Course Code	18CSC305J	Course Name	ARTIFICIAL INTELLIGENCE	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Provide a broad understanding of the basic techniques for building intelligent computer systems and an understanding of how AI is applied to problems.
CLR-2 :	Gain knowledge in problem formulation and building intelligent agents
CLR-3 :	Understand the search technique procedures applied to real world problems
CLR-4 :	Understand the types of logic and knowledge representation schemes
CLR-5 :	Acquire knowledge in planning and learning algorithms
CLR-6 :	Gain knowledge in AI Applications and advances in Artificial Intelligence

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency(%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO – 3
CLO-1 :	Formulate a problem and build intelligent agents	1	80	70	M	M	M	M	H	-	-	-	M	L	-	H	L	L	L
CLO-2 :	Apply appropriate searching techniques to solve a real world problem	2	85	75	M	H	H	H	H	-	-	-	M	L	-	H	M	L	M-
CLO-3 :	Analyze the problem and infer new knowledge using suitable knowledge representation schemes	2	75	70	M	H	H	M	H	-	-	-	M	L	-	H	M	L	M
CLO-4 :	Develop planning and apply learning algorithms on real world problems	2	85	80	M	H	M	H	H	-	-	-	M	L	-	H	M	M	M
CLO-5 :	Design an expert system and implement natural language processing techniques	3	85	75	M	H	H	H	H	-	-	-	M	L	-	H	H	M	H
CLO-6 :	Implement advance techniques in Artificial Intelligence	3	80	70	L	H	M	M	H	-	-	-	H	L	-	H	H	M	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Introduction to AI-AI techniques	Searching techniques- Uniformed search-General search Algorithm	Knowledge and reasoning-Approaches and issues of knowledge reasoning	Planning- Planning problems, Simple planning agent	Expert system-Architecture
	SLO-2	Problem solving with AI	Uniformed search Methods-Breadth first search	Knowledge base agents-Logic Basics	Planning languages	Pros and Cons of expert system
S-2	SLO-1	AI Models, Data acquisition and learning aspects in AI	Uniformed search Methods-Depth first search	Logic-Propositional logic-syntax ,semantics and inferences	Blocks world ,Goal stack planning	Rule based systems
	SLO-2	Problem solving- Problem solving process, Formulating problems	Uniformed search Methods-Depth limited search	Propositional logic- Reasoning patterns	Mean Ends Analysis	Frame based expert system
S-3	SLO-1	Problem types and characteristics	Uniformed search Methods- Iterative Deepening search	Predicate logic – Syntax and semantics, instance and is relationship	Non-linear Planning	Case study
	SLO-2	Problem space and search	Bi-directional search	Unification and Resolution	Conditional planning, Reactive planning	Case study
S 4-5	SLO-1	Lab 1: Implementation of toy problems	Lab4: Implementation and Analysis of DFS and BFS for an application	Lab 7: Implementation of unification and resolution for real world problems.	Lab 10 :Implementation of block world problem	Natural language processing-Levels of NLP
	SLO-2					
S-6	SLO-1	Intelligent agent	Informed search- Generate and test, Best First search	Knowledge representation using rules	Learning- Machine learning	Syntactic and Semantic Analysis
	SLO-2	Rationality and Rational agent with performance measures	Informed search-A* Algorithm	Knowledge representation using semantic nets	Goals and Challenges of machine learning	Information retrieval
S-7	SLO-1	Flexibility and Intelligent agents	AO* research	Knowledge representation using frames	Learning concepts, models	Information Extraction

	SLO-2	*Task environment and its properties*	*Local search Algorithms-Hill Climbing, Simulated Annealing*	*Inferences*	*Artificial neural network based learning-Back propagation*	*Machine translation*
S-8	SLO-1	*Types of agents*	*Local Beam Search*	*Uncertain Knowledge and reasoning-Methods*	*Support vector machines*	*NLP Applications*
	SLO-2	*Other aspects of agents*	*Genetic Algorithms*	*Bayesian probability and belief network*	*Reinforcement learning*	*NLP Applications*
S 9-10	SLO-1 SLO-2	*Lab 2: Developing agent programs for real world problems*	*Lab 5: Developing Best first search and A* Algorithm for real world problems*	*Lab 8: Implementation of knowledge representation schemes - use cases*	*Lab 11: Implementation of learning algorithms for an application*	*Lab 14:Implementation of NLP programs*
S-11	SLO-1	*Constraint satisfaction problems(CSP)*	*Adversarial search Methods-Game playing-Important concepts*	*Probabilistic reasoning*	*Adaptive learning*	*Advance topics in Artificial Intelligence-Cloud Computing and intelligent agent*
	SLO-2	*Crypto arithmetic puzzles*	*Game playing and knowledge structure*	*Probabilistic reasoning over time*	*Multi_agent based learning*	*Business intelligence and analytics*
S-12	SLO-1	*CSP as a search problem-constrains and representation*	*Game as a search problem-Minimax approach*	*Forward and backward reasoning*	*Ensemble learning*	*Sentiment Analysis*
	SLO-2	*CSP-Backtracking, Role of heuristic*	*Minimax Algorithm*	*Other uncertain techniques-Data mining*	*Learning for decision making*	*Deep learning Algorithms*
S-13	SLO-1	*CSP-Forward checking and constraint propagation*	*Alpha beta pruning*	*Fuzzy logic*	*Distributed learning*	*Deep learning Algorithms*
	SLO-2	*CSP-Intelligent backtracking*	*Game theory problems*	*Dempster -shafer theory*	*Speedup learning*	*Planning and logic in intelligent agents*
S 14-15	SLO-1 SLO-2	*Lab 3: Implementation of constraint satisfaction problems*	*Lab 6: Implementation of minimax algorithm for an application*	*Lab 9: Implementation of uncertain methods for an application*	*Lab12: Development of ensemble model for an application*	*Lab 15: Applying deep learning methods to solve an application.*

