DEPARTMENT OF COMPUTER SCIENCE AND ENGINNERING

PROPOSED CURRICULUM STRUCTURE FROM ACADEMIC YEAR 2023-24

Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-24

Third Year B. Tech. Program in Computer Science and Engineering

Semester V

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr. No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISEI**	**ISEII**	**ISEIII**	**ESE**	**Total (100)**
1	PC	CSPC3001	Design & Analysis of Algorithm	3	-	-	3	15	15	10	60	100
2	PC	CSPC3002	Compiler Design	3	1	-	4	15	15	10	60	100
3	PC	CSPC3003	Formal Language and Automata Theory	3	1		4	15	15	10	60	100
4	PE1	CSPE3004-06	PE1	3	-	-	3	15	15	10	60	100
5	HSMC	CSHS0011	HSMC-II	3	-	-	3	15	15	10	60	100
6	OE	CSOE1011	Open Elective-II	3	-	-	3	15	15	10	60	100
7	PC	CSPC3007	Lab Design & Analysis of Algorithm	-	-	2	1		-	25	25	50
8	PC	CSPC3008	Lab Compiler Design	-	-	2	1		-	25	25	50
9	PE1	CSPE3009-11	Lab PE1	-	-	2	1		-	25	25	50
10	PR	CSPR3012	Seminar	-	-	2	1		-	25	-	25
	Total			**18**	**2**	**10**	**24**	**90**	**90**	**160**	**435**	**775**

Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-24

Third Year B. Tech. Program in Computer Science and Engineering

Semester VI

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total (100)**
1	PC	CSPC3013	Computer Network	3	-	-	3	15	15	10	60	100
2	PC	CSPC3014	Software Engineering	3	1		4	15	15	10	60	100
3	PE2	CSPE3015-17	PE2	3	-	-	3	15	15	10	60	100
4	HSMC	CSHS1012	HSMC-III	3	-	-	3	15	15	10	60	100
5	OE	CSOE0012	Open Elective-III	3	-	-	3	15	15	10	60	100
6	OE	CSOE0013	Open Elective-IV	3	-	-	3	15	15	10	60	100
7	PC	CSPC3018	Lab Computer Network	-	-	2	1		-	25	25	50
8	PC	CSPC3019	Lab Programming	-	-	2	1		-	25	25	50
9	PE2	CSPE3020-22	Lab PE2	-	-	2	1		-	25	25	50
10	PR	CSPR3023	Mini Project			4	2		-	25	25	50
	Total			**18**	**1**	**10**	**24**	**90**	**90**	**160**	**460**	**800**

Professional Elective I
1] Data Mining & Data warehousing
2] Cloud Computing
3] Image Processing
Professional Elective II
1] Machine Learning
2] Computer Vision
3] Software Testing and Quality Assurance

Government College of Engineering, Aurangabad
(An Autonomous Institute)
Teaching and Evaluation Scheme from year 2024-25
Final Year B. Tech. Program in Computer Science and Engineering
Semester VII
(An Autonomous Institute)

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr. No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISEI I**	**ISEI II**	**ESE**	**Total (100)**
1	PC	CSPC4001	Artificial Intelligence	3	-	-	3	15	15	10	60	100
2	PE3	CSPE4002-04	PE III	3	-	-	3	15	15	10	60	100
3	PE4	CSPE4005-07	PE IV	3	-	-	3	15	15	10	60	100
4	PE5	CSPE4008-10	PE V	3	-	-	3	15	15	10	60	100
5	OE	CSOE1014	Open Elective V	3	-	-	3	15	15	10	60	100
6	PC	CSPC4011	Lab Artificial Intelligence	-	-	2	1		-	25	25	50
7	PE3	CSPE4012-14	Lab PE III	-	-	2	1		-	25	25	50
8	PE4	CSPE4015-17	Lab PE IV	-	-	2	1		-	25	25	50
9	PE5	CSPE4018-20	Lab PE V	-	-	2	1		-	25	25	50
10	HSMC	CSHS0013	HSMC-IV	3	-	-	3	15	15	10	60	100
11	PR	CSPR4021	Project I			6	3		-	50	50	100
12	PR	CSPR4022	Industrial Training	-	-	-	-	-	-			
13	AC		Activity Based Personality Development I & II	-	-	-	-	-	-	-	-	-
	Total			**18**	**-**	**14**	**25**	**90**	**90**	**210**	**510**	**900**

