d) Read a file line by line and print the word count of each line.
4. Light an LED through Python program
5. Get input from two switches and switch on corresponding LEDs.
6. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
7. Flash an LED based on cron output (acts as an alarm)
8. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
9. Get the status of a bulb at a remote place (on the LAN) through web.
10. Push sensor data to cloud and Control an actuator through cloud.

Introduction to Internet of Things	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-2	CIE-330T
ICE	6	PCE	PCE-3	ICE-328T
CSE-IoT/CSE-ICB	6	PC	PC	IOT-324T
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IOT-324T
EAE	6	IOT-EAE	IOT-EAE-1A	IOT-324T
EAE	6	ICB-EAE	ICB-EAE-1A	IOT-324T
ECE	7	PCE	PCE-5	ECE-429T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

1. Describe what IoT is and how it works today
2. Recognise the factors that contributed to the emergence of IoT
3. Design and program IoT devices
4. Define the infrastructure for supporting IoT deployments

Course Outcomes (CO)

- CO 1** Demonstrate basic concepts, principles and challenges in IoT.
- CO 2** Illustrate functioning of hardware devices and sensors used for IoT
- CO 3** Analyze network communication aspects and protocols used in IoT
- CO 4** Apply IoT for developing real life applications using Arduino programming.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	1	-	-	-	1	-	-	2	-	3	-
CO 2	1	-	2	-	3	-	-	-	-	1	-	2
CO 3	-	2	2	-	-	1	-	-	2	-	-	2
CO 4	2	1	-	-	2	-	-	-	-	1	1	-

UNIT-I

Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability

UNIT-II

Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.

UNIT-III

Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT - IV

Programming the Arduinio: Arduinio Platform Boards Anatomy, Arduinio IDE, coding, using emulator, using libraries, additions in arduinio, programming the arduinio for IoT.

Textbook(s):

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things key applications and protocols", Willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House

References:

1. Michael Miller, "The Internet of Things", Pearson
2. Raj Kamal, "Internet of Things", McGraw-Hill, 1st Edition

Intelligent and Expert Systems Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI	7	PC	PC	AI-405P
EAE	7	AI-EAE	AI-EAE-5	AI-405P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Intelligent and Expert Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Study of PROLOG. Write the following programs using PROLOG / LISP
2. Write simple fact for the statements using PROLOG
 - a. Ram likes mango.
 - b. Seema is a girl.
 - c. Bill likes Cindy.
 - d. Rose is red.
 - e. John owns gold.
3. Write predicates, one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing using PROLOG.
4. Write a program to solve 8 queens problem
5. Solve any problem using depth first search.
6. Solve any problem using best first search.
7. Solve 8-puzzle problem using best first search
8. Solve Robot (traversal) problem using means End Analysis
9. Solve traveling salesman problem.
10. Experiment based on knowledge representation.
11. Experiment based on reasoning
12. Study of Expert System – MYCIN.

Intelligent and Expert Systems	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI	7	PC	PC	AI-405T
EAE	7	AI-EAE	AI-EAE-5	AI-405T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To study the idea of intelligent agents and search methods.											
2.	To study about representing knowledge.											
3.	To study the reasoning and decision making in uncertain world.											
4.	To study the concepts of expert systems.											
Course Outcomes (CO)												
CO 1	Able to understand the idea of intelligent agents and search methods.											
CO 2	Able to represent knowledge using various knowledge representation techniques.											
CO 3	Able to apply reasoning for decision making in uncertain world.											
CO 4	Able to understand the concepts of expert systems and implement expert systems.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	3	2	2	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	2	-	-	-	-	2
CO 4	3	3	3	3	3	2	2	-	-	-	-	2
UNIT-I												
Introduction to AI: Intelligent agents – Perception – Natural language processing – Problem – Solving agents – Searching for solutions: Uniformed search strategies – Informed search strategies.												
UNIT-II												
Knowledge and Reasoning: Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents: Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic.												
UNIT-III												

Uncertain Knowledge and Reasoning: Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye’s rule – Probabilistic reasoning – Making simple decisions.

Learning: Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active.

UNIT-IV

Expert Systems: Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN.

Textbooks:

1. Stuart Russel and Peter Norvig, ‘Artificial Intelligence A Modern Approach’, 2nd Edition, Pearson, 2003.
2. Donald A. Waterman, ‘A Guide to Expert Systems’, Pearson Education.