Learning Resources

1. *Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1st ed., PHI learning,2015*
2. *DeepakKemhani,FirstcourseinArtificialIntelligence,McGrawHillPvtLtd,2013*
3. *Stuart J. Russell, Peter Norwig , Artificial Intelligence –A Modern approach, 3rd Pearson Education, 2016*
4. *PrateekJoshi,ArtificialIntelligencewithPhython,1st ed.,PacktPublishing,2017*
5. *DenisRothman,ArtificialIntelligencebyExample,Packt,2018*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr.Jagatheeswaran, Lead, Auxo labs jagatheeswarans.iot@auxolabs.in	*1. Dr. Chitrakala, Anna University, au.chitras@gmail.com*	*1. Dr.M.Pushpalatha, SRMIST*
2.	*2.*	*2. Dr.G..Vadivu, SRMIST*
	3.	*3. Dr.C.Lakshmi, SRMIST*

Course Code	18CSC304J	Course Name	COMPILER DESIGN	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	18CSC301T	Co-requisite Courses	Nil	Progressive Courses	
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Utilize the mathematics and engineering principles for the Design of Compilers
CLR-2 :	Acquire knowledge of Lexical Analyzer from a specification of a language's lexical rules
CLR-3 :	Acquire knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar
CLR-4 :	Gain knowledge to translate a system into various intermediate codes
CLR-5 :	Analyze the methods of implementing a Code Generator for compilers
CLR-6 :	Analyze and Design the methods of developing a Code Optimizer

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Acquire the knowledge of mathematics and engineering principles for the Design of Compilers	3	80	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-2 :	Acquire the ability to identify specification of a language's lexical rules of Lexical Analyzer	3	85	75	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-3 :	Apply the knowledge of Syntax Analyzer for parsing the sentences in a compiler grammar	3	75	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-4 :	Understand the concepts of translation of various intermediate codes .	3	85	80	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-5 :	Apply the knowledge to implement Code Generator for compilers	3	85	75	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H
CLO-6 :	Analyze and Design the methods of developing a Code Optimizer	3	80	70	H	H	H	H	M	L	L	L	M	M	L	H	H	H	H

Duration (hour)		15	15	15	15	15
S-1	SLO-1	Compilers – Analysis of the source program	Syntax Analysis Definition - Role of parser	Bottom Up Parsing	Intermediate Code Generation	Code optimization
	SLO-2	Phases of a compiler – Cousins of the Compiler	Lexical versus Syntactic Analysis	Reductions	Intermediate Languages - prefix - postfix	Introduction– Principal Sources of Optimization
S-2	SLO-1	Grouping of Phases – Compiler construction tools	Representative Grammars	Handle Pruning	Quadruple - triple - indirect triples Representation	Function Preserving Transformation
	SLO-2	Lexical Analysis – Role of Lexical Analyzer	Syntax Error Handling	Shift Reduce Parsing	Syntax tree- Evaluation of expression - three-address code	Loop Optimization
S-3	SLO-1	Input Buffering	Elimination of Ambiguity, Left Recursion	Problems related to Shift Reduce Parsing	Synthesized attributes – Inherited attributes	Optimization of basic Blocks
	SLO-2	Specification of Tokens	Left Factoring	Conflicts During Shift Reduce Parsing	Intermediate languages – Declarations	Building Expression of DAG
S 4-5	SLO-1 SLO-2	Lab 1 - Implementation of Lexical Analyzer	Lab 4Elimation of Ambiguity, Left Recursion and Left Factoring	Lab 7 - Shift Reduce Parsing	Lab 10-Intermediate code generation – Postfix, Prefix	Lab 13 Implementation of DAG
S-6	SLO-1	Finite automation - deterministic	Top down parsing	LR Parsers- Why LR Parsers	Assignment Statements	Peephole Optimization
	SLO-2	Finite automation - non deterministic	Recursive Descent Parsing,back tracking	Items and LR(0) Automaton, Closure of Item Sets,	Boolean Expressions, Case Statements	Basic Blocks, Flow Graphs
S-7	SLO-1	Transition Tables	Computation of FIRST	LR Parsing Algorithm	Back patching – Procedure calls	Next -Use Information