Professional Elective –III
1] Block Chain Technology
2] Neural Network
3] Cryptography & Network Security

Professional Elective -IV:
1] Data Analytics
2] Internet of Things
3] Natural Language Processing
Professional Elective -V:
1] Deep Learning
2] Design of Linux Operating System
3] Information Retrieval

Government College of Engineering, Aurangabad

Teaching and Evaluation Scheme from year 2024-25

Final Year B. Tech. Program in Computer Science and Engineering

Semester VIII

Course				**Teaching Scheme**			**Continuous Evaluation in terms of Marks**					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total (100)**
1	PR	CSPR4023	Project II	-	-	20	10	-	-	100	100	200
	Total			**-**	**-**	**20**	**10**				**100**	**300**

Government College of Engineering, Aurangabad
(An Autonomous Institute)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINNERING

Semester wise credit distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total	AICTE	Diff
BSC	8	9	3	3					23	25	-2
ESC	9	10	4	1					24	24	0
HSMC		3			3	3	3		12	12	0
PCC			11	13	13	9	4		50	48	+2
PEC					4	4	12		20	18	+2
OEC				3	3	6	3		15	18	-3
LC											
MC											
PROJ					1	2	3	10	16	15	+1
Total	18	21	18	20	24	24	25	10	160	160	

CSPC3001: Design and Analysis of Algorithm

Teaching Scheme			**Evaluation Scheme**	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Prerequisite: Data Structures

Course description: This Course describes the techniques of design and analysis of algorithms. Topics like Divide and Conquer, Greedy and Dynamic programming, Backtracking will be covered. Students will also learn to analyze the performance of algorithms

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Describe asymptotic notation, its properties and use in measuring algorithm behavior.
CO2	Apply mathematical principles to solve various problems t
CO3	Analyze and apply the complexities of various algorithms and select the best
CO4	Know the different strategies that are known to be useful in finding efficient algorithms to solve problems and to be able to apply them.
CO5	Use appropriate data structure and algorithms to solve a particular problem

Detailed Syllabus:

Unit 1	**DIVIDE-AND-CONQUER** What is an algorithm, Performance Analysis- Space complexity, Time Complexity, Asymptotic Notation, and Divide-and-Conquer- Introduction, Binary Search-Iterative and Recursive, finding the Maximum and Minimum, Merge Sort, Quick Sort, Heap Sort.
Unit 2	**GREEDY METHOD** Introduction , 0/1 Knapsack Problem, Job scheduling, Huffman codes, Minimum cost spanning trees- Prim's Algorithm, Kruskal's Algorithm, Optimal Merge Patterns.
Unit 3	**DYNAMIC PROGRAMMING** Multistage Graphs, All pairs shortest path, single source shortest path, Optimal Binary Search tree, Traveling Sales man problem, Flow shop Scheduling.
Unit 4	**BACK TRACKING** Introduction, The 8 queens problem, Sum of Subset, Graph coloring, Hamiltonian cycles ,Branch and Bound
Unit 5	**BASIC TRAVERSAL AND SEARCH TECHNIQUES** Techniques for binary trees, Techniques for graphs- Breadth First Search and traversal, Depth First Search and traversal, Connected components and Spanning Trees.

Text Books and Reference Books

1. Horowitz, Sahani, Rajasekaran, *Fundamental of Computer Algorithm* , Galgotia Publication
2. Coreman, Leiserson, Rivest, Stein, *Introduction to Algorithms*, PHI.
3. Aho Ulman, Hopecroft, Design and Analysis of Algorithms, Addison Wesley.