References:

1. George F. Luger, ‘Artificial Intelligence – Structures and Strategies for Complex Problem Solving’, 4th Ed, Pearson Education, 2002.
2. Elaine Rich and Kevin Knight, ‘Artificial Intelligence’, Second Edition Tata McGraw Hill, 1995.
3. Rich and Knight, “Artificial Intelligence”, Tata McGraw Hill, 1992

Machine Learning and Data Analytics Case Studies	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-5A	ML-467T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	This course provides the fundamental concepts in data science.											
2.	Learn the Basics of statistical data analysis with examples.											
3.	Basics of Machine Learning and statistical measures.											
4.	Compile and visualize data using statistical functions.											
Course Outcomes (CO)												
CO 1	Impart the knowledge of data classification, process of big data technology, user roles and skills in data science.											
CO 2	Understand how data is analysed and visualized using statistic functions											
CO 3	Analyze the methodologies of data science											
CO 4	Design the code for the problems related to data science using R											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	2	3	-	2	-	-	-	-	-	-
CO 2	-	3	-	2	-	-	-	-	-	-	2	-
CO 3	-	-	-	3	3	3	-	-	-	-	2	3
CO 4	-	-	3	2	-	3	-	-	-	-	2	2
UNIT-I												
Unsupervised Machine Learning Algorithms: Dimensionality Reduction, Clustering, Supervised Machine Learning Problems: Regression and classification.												
Case Study: Balanced Scorecard Model for Measuring Organizational Performance, Employee Attrition in an Organization, Market Capitalization Categories, Performance Appraisal in Organizations, Application of Technology Acceptance Model in Cloud Computing, Prediction of Customer Buying Intention due to Digital Marketing.												
UNIT-II												
Supervised Machine Learning Algorithms: Naïve Bayes Algorithm, k-Nearest Neighbor's (KNN) Algorithm, Support Vector Machines (SVMs), Decision Trees.												
Case Study: Measuring Acceptability of a New Product, Case Study: Predicting Phishing Websites, Fraud Analysis for Credit Card and Mobile Payment Transactions, Artificial Intelligence and Employment.												

UNIT-III

Data Analytics- Relation: Data Science, Analytics and Big Data Analytics. Data Science Components – Big data technology – Data Science user- roles and skills- Data Science use cases. Statistical Measures in R: Measures of central tendency – Range- inter quartile range – Mean – Median – variance- Standard deviation – Sampling distribution – probability distributions- hypothesis tests.

UNIT - IV

Mathematics for Data science Probability, Statistics, Linear Algebra, Gradient Descent, Calculus for data science, ANOVA, Hypothesis testing, Data Visualization using GGPlot2 and Matplotlib, Data Pre-processing, Data Transformation, Data Reduction, Feature Extraction. Univariate and Multi-variate analysis.

Case study: Insurance policy offers, Discount targeting in online shopping.

Textbook(s):

1. Data analytics with R by Dr. Bharti Motwani , Wiley publication
2. V. Bhuvaneshwari (2016). Data Analytics with R, Bharathiar University.

References:

1. Nina Zumal, John Mount (2014). Practical Data science in R, Manning Publication Company
2. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017

Machine Learning and Data Analytics Case Studies Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-5A	ML-467P

<p>Marking Scheme:</p> <ol style="list-style-type: none"> Teachers Continuous Evaluation: 40 marks Term end Theory Examinations: 60 marks
<p>Instructions:</p> <ol style="list-style-type: none"> The course objectives and course outcomes are identical to that of (Machine Learning and Data Analytics Case Studies) as this is the practical component of the corresponding theory paper. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

Implement a case study mentioned in syllabus by considering following methods.