	SLO-2	*Acceptance of Input Strings by Automata*	*Problems related to FIRST*	*Operator Precedence Parser Computation of LEADING*	*Code Generation*	*Introduction to Global Data Flow Analysis*
S-8	SLO-1	*State Diagrams and Regular Expressions*	*Computation of FOLLOW*	*Computation of TRAILING*	*Issues in the design of code generator*	*Computation of gen and kill*
	SLO-2	*Conversion of regular expression to NFA – Thompson's*	*Problems related to FOLLOW*	*Problems related to LEADING AND TRAILING*	*The target machine – Runtime Storage management*	*Computation of in and out*
S 9-10	SLO-1 SLO-2	*Lab 2 conversion from Regular Expression to NFA*	*Lab 5 -FIRST AND FOLLOW computation*	*Lab 8- Computation of LEADING AND TRAILING*	*Lab 11 Intermediate code generation – Quadruple, Triple, Indirect triple*	*Lab 14 : Implementation of Global Data Flow Analysis*
S-11	SLO-1	*Conversion of NFA to DFA*	*Construction of a predictive parsing table*	*SLR Grammars*	*A simple Code generator*	*Parameter Passing.*
	SLO-2	*Simulation of an NFA*	*Predictive Parsers LL(1) Grammars*	*SLR Parsing Tables*	*Code Generation Algorithm*	*Runtime Environments*
S-12	SLO-1	*Converting Regular expression directly to DFA*	*Transition Diagrams for Predictive Parsers*	*Problems related to SLR*	*Register and Address Descriptors*	*Source Language issues*
	SLO-2	*Minimization of DFA*	*Error Recovery in Predictive Parsing*	*Construction of Canonical LR(1) and LALR*	*Generating Code of Assignment Statements*	*Storage Organization*
S-13	SLO-1	*Minimization of NFA*	*Predictive Parsing Algorithm*	*Construction of LALR*	*Cross Compiler – T diagrams*	*Activation Records*
	SLO-2	*Design of lexical analysis (LEX)*	*Non Recursive Predictive Parser*	*Problems related to Canonical LR(1) and LALR Parsing Table*	*Issues in Cross compilers*	*Storage Allocation strategies*
S 14-15	SLO-1 SLO-2	*Lab 3 Conversion from NFA to DFA*	*Lab 6 Predictive Parsing Table*	*Lab9 Computation of LR(0) items*	*Lab 12 : A simple code Generator*	*Lab 15: Implement any one storage allocation strategies(heap, stack, static)*

Learning Resources	*1. AlfredVAho,JefferyDUllman,RaviSethi,"Compilers,Principlestechniquesandtools",Pearson Education2011* *2. S.GodfreyWinster,S.ArunaDevi,R.Sujatha,"CompilerDesign",YesdeePublishingPvt.Ltd,2016* *3. WilliamM.WaiteandGerhardGoos.CompilerConstruction.Springer-Verlag,NewYork,2013.*	*4. K.Muneeswaran,,"CompilerDesign",OxfordHigherEducation,Fourthedition2015* *5. DavidGalles,"ModernCompilerDesign",PearsonEducation,Reprint2012.* *6. RaghavanV.,"PrinciplesofCompilerDesign",TataMcGrawHillEducationPvt.Ltd.,2010*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Ms.R.Jeya
		2. Mrs.J. Jeyasudha

Course Code	18CSC303J	Course Name	DATABASE MANAGEMENT SYSTEMS	Course Category	C	Professional Core	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Understand the fundamentals of Database Management Systems, Architecture and Languages	LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-2 :	Conceive the database design process through ER Model and Relational Model			
CLR-3 :	Design Logical Database Schema and mapping it to implementation level schema through Database Language Features			
CLR-4 :	Familiarize queries using Structure Query Language (SQL) and PL/SQL			
CLR-5 :	Familiarize the Improvement of the database design using normalization criteria and optimize queries			
CLR-6 :	Understand the practical problems of concurrency control and gain knowledge about failures and recovery			
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*			
CLO-1 :	Acquire the knowledge on DBMS Architecture and Languages	3	80	70
CLO-2 :	Apply the fundamentals of data models to model an application's data requirements using conceptual modeling tools like ER diagrams	3	85	75
CLO-3 :	Apply the method to convert the ER model to a database schemas based on the conceptual relational model	3	75	70
CLO-4 :	Apply the knowledge to create, store and retrieve data using Structure Query Language (SQL) and PL/SQL	3	85	80
CLO-5 :	Apply the knowledge to improve database design using various normalization criteria and optimize queries	3	85	75
CLO-6 :	Appreciate the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.	3	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EngineeringKnowledge	Problem Analysis	Design&Development	Analysis,Design,Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO – 3
H	M	L	L	-	-	-	-	L	L	L	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	H	H	H	-	-	-	H	H	H	H	-	-	-
H	H	L	M	L	-	-	-	M	M	M	L	-	-	-
H	L	L	L	L	-	-	-	H	L	L	L			