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Tutorials
2) Problem Solving
3) Power point presentation of case studies
4) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISE I & II**	**ISE III**	**End Semester Examination**
K1	Remember	15	5	15
K2	Understand	15	00	20
K3	Apply	00	5	25
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
Total Marks 100		30	10	60

Assessment table

Assessment Tool	K1	K2	K3	K1	K3
	C01	C02	C03	CO4	CO5
ISE I & II (30 Marks)	15	10	05	00	00
ISE III (10 Marks)	05	00	00	05	00
ESE Assessment (60 Marks)	15	15	10	10	10

Special Instructions if any: Nil

CSPC3002: Compiler Design

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Course Description: This course gives the introduction to system programs and compiler construction. It also gives the knowledge role of a lexical analyzer, specification and recognition tokens, Lexical analyzer generator LEX, role of Parser, Types of Parsers . This course also gives the idea about Syntax Directed Translation and Intermediate Code Generation using different technique such as DAG, Three address code, etc. At the end this course gives the information runtime environment and issues in code generation and code optimization.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Enrich the knowledge in various phases of compiler and its use.
CO2	Describe the use of lexical & syntax analyzer for generation of tokens & parse trees .
CO3	Develop program constructs using SDD's & type checkers
CO4	Illustrate and demonstrate code generation techniques for targeted code
CO5	Design a simple compiler with tools & different with optimized techniques

Detailed Syllabus:

Unit 1	**Introduction to Compiling and Lexical Analysis:** Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler Construction tools, A simple one-pass compiler, The role of the Lexical analyzer, Input buffering, Specification of Tokens, Regular expressions, A Language for Specifying Lexical Analyzers, Lexical Analyzer generator.(Lex)
Unit 2	**Syntax Analysis:** The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Operator-precedence Parsing, LR-Parsers, Using Ambiguous Grammars, Parser Generators(Yacc)
Unit 3	**Syntax-Directed Translation:** Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of SAttributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes. Type Checkers : type checking for expressions, declarations (variable, type, function, recursive), statements,
Unit 4	**Intermediate Code Generation:** Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

Unit 5	**Code Generation & Code Optimization :**Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Peephole Optimization, Principal sources of optimization,

Text and Reference Books:

1. Alfred V.AboColumbia University Monica S. Lam Stanford University Ravi Sethi Avaya Jeffrey D. Ullman Stanford University," *Compilers Principles, Techniques and Tools*",2nd edition, Pearson.
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J. H. Jacobs and Koen Langendoen, *Modern Compiler Design*, Wiley Publication
3. Paul G. Sorenson, *Compiler Writing*, McGraw-Hill Publication.
4. Hunter, *The Essence of Compilers*, Pearson Publication.
5. Lewis, *Elements of the Theory of Computation*, Pearson Publication.
6. Jean Paul Tremblay, Paul Gordon Sorenson, *Theory and Practice of Compiler Writing*, BS Publications, 2008.

Web Resources:

1. https://nptel.ac.in/courses/106105190
2. https://www.javatpoint.com/compiler-tutorial

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2											2	1	
CO2	3	3	1										2	1	
CO3	3	3	1										2	1	
CO4	3	3	2									1	2	1	
CO5		3	3									1	1	1	1

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Class room Question & answer

4. Power point presentation of Topic which is related but out of syllabus
5. Overall approach towards learning, creativity.

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	05	02	10
K2	Understand	05	05	02	10
K3	Apply	05	05	02	20
K4	Analyze	00	00	02	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	02	10
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,k6**
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPC3003: Formal Language and Automata Theory

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**1**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**4**		**ESE**	**60 Marks**

Prerequisites: Discrete Mathematical Structures

Course Description: This course provides a set of abstract structures that are useful for solving certain classes of problems. It describes properties and design methods and corresponding languages of Finite automata, pushdown automata and Turing machine.