- Define the problem statement:** Clearly articulate the problem you want to solve or the objective you want to achieve using machine learning and data analytics.
- Gather and preprocess data:** Collect relevant data for your case study and perform necessary preprocessing tasks such as data cleaning, handling missing values, and feature engineering.
- Exploratory data analysis (EDA):** Analyze the dataset to gain insights into the data distribution, identify patterns, and visualize relationships between variables.
- Split the data and model training:** Divide the dataset into training, validation, and testing sets and train your models on the training set, tune hyperparameters using the validation set, and evaluate their performance on the testing set.
- Model evaluation:** Train the selected machine learning models using the training set and evaluate their performance using appropriate metrics such as accuracy, precision, recall, F1-score, or mean squared error.
- Deployment:** Implement the chosen model in a real-world scenario, considering factors such as scalability, performance, and integration with existing systems.
- Interpretation and visualization:** Interpret the results of your models and visualize them in a meaningful way. This helps in presenting insights to stakeholders and understanding the impact of different variables on the outcome.
- Documentation:** Document your case study, including the problem statement, data sources, preprocessing steps, modeling techniques used, results obtained, and any limitations or assumptions made during the process.
- Communication and presentation:** Prepare a clear and concise presentation of your case study findings, highlighting the key insights and recommendations derived from your analysis.
- Ethical considerations:** Consider ethical aspects such as data privacy, bias, and fairness throughout the entire process. Ensure that your models and analyses are fair, transparent, and aligned with legal and ethical guidelines.

Real Time Operating Systems	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-in-EA	6	OAE-CSE-EA	OAE-1	ES-304
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	ES-304
EAE	6	ES-EAE	ES-EAE-2A	ES-304
ECE	7	PCE	PCE-5	ECE-425

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	Describe the key characteristics and requirements of real-time systems, understanding their fundamental differences from general-purpose systems.											
2.	Differentiate between various types of operating systems, particularly RTOS, and justify the selection of RTOS in embedded applications based on its advantages and suitability.											
3.	Designing and implementing tasks with inter-process communication in a chosen RTOS. They will also gain expertise in applying different task synchronization mechanisms to ensure efficient resource management and overcome priority inversion challenges.											
4.	Analyse and troubleshoot synchronization issues in RTOS-based systems, utilizing profiling techniques to optimize task performance and evaluate and select the most suitable scheduling algorithms for specific embedded applications.											
Course Outcomes (CO)												
CO 1	Understand and analyse the basic concepts of real-time systems, task creation, scheduling, termination mechanisms, and different interprocess communication and synchronization methods in RTOS.											
CO 2	Design and implement task scheduling algorithms and different task synchronization mechanisms to solve priority inversion problems in RTOS.											
CO 3	Implement memory pools and dynamic memory allocation strategies and develop device drivers for different hardware peripherals in an RTOS to analyse and optimize interrupt handling enhanced real-time responsiveness.											
CO 4	Implement real-time communication protocols to interface with external devices in embedded systems to analyse and design real-time systems considering timing constraints.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	1	1	-	-	-	-	-	-	-
CO 2	1	1	3	2	1	-	-	-	-	-	-	-
CO 3	3	3	3	2	3	-	-	-	-	-	-	-
CO 4	2	2	3	2	3	-	-	-	-	-	-	2

UNIT-I

Introduction to RTOS: Overview of embedded systems and their applications, Introduction to real-time systems and their characteristics, Fundamentals of operating systems and their role in embedded systems, Real-Time Operating Systems (RTOS) vs. General-Purpose Operating Systems, Tasks and processes in RTOS: creation, scheduling, and termination, Inter-process communication and synchronization mechanisms in RTOS, Case studies of popular RTOS used in embedded systems (e.g., FreeRTOS, VxWorks, RTLinux)

UNIT-II

Task Management and Scheduling: Task management in RTOS: task states, priorities, and context switching, Task scheduling algorithms: pre-emptive vs. non-pre-emptive, priority-based, round-robin, Rate monotonic scheduling (RMS) and earliest deadline first (EDF) algorithms, Task synchronization and communication: semaphores, mutexes, message queues, Deadlock and priority inversion issues in RTOS, Task profiling and performance analysis in real-time systems

UNIT-III

Memory Management and Device Drivers in RTOS: Memory management in embedded systems and its challenges, Memory partitioning and protection mechanisms in RTOS, Memory pools and dynamic memory allocation in RTOS, Introduction to device drivers and their role in embedded systems, implementing device drivers for peripherals in RTOS, Interrupt handling and real-time responsiveness in device drivers, Case study: Writing a device driver for a specific hardware peripheral in an RTOS environment

UNIT – IV

Real-Time Communication and System Design: Interfacing with external devices and communication protocols (UART, SPI, I2C), Real-time communication protocols (CAN, Ethernet) and their importance in industrial applications, Introduction to real-time constraints and analysis in system design, System-level design and considerations for real-time applications, Introduction to software engineering principles in RTOS projects, Real-time debugging and testing techniques in embedded systems, Any one Real-time case study and application (robotics, automotive systems, medical devices)

Textbook(s):

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011
2. Embedded Systems- Architecture, Programming and Design by Rajkamal, TMH, 2007.