Duration (hour)		15	15	15	15	15
S-1	SLO-1	What is Database Management System	Database Design	Basics of SQL-DDL,DML,DCL,TCL	Relational Algebra – Fundamental Operators and syntax, relational algebra queries, Tuple relational calculus	Transaction concepts, properties of transactions,
	SLO-2	Advantage of DBMS over File Processing System	Design process	Structure Creation, alternation		
S-2	SLO-1	Introduction and applications of DBMS	Entity Relation Model	Defining Constraints-Primary Key, Foreign Key, Unique, not null, check, IN operator		serializability of transactions,
	SLO-2	Purpose of database system				testing for serializability, System recovery,
S-3	SLO-1	Views of data	ER diagram	Functions-aggregation functions	Pitfalls in Relational database, Decomposing bad schema	Concurrency Control
	SLO-2			Built-in Functions-numeric, date, string functions, string functions, Set operations,	Functional Dependency – definition, trivial and non-trivial FD	
S 4-5	SLO-1	Lab 1: SQL Data Definition Language Commands on sample exercise	Lab4 : Inbuilt functions in SQL on sample exercise.	Lab 7 : Join Queries on sample exercise.	Lab10: PL/SQL Procedures on sample exercise.	Lab 13: PL/SQL Exception Handling
	SLO-2	* The abstract of the project to construct database must be framed		* Frame and execute the appropriate DDL,DML,DCL,TCL for the project	* Frame and execute the appropriate Join Queries for the project	* Frame and execute the appropriate PL/SQL Procedures and Functions for the project
S-6	SLO-1	Database system Architecture	Keys , Attributes and Constraints	Sub Queries, correlated sub queries	closure of FD set , closure of attributes	Two- Phase Commit protocol, Recovery and Atomicity
	SLO-2				irreducible set of FD	
S-7	SLO-1	Data Independence	Mapping Cardinality	Nested Queries, Views and its Types	Normalization – 1Nf, 2NF, 3NF,	Log-based recovery
	SLO-2					
S-8	SLO-1	The evolution of Data Models	Extended ER - Generalization,	Transaction Control Commands	Decomposition using FD- dependency	concurrent executions of transactions and

	SLO-2		*Specialization and Aggregation*	*Commit, Rollback, Savepoint*	*preservation,*	*related problems*
S 9-10	SLO-1 SLO-2	*Lab 2: SQL Data Manipulation Language Commands* ** Identification of project Modules and functionality*	*Lab 5: Construct a ER Model for the application to be constructed to a Database*	*Lab 8: Set Operators & Views.* ** Frame and execute the appropriate In-Built functions for the project*	*Lab 11: PL/SQL Functions* ** Frame and execute the appropriate Set Operators & Views for the project*	*Lab 14: PL/SQL Trigger* ** Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project*
S-11	SLO-1 SLO-2	*Degrees of Data Abstraction*	*ER Diagram Issues* *Weak Entity*	*PL/SQL Concepts- Cursors*	*BCNF*	*Locking mechanism, solution to concurrency related problems*
S-12	SLO-1 SLO-2	*Database Users and DBA*	*Relational Model*	*Stored Procedure, Functions Triggers and Exceptional Handling*	*Multi- valued dependency,* *4NF*	*Deadlock*
S-13	SLO-1 SLO-2	*Database Languages*	*Conversion of ER to Relational Table*	*Query Processing*	*Join dependency and 5NF*	*two-phase locking protocol, Isolation, Intent locking*
S 14-15	SLO-1 SLO-2	*Lab 3: SQL Data Control Language Commands and Transaction control commands to the sample exercises* ** Identify the issues that can arise in a business perspective for the application*	*Lab 6: Nested Queries on sample exercise* ** Construction of Relational Table from the ER Diagram*	*Lab9: PL/SQL Conditional and Iterative Statements* ** Frame and execute the appropriate Nested Queries for the project*	*Lab 12: PL/SQL Cursors* ** Frame and execute the appropriate PL/SQL Conditional and Iterative Statements for the project*	*Lab 15 : * Frame and execute the appropriate PL/SQL Cursors and Exceptional Handling for the project* ** Demo of the project*

Learning Resources

1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts‖, Sixth Edition, Tata McGraw Hill,2011.*
2. *Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems‖, Sixth Edition, Pearson Education,2011.*
3. *CJ Date,A Kannan,S Swamynathan, An Introduction to Database Systems, Eight Edition, Pearson Education,2006.*
4. *Rajesh Narang, Database Management Systems, 2nd ed., PHI Learning Private Limited,2011.*
4. *Martin Gruber, Understanding SQL, Sybex,1990*
5. *SharadMaheshwari,IntroductiontoSQLandPL/SQL,2d ed.,LaxmiPublications,2016.*
6. *RaghuramaKrishnan,JohannesGehrke,DatabaseManagementSystems,3rdEdition,McGrawHill Education,2003.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
Level 2	Apply Analyze	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
Level 3	Evaluate Create	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Total	100 %		100 %		100 %		100 %		-	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.Mariappan Vaithilingam, Engineering Leader *Amazon, dr.v.m@ieee.org*		*1. Ms. Sasi Rekha Sankar SRMIST*
2. Mr. Badinath, SDET, Amzon, sbadhrinath@gmail.com		*2. Mr.Elizer, SRMIST*
		3. Mrs. Hemavathy, SRMIST

Course Code	18CSE484T	Course Name	DEEP LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science and Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the concepts of Neural Networks and Deep Learning
CLR-2 :	Understand Deep neural network and layered learning approach
CLR-3 :	Study and understand CNN and RNN for deep learning
CLR-4 :	Learn and understand Auto Encoders and its applications
CLR-5 :	Understand concept of transfer learning and its applications with keras

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning		
		1	2	3
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLO-1 :	Apply basic mathematical concepts in Deep Learning	2	80	85
CLO-2 :	Work with powerful framework for supervised learning	3	75	80
CLO-3 :	Deal with Convolution Neural Networks	2	85	80
CLO-4 :	Analyze various types efficient data encoders	2	80	75
CLO-5 :	Apply various network models in deep learning	3	75	85