Course Outcomes:
After successful completion the course, students will be able to:

	Course Outcomes
CO1	Discuss properties of different grammars and languages
CO2	Solve problems related to string membership to an automata and respective Language
CO3	Create grammar for specific language.
CO4	Identify language accepted by particular automata.
CO5	Design optimum automata for particular language

Detailed Syllabus:

Unit 1	Automata: why study automata theory? Introduction to formal proof, Inductive Proofs, The central concept of automata theory. Finite Automata: Deterministic Finite automata, Nondeterministic finite automata, An Application: Text Search, Finite automata with Epsilon – Transitions.
Unit 2	Regular Expressions and Languages: Regular expressions, Finite automata and regular expressions, Applications of regular expressions, Algebraic Laws for Regular Expressions Properties of Regular Languages: Proving Languages not to be regular, Closure properties of regular Languages, Decision properties of Regular Languages, Equivalence and minimization of Automata.
Unit 3	Context Free Grammars and Languages: Context Free Grammars, parse Trees, Application of Context Free Grammars, Ambiguity in Grammars and languages. Push Down Automata: Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automaton.
Unit 4	Properties of Context Free Languages: Normal Forms for Context Free Grammars, The pumping Lemma for context Free Languages, Closure Properties of Context Free Languages, and decision properties of CFL's.
Unit 5	Introduction to Turing Machine: Problems that computer cannot solve, The Turing Machine, Programming Techniques for Turing machines, Extensions to the basic Turing Machines, Turing machines and Computers, Undecidable Problems about Turing machines. An Introduction to intractable problems.

Text and Reference Books:

1. Hopcroft & Ullaman, *Introduction to Automata Theory languages, and Computation* 3rd edition. Pearson Education.
2. John C. Martin , *Introduction to Languages and theory of computation 2nd edition* TMH.

3. K.L.P.Mishra ,N. Chandrasekaran, *Theory of Computer Science Automata, Languages and Computation, 2nd Edition,* PHI.

Web Resources:

NPTEL course : Theory of computation(IITK): https://nptel.ac.in/courses/106104148

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2								2				
CO2	1	1								2	2				
CO3		2	3	3										2	
CO4						2			3						
CO5	3	2	3	2				2			2		3		

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	05	05	00	10
K3	Apply	05	05	00	10
K4	Analyze	00	05	05	10
K5	Evaluate	00	00	00	20
K6	Create	00	00	05	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1,CO2	CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	20	40
Total Marks 100		

Special Instructions if any: Nil

CSPE3004: Data Mining & Data Warehousing

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Mathematics, Programming language.

Course Description: This course helps the students to understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing using OLAP tools. The different data mining models and techniques like classification, clustering and association rule analysis, will be discussed in this course.

Course Outcomes:
After successful completion the course, students will be able to:

Course Outcomes	
CO1	Describe various techniques which enhance the data modeling.
CO2	Understand the concepts of Data Ware housing and Data Mining Concepts
CO3	Demonstrate the patterns that can be discovered by association rule mining, classification and clustering
CO4	Apply different classification techniques to different data types.
CO5	Illustrate the various clustering algorithms.

Detailed Syllabus:

Unit 1	**Introduction** Data Mining Introduction , Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Preprocessing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, sampling; and Data Discretization: Binning, Histogram Analysis. Exploratory data analysis and visualization
Unit 2	**Data Warehouse** Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, A three-tier data warehousing architecture
Unit 3	**Association rule Mining** Market basket Analysis, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules.
Unit 4	**Classification** Introduction to Classification and Regression for Predictive Analysis, Decision Tree Induction, Naïve Bayesian classification, Rule-Based Classification: using IF-THEN Rules for Classification, Bayesian Belief Networks, Classification Using Frequent Patterns, K-Nearest Neighbor Classifiers, Prediction – Accuracy and Error Measures,

	Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods, Bagging, Boosting and Random Forest, Model Section and Evaluation.
Unit 5	**Cluster Analysis** Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis ,Outlier Analysis.

Text and Reference Books:

1. Jiawei Han and Micheline Kamber, "*Data Mining Concepts and Techniques*", Second Edition, Elsevier, 2007.
2. Alex Berson and Stephen J. Smith, "*Data Warehousing, Data Mining & OLAP*", Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "*Introduction To Data Mining*", Person Education, 2007.
4. G.K.Gupta, "*Introduction to Data Mining with Case Studies*", Easter Economy Edition, Prentice Hall of India, 2006.