References:

1. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.
2. Embedded Systems: Real-Time Operating Systems for Arm Cortex-M Microcontrollers by Jonathan Valvano, Vol 3, 4th Edition, 2017
3. **Mastering the FreeRTOS Real-Time Kernel: A Hands-On Tutorial Guide by Richard Barry**

Supervised and Deep Learning Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-3	ML-463P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Supervised and Deep Learning) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Linear regression: Implement linear regression on a dataset and evaluate the model's performance.
2. Logistic regression: Implement logistic regression on a binary classification dataset and evaluate the model's performance.
3. k-Nearest Neighbors (k-NN): Implement k-NN algorithm on a dataset and evaluate the model's performance.
4. Decision Trees: Implement decision trees on a dataset and evaluate the model's performance.
5. Random Forest: Implement random forest algorithm on a dataset and evaluate the model's performance.
6. Support Vector Machines (SVM): Implement SVM on a dataset and evaluate the model's performance.
7. Naive Bayes: Implement Naive Bayes algorithm on a dataset and evaluate the model's performance.
8. Gradient Boosting: Implement gradient boosting algorithm on a dataset and evaluate the model's performance.
9. Convolutional Neural Networks (CNN): Implement CNN on an image classification dataset and evaluate the model's performance.
10. Recurrent Neural Networks (RNN): Implement RNN on a text classification dataset and evaluate the model's performance.
11. Long Short-Term Memory Networks (LSTM): Implement LSTM on a time-series dataset and evaluate the model's performance.
12. Autoencoders: Implement autoencoders on an image dataset and evaluate the model's performance.
13. Generative Adversarial Networks (GANs): Implement GANs on an image dataset and evaluate the model's performance.
14. Transfer Learning: Implement transfer learning on an image dataset and evaluate the model's performance.
15. Reinforcement Learning: Implement reinforcement learning on a game environment and evaluate the model's performance.

Supervised and Deep Learning	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-3	ML-463T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

- | | |
|----|--|
| 1. | To introduce students to the fundamentals of Supervised Learning and Deep Learning techniques and algorithms. |
| 2. | To enable students to develop skills in implementing supervised and deep learning algorithms using Python programming language and popular machine learning libraries. |
| 3. | To equip students with the ability to evaluate the performance of supervised and deep learning models and select the appropriate models for specific problems. |
| 4. | To provide students with hands-on experience in working with real-world supervised and deep learning projects. |

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Develop a deep understanding of the concepts and applications of Supervised Learning and Deep Learning techniques and algorithms. |
| CO 2 | Develop proficiency in using Python programming language and popular machine learning libraries to implement supervised and deep learning models. |
| CO 3 | Demonstrate the ability to evaluate the performance of supervised and deep learning models and select the appropriate models for specific problems. |
| CO 4 | Gain hands-on experience in working with real-world supervised and deep learning projects, including image recognition, text analysis, and time-series analysis. |

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	3	-	-	-	3	2	2	3
CO 2	3	2	2	2	3	-	-	-	3	2	2	3
CO 3	3	2	2	2	3	-	-	-	3	2	2	3
CO 4	3	2	2	2	3	-	-	-	3	2	2	3

UNIT-I

Introduction to Machine Learning, Types of Machine Learning, Supervised Learning Basics, Regression and Classification, Linear Regression, Logistic Regression, Model Evaluation Metrics

UNIT-II

Introduction to Deep Learning, Artificial Neural Networks, Activation Functions, Loss Functions, Optimization Algorithms, Backpropagation Algorithm, Regularization Techniques

UNIT-III

Introduction to CNNs, CNN Architecture, Convolution and Pooling Layers, Object Detection, Image Segmentation, Transfer Learning, Introduction to RNNs, RNN Architecture, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Text Generation, Language Translation

UNIT – IV

Generative Adversarial Networks (GANs), Autoencoders, Reinforcement Learning, Natural Language Processing (NLP), Sentiment Analysis, Time Series Analysis