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design,Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
H	L	-	-	H-	-	-	-	-	-	-	H	H	-	-
H	H	-	-	H	-	-	-	-	-	-	H	H	H	M
H	H	H	-	H	-	-	-	-	-	-	H	H	H	H
H	H	-	-	H	-	-	-	-	-	-	H	H	H	H
H	H	H	H	H	-	-	-	-	-	-	H	H	H	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Historical trends in deep learning – Machine Learning basics	Introduction to Simple DNN	Convolution Neural Networks Introduction	Encoder	Deep Architectures in Vision
	SLO-2	Learning algorithms – Supervised and Unsupervised Training	Platform for Deep Learning	Convolution Operation	Decoder	AlexNet to ResNet
S-2	SLO-1	Linear Algebra for machine learning	Deep Learning Software Libraries	Motivation	Auto Encoders Introduction	Transfer Learning
	SLO-2	Testing - Cross Validation	Deep Feed Forward Networks Introduction	Pooling	Auto Encoders	
S-3	SLO-1	Dimensionality Reduction	Learning XOR	Normalization	Under Complete Auto Encoder	Siamese Networks
	SLO-2	Over fitting /Under Fitting	Gradient-Based Learning	Applications in Computer Vision - ImageNet	Regularized Auto Encoder	
S-4	SLO-1	Hyper parameters and validation sets	Various Activation Functions, ReLU, Sigmoid – Error Functions	Sequence Modelling –VGGNet, LeNet	Stochastic Auto Encoder	Metric Learning
	SLO-2	Estimators – Bias - Variance	Architecture Design	Recurrent Neural Networks	Denoising Auto Encoder	Ranking / Triplet Loss
S-5	SLO-1	Loss Function-- Regularization	Differentiation Algorithms	RNN topologies- Difficulty in Training RNN	Contractive Auto Encoder	RCNNs with keras
	SLO-2	Biological Neuron – Idea of Computational units	Regularization methods for Deep Learning		Auto Encoder Applications	
S-6	SLO-1	McCulloch-Pitts units and Thresholding logic	Early Stopping	Long Short Term Memory	Dimensionality Reduction and Classification using Auto encoders	CNN-RNN
	SLO-2	Linear Perceptron	Drop Out		Recommendation	
S-7	SLO-1	Perceptron Learning Algorithm	Difficulty of training deep neural networks	Bidirectional LSTMs	Optimization for Deep Learning-Optimizers –RMS prop for RNNs	Applications in captioning and Video tasks
	SLO-2	Convergence theorem for Perceptron Learning Algorithm				
S-8	SLO-1	Linear Separability	Greedy layer wise training	Bidirectional RNNs	SGD for CNNs	3D CNNs
	SLO-2	Multilayer perceptron –The first example of network with Keras code				
S-9	SLO-1	Backprobagation	Optimization methods for Neural Networks-Adagrad, Adam	Application case study -Handwritten digits recognition using deep learning, LSTM with Keras – sentiment Analysis	Application case study – Image dimensionality reduction using encoders LSTM with Keras – sentiment Analysis	Application case study – Image recognition using RCNN and transfer learning
	SLO-2					

Learning Resources	1. *IanGoodfellow,YoshuaBengio,AaronCourville,"DeepLearning",MITPress,2016.* 2. *KevinP.Murphy,"MachineLearning:AProbabilisticPerspective",MITPress,2012.*	3. *Neural Networks: A Systematic Introduction, RaulRojas, 1996.* 4. *ChristopherandM.Bishop,"PatternRecognitionandMachineLearning",SpringerScienceBusinessMedia, 2006.* 5. *JasonBrownlee,"DeepLearningwithPython",ebook,2016.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.	*1.*	*1. Dr.E.Poovammal*
2.	*2.*	*2. Dr.G.Vadivu*
		3. Mr.Joseph James

Course Code	18ECO107T	Course Name	FIBER OPTICS AND OPTOELECTRONICS	Course Category	O	Open Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Electronics and Communication Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Analyze the basic laws and theorems of light associated with the optical fiber communication and the classification of optical fibers*
CLR-2 :	*Address concepts related to transmission characteristics such as attenuation and dispersion.*
CLR-3 :	*Explore the fundamentals of optoelectronics display devices, Sources and Detectors*
CLR-4 :	*Gain to information on Optical modulators and amplifiers*
CLR-5 :	*Illustrate the integration methods available for optoelectronic circuits and devices*
CLR-6 :	*Utilize the basic optical concepts applied in various engineering problems and identify appropriate solutions*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Review the basic theorems related to fiber optic communication, and attain knowledge of types of optical fibers*	*2*	*80*	*70*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-		*H*
CLO-2 :	*Understand the optical signal distortion factors in optical fiber communication*	*2*	*85*	*75*	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-	-	*M*
CLO-3 :	*Familiarize the principle and operation of various display devices, light sources and detectors*	*2*	*75*	*70*	*H*	*M*	*M*	-	-	-	-	-	-	-	-	-	-	-	*L*
CLO-4 :	*Acquire knowledge of various optoelectronic modulators and amplifiers*	*2*	*85*	*80*	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-	-	*H*
CLO-5 :	*Understand the various optoelectronic integrated circuits*	*2*	*85*	*75*	*H*	-	*M*	*L*	-	-	-	-	-	-	-	-	-	-	*L*
CLO-6:	*Acquire fundamental concepts related to optical communication and optoelectronic devices*	*2*	*80*	*75*	*H*	*M*	*M*	*L*	-	-	-	-	-	-	-	-	-	-	*H*