Web Resources:

NPTEL course :Data Mining: https://nptel.ac.in/courses/106105174

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	1	3				1		2		2	2	1	
CO2	3	3	1	2				1					2	1	
CO3	2	3	1	2				1	2	2		3	2	1	3
CO4	2	2	1	3				1	2	2		3	2	1	3
CO5	3	2	1					1	2	2		3	2	1	3

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3,K4,K5
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	25	35
Total Marks 100		

Special Instructions if any: Nil

CSPE3005: Cloud Computing

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: None
Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Identify the appropriate cloud services for a given application
CO2	Assess the comparative advantages and disadvantages of Virtualization technology
CO3	Analyze authentication, confidentiality and privacy issues in cloud computing
CO4	Identify security implications in cloud computing
CO5	Understand the importance of protocols and standards in management for cloud services

Detailed Syllabus:

Unit 1	**Introduction to Cloud Computing:** Defining Cloud computing, Characteristics, Components, deployment model, service model, Applications, Benefits of cloud computing, Limitations of cloud computing. Grid Computing, Grid vs Cloud Computing.
Unit 2	**Cloud architecture, Services and Applications** Exploring cloud computing stack – Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Defining Infrastructure as a Service (IaaS), Defining Software as a Service (SaaS), Defining Platform as a Service (PaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS).
Unit 3	**Cloud Infrastructure and Virtualization** Hardware and Infrastructure – Clients, Security, Network and Services., use of Virtualization technology, Load Balancing and Virtualization, virtualization benefits, Hypervisors, porting application, Defining cloud capacity by defining baselines and Metrics
Unit 4	**Exploring cloud services** Software as a Service – Overview, advantages, limits, virtualization benefits, examples. Platform as a Service – overview, advantages and functionalities, PaaS application frameworks – Drupal, Long Jump. Case study – Google Apps and Web Services.

Unit 5	**Cloud Administration and Security Management** Management responsibilities, lifecycle management, cloud management products, Cloud management standards. Cloud security, data security, Identity and presence protocol standards, Availability management in SaaS, IaaS, PaaS, Access Control, Security Vulnerability, Patch and Configuration Management, Security as a Service of cloud, Future of Security in Cloud computing..

Text and Reference Books:

1. Barrie Sosinsky, "*Cloud Computing Bible*", Wiley India Edition.
2. Anthony Velte, toby Velte, Robert Elsenpeter, "*Cloud Computing – A Practical Approach*", Tata McGraw-Hill Edition.

Web Resources:

NPTEL course : Database management system(IITK):
https://onlinecourses.nptel.ac.in/noc21_cs04/

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	2	3											
CO2	1	2	1												
CO3	1	2	2	2						3			2	2	
CO4	1	2	2										2	1	
CO5	1	2	1	3									3	1	

3 - High 2 – Medium 1 –Low

Assessment:
ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	05	05	00	10

K3	Apply	05	05	00	10
K4	Analyze	00	05	05	10
K5	Evaluate	00	00	00	20
K6	Create	00	00	05	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1,CO2	CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	20	40
Total Marks 100		

Special Instructions if any: Nil

CSPE3006: Image Processing

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Mathematics, Programming language.

Course Description: Images and visual information are integral parts of our daily lives. Digital image processing plays an important role in various practical applications among them: television, medical imaging modalities such as X-ray or ultrasound, photography, security, astronomy and remote sensing. This subject will introduce the fundamentals of image processing and manipulation. While image applications will be used for illustrations, the subject emphasizes general principles of image processing rather than specific applications. This subject discusses how computers can process digital images and their basic operations (their basis, implementation and consequences) in image processing.

Course Outcomes:
After successful completion the course, students will be able to:

Course Outcomes	
CO1	Describe the theory and algorithms that are widely used in digital image processing
CO2	Discuss the image enhancement techniques for different a set of noisy images.
CO3	Compare different image segmentation and compression techniques.
CO4	Formulate solutions using morphological concepts.
CO5	Develop any application using different image processing techniques.