Textbooks:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, 2019. ISBN: 978-1492032649
2. Francois Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2017. ISBN: 978-1617294433

Reference Books:

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop.
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016. ISBN: 978-0262035613
5. Andrew Ng, "Machine Learning Yearning", eBook, 2018.
6. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", 3rd Edition, Packt Publishing, 2019. ISBN: 978-1789955750

Unsupervised Learning Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-4	ML-465P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Unsupervised Learning) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Setting up the Jupyter Notebook and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch, Pandas, numpy etc libraries and making use of them
3. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
4. Program to demonstrate k-means clustering algorithm
5. Program to demonstrate DBSCAN clustering algorithm
6. Program to demonstrate PCA and LDA on Iris dataset
7. Compare the performance of PCA and Autoencoders on a given dataset
8. Build Generative adversarial model for fake (news/image/audio/video) prediction.
9. Outlier detection in time series dataset using RNN
10. Anomaly detection using Self-Organizing Network

Unsupervised Learning	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-4	ML-465T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To learn about unsupervised learning and clustering algorithms											
2.	To learn about Gaussian mixture models and linear dimensional reduction methods											
3.	To learn about autoencoders and generative adversarial network											
4.	To learn about outlier detection, density estimation methods and unsupervised learning networks											
Course Outcomes (CO)												
CO 1	Applying clustering algorithms for the real world data											
CO 2	Applying Dimensional reduction techniques for feature extraction and learn, Gaussian mixture models											
CO 3	Learn about Autoencoders and Generative adversarial network											
CO 4	Applying outlier and novelty detection, density estimation methods to real world data and learn about unsupervised learning networks											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	3	3	3	2	2	-	-	-	-	2
CO 2	3	2	3	3	3	2	2	-	-	-	-	2
CO 3	3	2	3	3	3	2	2	-	-	-	-	2
CO 4	3	2	3	3	3	2	2	-	-	-	-	2
UNIT-I												
Unsupervised learning - Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning,												
Clustering –Clustering as a Machine Learning task, Different types of clustering techniques, Partitioning methods, Hierarchical clustering, Density-based methods: DBSCAN												
Biclustering :Spectral co-clustering, spectral biclustering												
Finding Pattern using Association Rule - Definition of common terms, Association rule, Apriori algorithm.												
UNIT-II												
Gaussian Mixture Models: Gaussian mixture, Variational Bayesian Gaussian mixture												
Manifold learning: Introduction, Isomap, Locally linear embedding, Modified locally linear embedding, Spectral embedding, MDS (Multi dimensional scaling, t-distributed Stochastic Neighbor Embedding (t-SNE)												

Decomposing signals in components (matrix factorization problems):PCA(Principal component Analysis),Factor Analysis, Kernel Principal Component Analysis (kPCA), Truncated singular value decomposition and latent semantic analysis, Independent component analysis (ICA), Non-negative matrix factorization (NMF or NNMF), Latent Dirichlet Allocation (LDA)

UNIT-III

Autoencoders: Architecture,Layers in autoencoder ,training of autoencoder ,Sparse Coding, Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.

Generative Adversarial Networks: Generative Vs Discriminative Modeling, Probabilistic Generative Model, Generative Adversarial Networks (GAN), GAN challenges: Oscillation Loss, Mode Collapse, Uninformative Loss, Hyperparameters, Tackling GAN challenges, Wasserstein GAN, Cycle GAN, Neural Style Transfer

UNIT - IV

Novelty and outlier detection:Overview of outlier detection methods,Novelty detection,outlier detection

Density estimation:Histograms and kernel density estimation

Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps – architecture, training algorithm, Kohonen Self-Organizing Motor Map,Restricted Boltzmann machine(neural network model)

Textbook(s):

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Benyamin Ghojogh, Mark Crowley, Fakhri Karray, ˆ Ali Ghodsi , Elements of Dimensionality Reduction and Manifold Learning,Springer

References:

1. C. M. BISHOP (2006), "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition
2. Kevin Murphy, *Machine learning: a probabilistic perspective.*
3. Jennifer Grange ," Machine Learning for Absolute Beginners: A Simple, Concise & Complete Introduction to Supervised and Unsupervised Learning Algorithms",Kindle