Duration (hour)		Introduction to Optical Fibers	Transmission Characteristics of Optical Fibers	Display Devices, Light Sources and Detection Devices	Optoelectronic Modulators and Switching Devices	Optoelectronic Integrated Circuits
		9	9	9	9	9
S-1	SLO-1	*Evolution of fiber optic system*	*Attenuation – Absorption, Attenuation units*	*Display devices – Photo luminescence*	*Analog and Digital Modulation*	*Optoelectronic integrated circuits - Introduction*
	SLO-2	*Elements of an optical fiber transmission link*	*Attenuation – Scattering losses*	*Cathode luminescence*	*Electro optic modulators – Electro optic effect – Longitudinal electro optic modulator*	*Need for Integration - Hybrid and Monolithic Integration*
S-2	SLO-1	*Elements of an optical fiber transmission link*	*Attenuation – Bending losses, microbending and macro bending losses*	*Electro luminescence*	*Electro optic modulators – Transverse electro optic modulator*	*Hybrid and Monolithic Integration*
	SLO-2	*Advantages of fiber optic system*	*Attenuation - Core cladding losses*	*Injection luminescence*	*Acousto optic modulators – Transmission type – Raman Nath modulator*	*Materials and processing of OEICs*
S-3	SLO-1	*Characteristics and behavior of light*	*Signal distortion in optical waveguides*	*Light source materials*	*Acousto optic modulators – Reflection type – Bragg modulator*	*Application of optoelectronic integrated circuits*
	SLO-2	*Total internal reflection*	*Types of dispersion-Intramodal and Intermodal dispersion*	*Surface emitting LEDs*	*Solving Problems*	*Slab and Strip Waveguides*
S-4	SLO-1	*Acceptance angle*	*Material dispersion*	*Edge emitting LEDs*	*Optical switching and logic devices – self-electro-optic-device*	*Integrated transmitters and receivers – Front end photo receivers*
	SLO-2	*Numerical aperture, Critical angle*	*Material dispersion, Waveguide dispersion*	*Quantum efficiency and LED power – Internal quantum efficiency derivation*	*Optical switching and logic devices – Bipolar controller modulator*	*Integrated transmitters and receivers – photoreceiver noise and bandwidth considerations*
S-5	SLO-1	*Solving Problems*	*Waveguide dispersion*	*Quantum efficiency and LED power – External quantum efficiency and total LED power*	*Optical switching and logic devices-tunable threshold logic gate – Switching speed and energy.*	*Integrated transmitters and receivers – PIN-HBT photoreceivers*
	SLO-2	*Solving Problems*	*Signal distortion in single mode fibers*	*Solving Problems*	*Optical Amplifiers – General applications of*	*Integrated transmitters and receivers –*

					optical amplifiers	*OEIC transmitters – equivalent circuit for integrated receivers*
S-6	SLO-1	*Ray optics*	*Polarization mode dispersion*	*Semiconductor laser diode*	*Semiconductor optical amplifiers – Basic configuration*	*Integrated transmitters and receivers – Complex circuits and arrays*
	SLO-2	*Types of rays*	*Polarization mode dispersion, Intermodal dispersion*	*Modes and threshold condition*	*Semiconductor optical amplifiers – Optical gain - Limitations*	*Integrated transmitters and receivers - optical control and microwave oscillators*
S-7	SLO-1	*Optical fiber modes*	*Intermodal dispersion*	*Photo detection principle*	*Erbium doped fiber amplifiers – energy level diagram and amplification mechanism*	*Guided wave devices – Waveguide and couplers*
	SLO-2	*Optical fiber configurations*	*Solving Problems*	*PIN Photodiode*	*Erbium doped fiber amplifiers – EDFA configuration*	*Guided wave devices – Active guided wave devices*
S-8	SLO-1	*Single mode fibers*	*Solving Problems*	*PIN photodiode - Avalanche Photodiode*	*Solving Problems*	*Guided wave devices – Mach Zehnder Interferometers*
	SLO-2	*Multimode Fibers*	*Pulse Broadening in Graded Index Waveguides*	*Avalanche Photodiode*	*Solving Problems*	*Active couplers*
S-9	SLO-1	*Step Index Fibers*	*Mode Coupling*	*Noise mechanism in photodetectors*	*Fiber Raman Amplifiers – Configuration – Forward pumping*	*Active Couplers*
	SLO-2	*Graded Index Fibers*	*Design Optimization of Single Mode Fibers*	*Solving Problems*	*Fiber Raman Amplifiers – Backward pumping*	*Active Couplers*

Learning Resources	1. *Gerd Keiser, "Optical Fiber Communications", 5th Edition, McGraw Hill Education (India), 2015.* 2. *Khare R P, "Fiber Optics and Optoelectronics", Oxford University Press, 2014.*	3. *J. Wilson and J. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, 1995.* 4. *Pallab Bhattacharya, "Semiconductor Optoelectronic Devices", Prentice Hall of India Pvt. Ltd, 2006.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Anuj Kumar, Bombardier Transportation, Ahmedabad, kumaranuj.aniii@gmail.com	*1. Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu*	*1. Dr. S. Sathiyan, SRMIST*
2. Mr. Hariharasudhan - Johnson Controls, Pune, hariharasudhan.v@jci.com	*2. Dr. Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in*	