Detailed Syllabus:

Unit 1	**Digital Image Fundamentals** Different fields of DIP**,** The digitized image and its properties – Image sampling and quantization ,image types, spatial Intensity and resolution, basic relationship between pixels, Mathematical tools used in DIP.
Unit 2	**Image Enhancement** Basic Intensity transformation functions, Histogram processing, smoothing and sharpening filters in spatial and frequency domain , Periodic noise. **Image Restoration and reconstruction** A model of Image Degradation/ restoration Process, Noise Models, Mean filters, order statistics filters, Adaptive filters, and Notch filters.
Unit 3	**Morphological Image Processing** Erosion & Dilation, Opening & Closing , Hit or Miss Transformation, Boundary Extraction, Thinning, Thickening, Skeletons ,Pruning, Textural segmentation, morphological smoothing.
Unit 4	**Image Segmentation** Fundamentals, Point, line & Edge Detection, Thresholding, basic thresholding, global thresholding, multivariable thresholding, region growing, region splitting and merging. **Image Compression**

	Coding redundancy, measuring image information, fidelity criteria, image compression models, Huffman coding, Arithmetic coding, run length coding, symbol based coding, bit plane coding, digital image watermarking.
Unit 5	**Object recognition** Need for object recognition system, automated object recognition system, patterns and pattern class, representation of pattern class, selection of measurement parameters, relationship between image processing and object recognition, approaches to object recognition, Bayes' parametric classification, and Structural method-shape numbers, string matching, Face recognition.

Text and Reference Books:

1) Gonzales Woods "*Digital image processing, 3rd Edition*", Pearson Education
2) S Jayaraman, S Esakkirajan, T Veerakumar, "*Digital Image Processing*",TMH Publication
3) Anil K. Jain, "*Fundamental of Digital Image Processing*", PHI Pub.
4) Milan Sonka ,Vaclav Hlavac , Roger Boyle, "*Image Processing, Analysis and Machine Vision 3rd Edition"* , Cengage Learning

Web Resources:

NPTEL course : Digital Image Processing https://nptel.ac.in/courses/117105079

Virtual Lab: Image Processing https://cse19-iiith.vlabs.ac.in/List%20of%20experiments.html

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	1					2		2		2		1	
CO2	3	3	1					2		2		2		1	
CO3	3	2	1					2		2		3			
CO4	2	3	1					2		2		3	3		1
CO5	2	2	1					2		2		3	3		1

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	02	10

K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	00	05
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,K5**
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPC3007: Lab Design & Analysis of Algorithms

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III (Term Work)**	**25 Marks**
Credits: 01	**ESE**	**25 Marks**

Prerequisite: CS1001: Basics of Computer & Information Technology
CS2003: Discrete Mathematical Structure
CS2008: Data Structures

Course Outcomes: After completion of this course students will be able to:

CO1	Design and implement appropriate data structures for computation
CO2	Demonstrate algorithms using divide and conquer approach
CO3	Solve problems using greedy method.
CO4	Employ dynamic programming techniques.
CO5	Problem solving Using backtracking techniques

List of the Experiments:
The student shall perform minimum ten experiments of the following using C & Flex tool environment

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: (all)				
1	Recursive and non-recursive algorithm for specific problem and there complexity measures	S1	CO1	04
2	Implement merge sort using divide and conquer approach.	S1	CO1	04
3	Write a program for finding an element Using Binary Search.	S1	CO1,CO2	04
4	Write a Program for Greedy Knapsack problem.	S1	CO3	04
5	Minimal spanning trees using Prime's algorithm.	S2	CO2, CO3	04
6	Minimal spanning trees using Kruskal's algorithm	S2	CO2, CO3	04
7	Find single source shortest path for multistage graph problem	S2	CO2	04
8	Find all pairs shortest path for multistage graph problem.	S2	CO2	04
9	Huffman code problem.	S2	CO2	04
10	Flow shop scheduling or knapsack's problem or 8 Queen problem.	S2	CO3	04

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2										
CO2		2	2		3							
CO3		3	3		3							
CO4		3	3		3							
CO5		3	3		3							

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2	S2	S3
	CO1	CO2	CO3	CO4	CO5
Term Work (25 Marks)	05	05	05	05	05
Practical Examination & Viva Voce (25 Marks)	05	05	05	05	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	5
S2	Manipulation	15	15
S3	Precision	5	5
S4	Articulation	00	00
55	Naturalization	00	00
Total		25	25

Preparation (S1)	04	05
Conduct of Experiment (S2)	04	07
Observation and Analysis of Results (S3)	08	05
Record (S2)	03	03
Mini-Project / Presentation/ Viva-Voce (S3)	06	05
Total	**25**	**25**

Special Instructions if any: Nil

CSPC3008: Lab Compiler Design

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III (Term Work)**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the working of LEX & Yacc tool for writing programs.
CO2	Incorporate the of Lex & Yacc tool for debugging programs.
CO3	Demonstrate the programs for identifiers , tokens & comments.
CO4	Develop programs in C or Lex for parsers.
CO5	Create a mini compiler using lex & yacc tools with their program format

List of the Experiments:

The student shall perform minimum ten experiments of the following using C & Flex tool environment

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: (all)				
1	Study of LEX Analyzer Generator	S1	CO1	04
2	Study of YACC Generator	S1	CO1	04
3	Write a C program to identify whether a given line is a comment or not	S1	CO1,CO2	04
4	Implement a lex program to count the no of vowels & consonants in a given string	S1	CO3	04
5	Implement a lex program to count the no of characters, words, spaces & end lines in a given input file	S2	CO2, CO3	04
6	Implement a lex program to count the no of –ve & +ve integers & fractions	S2	CO2, CO3	04
7	Implement a program to find out whether the string is keyword or not	S2	CO2	04
8	Implement a program to find out whether the string is identifier or not	S2	CO2	04
9	Implement a program to find out whether the string is constant or not	S2	CO2	04
10	Write a C program to recognize strings under 'a*', 'a*b+', 'abb'.	S2	CO3	04

11	Evaluate a C program for generation of Parse tree	S2	CO4	04
12	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.	S2	CO5	06

Assessment:
ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.
End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S3	S2
	CO1	CO2	CO3	CO4	CO5
Term Work (25 Marks)	07	07	05	03	03
Practical Examination & Viva Voce (25 Marks)	05	05	05	05	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	08	10
S3	Precision	12	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

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

3 – High 2 – Medium 1- Low

CSPE3009: Lab Data Mining and Data warehousing

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III (Term Work)**	**25 Marks**
Total Credits	**01**	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Learn to perform data mining tasks using a data mining toolkit (such as open source WEKA).
CO2	Understand the data sets and data preprocessing.
CO3	Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression.
CO4	Exercise the data mining techniques with varied input values for different parameters.

List of the Experiments:

The student shall perform minimum ten experiments of the following using WEKA

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Install WEKA TOOL	S1	CO1	02
2	Demonstrate the use of ARFF files taking input and diplay the output of the files.	S2	CO2	02
3	Create your own excel file. Convert the excel file to .csv format and prepare it as ARFF files.	S2	CO2	02
4	Preprocess and classify IRIS dataset.	S2	CO1	03
5	Perform Preprocessing, Classification techniques on Agriculture dataset.	S2	CO2	03
Level: Moderate (all)				
6	Preprocess and classify Weather dataset.	S2	CO3	02
7	Perform Clustering technique on Weather dataset	S2	CO4	02
8	Perform Association technique on Customer dataset.	S2	CO3	02
9	Perform Naïve Bayes Classifiation.	S2	CO3	02
Level: Complex (all)				
10	Compare various Data Mining techniques available in WEKA	S3	CO4	03
11	Apply filters to database and see performance	S2	CO4	02

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4
ESE (25 Marks)	03	22

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	03
S2	Manipulation	19
S3	Precision	03
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	1	2	2		1	2	1			1	1	2	
CO2	2	3	1	1	2		1	2	1			1	1	2	
CO3	3	3	1	2	2		1	2	1			2	1		
CO4	3	3	1	3	2		1	2	1			2			