Course Code	18CSE479T	Course Name	STATISTICAL MACHINE LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understand the statistical machine learning techniques.
CLR-2 :	Gain knowledge on linear regression models ,Random Forests
CLR-3 :	KNN classifier Gain knowledge on the basics of probabilistic approaches like Naïve Bayes, Bayes Theorem
CLR-4 :	Acquire knowledge on Support Vector machines
CLR-5 :	Introduce the working principle of Artificial Neural networks
CLR-6 :	Understand the K-means clustering techniques, PCA and SVD

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)	EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design, Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO – 3
CLO-1 :	Acquire the knowledge on statistical machine learning techniques.	1	80	85	H	-	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-2 :	Acquire the ability to build model based on logistic regression and random forest techniques	1	75	80	H	H	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-3 :	Understand the basic ideas of probability and work on probabilistic approaches like Naïve Bayes, Bayes Theorem	1	85	80	H	-	-	-	-	-	-	-	-	-	-	H	H	-	-
CLO-4 :	Apply the knowledge of Kernel functions in practical applications	3	80	75	H	H	H	H	-	-	-	-	-	-	-	H	H	M	H
CLO-5 :	Apply the knowledge of K-means clustering on real world examples	3	75	85	H	-	H	H	-	-	-	-	-	-	-	H	H	M	H
CLO-6 :	Acquire the knowledge on using PCA and SVD with Scikit-learn	2	80	85	H	-	H	H	-	-	-	-	-	-	-	H	H	M	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Statistical terminology for model building and validation-Machine Learning,Major differences between statistical modeling andmachine learning	Comparison between regression and machinelearning models	K-nearest neighbors-KNN voter example	Support Vector Machines and Neural Networks-Support vector machines working principles-Maximum margin classifier	K-means clustering-K-means working methodology from first principles
	SLO-2		Compensating factors in machine learning models	Curse of dimensionality-Curse of dimensionality with 1D, 2D, and 3D example		
S-2	SLO-1	Steps in machine learning model developmentand deployment	Assumptions of linear regression Steps applied in linearregression modeling	Curse of dimensionality with 3D example	Support vector classifier	Optimal number of clusters and cluster evaluation
	SLO-2					
S-3	SLO-1	Statistical fundamentals and terminology for model building and validation	Example of simple linear regression from first principles	KNN classifier with breast cancer Wisconsin data example	Support vector machines	The elbow method
	SLO-2					
S-4	SLO-1	Bias versus variance trade-off,Train and test data	Machine learning models - ridge and lasso regression-Example of ridge regression machine learning,Example of lasso regression machine learning model	Naive Bayes	Kernel functions	K-means clustering with the iris data example
	SLO-2					
S-5	SLO-1	Linear regression versus gradient descent Machine learning losses	Logistic Regression Versus Random Forest-Maximum likelihood estimation	Probability fundamentals-Joint probability	Artificial neural networks - ANN	Principal component analysis - PCA-PCA working methodology from first principles
	SLO-2					
S-6	SLO-1	When to stop tuning machine learning models	Terminology involved in logistic regression	Understanding Bayes theorem with conditional probability	Forward propagation and backpropagation	PCA applied on handwritten digitsusing scikit-learn
	SLO-2		Applying steps in logistic regression modeling			
S-7	SLO-1	Train, validation, and test data Cross-validation	Random forest-Example of random forest using German credit data	Naive Bayes classification	Optimization of neural networks-Stochastic gradient descent - SGD	Singular value decomposition - SVD
	SLO-2		Grid search on random forest			

S-8	SLO-1 SLO-2	*Grid Search*	*Variable importance plot*	*Laplace estimator*	*Introduction to deep learning-Solving methodology*	*SVD applied on handwritten digitsusing scikit-learn*
S-9	SLO-1 SLO-2	*Machine learning model overview*	*Comparison of logistic regression with random forest*	*Naive Bayes SMS spam classification example*	*Deep learning software*	*SVD applied on handwritten digitsusing scikit-learn*

Learning Resources	*1. PratapDangeti,"StatisticsforMachineLearning":,PacktPublishingLtd,,2017.* *2. MasashiSugiyama,"IntroductiontoStatisticalMachineLearning",Elsevier,2016*	*3. Gareth James,Daniela Witten,Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer,2015* *4. Hastie Trevor, The Elements of Statistical Learning: Data Mining, Inference, and Prediction,* Springer-Verlag New York Inc, *February2009*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
Level 2	Apply Analyze	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
Level 3	Evaluate Create	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.Harisekharan,CTO,Sri SeshaaTechnologies Pvt. Ltd., Chennai	*1. Dr.Bagavandas, Cetre for Statistics, SRMIST*	*1. Dr.G.Vadivu*
2. Mr. S. Sudarsun – Chief Scientist, Co-Founder, Buddhealth	*2. Dr. Sampath, Professor, Department of Statistics, Madras University*	*2. Dr.C.Lakshmi*
		3.Dr.G.Manju

Course Code	18CSE481T	Course Name	APPLIED MACHINE LEARNING	Course Category	E	Professional Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	18CSE392T	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	CSE	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning		
		1	2	3
CLR-1 :	Analyze the text data using Machine Learning	LevelofThinking (Bloom)	ExpectedProficiency (%)	ExpectedAttainment(%)
CLR-2 :	Analyze the audio data using Machine Learning			
CLR-3 :	Analyze Time series and Sequential data using Machine Learning			
CLR-4 :	Analyze the Image Content using Machine Learning			
CLR-5 :	Visualize the data			

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:				Program Learning Outcomes (PLO)														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					EngineeringKnowledge	ProblemAnalysis	Design&Development	Analysis,Design,Research	ModernTool Usage	Society&Culture	Environment& Sustainability	Ethics	Individual & TeamWork	Communication	ProjectMgt.&Finance	LifeLongLearning	PSO-1	PSO-2	PSO– 3
CLO-1 :	Identifying patterns in text using topic modeling	3	75	80	H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
CLO-2 :	Building a speech recognizer	3	75	80	H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
CLO-3 :	Extracting statistics from time series data, Building Conditional Random Fields for sequential text data	3	75	80	H	M	H	-	H	-	-	-	-	-	-	H	H	H	H
CLO-4 :	Building an object recognizer	3	75	80	H	M	H	-	H	-	-	-	-	-	-	H	H	H	H

Duration (hour)		9	9	9	9	9
S-1	SLO-1	Text Feature Engineering Introduction	Speech Recognition Introduction	Dissecting Time Series and Sequential Data	Image Content Analysis	Biometric Face Recognition
	SLO-2	Cleaning text data	Reading audio data	Introduction	Computer Vision	Face detection from the image and video
S-2	SLO-1	Preprocessing data using tokenization	Plotting audio data	Transforming data into the time series format Pandas and Numpy to convert Time Series data	Operating on images using OpenCV-Python	Capturing and processing video from a webcam Resizing and Scaling
	SLO-2	Tagging and categorising words	Transforming audio signals into the frequency domain	Plotting time series data	Learn to extract and load the image	Building a face detector using Haar cascades
S-3	SLO-1	Sequential tagging, Backoff tagging	Apply Fourier transform signal and plot	Slicing time series data Operating on time series data	Detecting edges Histogram equalization	determine the location of a face in the video frames captured from the webcam
	SLO-2	Creating features from text data-Stemming,	Generating audio signals with custom parameters	Plotting sliced time series data	Sobel filter, Laplacian edge detector, Canny edge detector	Face detector on the grayscale image
S-4	SLO-1	Lemmatising	Generate the time axis	Operating on time series data	Histogram equalization	Building eye and nose detectors
	SLO-2	Bagging using random forests	Synthesizing music	Extracting statistics from time series data	Visualize gray scale image	Face cascade classifier

S-5	SLO-1	Implementing bag of words	Construct the audio sample -amplitude and frequency	Correlation coefficients	Detecting corners	Visualize eye and nose detector
	SLO-2	Testing prepared data	synthesizer function	Plotting and understanding correlations	Understand the output corner detection image	Performing Principal Components Analysis
S-6	SLO-1	Analyze the results	Extracting frequency domain features	Building Hidden Markov Models for sequential data	Detecting SIFT feature points	PCA in face recognition systems
	SLO-2	Building a text classifier	MFCC and filter bank features	Prepare the Time Series data	SIFT feature detection	Convert the dataset from a five-dimensional set to a two-dimensional set
S-7	SLO-1	Analyzing the sentiment of a sentence	Building Hidden Markov Models	Train Gaussian HMM	Visualize the feature detected image	Kernel Principal Components Analysis
	SLO-2	Implement the sentiment analysis of a sentence	HMM training and prediction	Visualizing the model	Building a Star feature detector	Perform Kernel PCA
S-8	SLO-1	Identifying patterns in text using topic modeling	Building a speech recognizer	Building Conditional Random Fields for sequential text data	Detect features using the Star feature detector	Plot the PCA-transformed data
	SLO-2	Implement identifying patterns in text using topic modeling	MFCC features	CRF Model	Visualize keypoints on the input image	Plot Kernel PCA-transformed data
S-9	SLO-1	Case study- Twitter Data	Case study	Analyzing stock market data using Hidden Markov Models	Creating features using visual codebook and vector quantization	Performing blind source separation
	SLO-2	Case study- Twitter Data	Case study	Train the HMM and visualize	Method to quantize the data points	Independent Components Analysis

Learning Resources	1. *PrateekJoshiandco,Python:RealWorldMachineLearning,PacktPublishing,2016* 2. *SebastianRaschka,PythonMachineLearning,PacktPublishing,2013.*	3. *RichertCoelho,BuildingMachineLearningSystemswithPython,PacktPublishing,2016* 4. *MichaelBowles,MachineLearninginPython,Wiley&Sons,2015*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*40 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Understand										
Level 2	Apply	*40 %*	-	*40 %*	-	*40 %*	-	*40 %*	-	*40%*	-
	Analyze										
Level 3	Evaluate	*20 %*	-	*30 %*	-	*30 %*	-	*30 %*	-	*30%*	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr.Harisekharan,CTO,Sri SeshaaTechnologies Pvt. Ltd., Chennai	Dr.J.Suresh, SSN College of Engineering	1. Dr.G.Vadivu
Mr. S. Sudarsun – Chief Scientist, Co-Founder, Buddhealth	Dr. Sharmila Shankar, Crescent Institute of Science and Technology	2. Mr.Karthik Nanmaran
		3. Dr.Renukadevi