3 – High 2 – Medium 1- Low

CSPE3010: Lab- Cloud Computing

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Create Virtual Machine images and to deploy them on a Cloud.
CO2	Characterize performance of cloud equipment.
CO3	Installation of Cloud.
CO4	Exercise the data mining techniques with varied input values for different parameters.
CO5	Develop an understanding of economic issues related to cloud

List of the Experiments:

The student shall perform minimum ten experiments of the following using WEKA

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Introduction to cloud computing.	S1	CO1	4
2	Implementation of SOAP Web services in C#/JAVA Applications.	S2	CO2	4
3	Implementation of RESTFul Web services in C#/JAVA Applications.	S2	CO2	5
4	Implementation of Para-Virtualization using VMWare's Workstation/ Oracle's Virtual Box and Guest O.S	S2	CO1	5
5	Implementation of Full-Virtualization using VMWare's ESXi and Guest O.S.	S2	CO2	5
6	Creating a Warehouse Application in SalesForce.com.	S3	CO5	6
7	Installation and Configuration of Single-Node Setup in Hadoop.	S3	CO4	4
8	Create any Application (Ex: Word Count) Using Hadoop Map/Reduce.	S3	CO5	5
9	To study Cloud security challenges.	S1	CO1	4
10	Case Study: PAAS (Face book, Google App	S1	CO1	4

	Engine)			
11	Case Study : Amazon Web Services	S2	CO3	4

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4
ESE (25 Marks)	03	22

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	03
S2	Manipulation	19
S3	Precision	03
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	1	3	2			2	1	3		3	2	1	
CO2	2	3	1	3	2			2	1	3		3	2	1	
CO3	3	3	1	2	1			1	1	1		3	2	1	
CO4	3	3	1	2	1			1	1	1	2	3	1	1	

3 – High 2 – Medium 1- Low

CSPE3011: Lab Image Processing

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE- III (Term Work)**	**25 Marks**
Total Credits	**01**	**End Semester Exam**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Perform image related operations.
CO2	Apply a proper filter for given a set of noisy images.
CO3	Analyze different image segmentation and compression techniques.
CO4	Demonstrate different morphological operations.
CO5	Develop any application using different image processing techniques

List of the Experiments:

The student shall perform minimum ten experiments of the following using Matlab

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	To study Mat lab toolbox.	S1	CO1	02
2	To perform simple arithmetic operations on images.	S2	CO2	02
3	To implement program for image enhancement using histogram equalization.	S2	CO2	02
4	To study and implement the program addition of different type of noise's to images.	S2	CO2	03
5	To study and implement program of low pass and high pass filter using Gaussian filter.	S2	CO2	03
Level: Moderate (all)				
6	To implement program of the edge detection using different type of method	S3	CO3	02
7	To implement program to perform different morphological operations on images and reduce noise using morphological operations in images.	S3	CO4	02
8	To study and implement program of the different type of texture effect on images.	S2	CO4	02
9	To study and implement a program to detect a cell using image segmentation.	S3	CO3	02
Level: Complex (all)				
10	To study and implement the program of bit plane coding.	S3	CO3	02
11	To study and implementation of wavelet-based watermarking.	S3	CO5	03

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4,CO5
ESE (25 Marks)	02	23

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	02
S2	Manipulation	12
S3	Precision	11
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1					2	1	2		1	2	1	
CO2	3	3	1					2	1	1		1	2	1	
CO3	3	3	2					1	2	2		2	3	1	
CO4	3	3	2					1	1	1		2	1	1	
CO5	2	3						1	1	2		2	1	2	1

3 – High 2 – Medium 1- Low

CSPR3012: Seminar

Teaching Scheme			Evaluation Scheme	
Practical	**2 Hrs/Week**			
			ISE III (Term Work)	**25 Marks**
Total Credits	**1**			

Total Hours required for this practical course: 30 Hours.

Course Outcomes:

After completing this course, students will able to:

	Course Outcomes
CO1	Collect Organize & Analyze information about emerging technologies /market demands/current trends.
CO2	Exhibit effective communication skills, stage courage, and confidence.
CO3	Demonstrate intrapersonal skills.
CO4	Awareness in keeping with new innovations and inventions.

Guidelines for presenting a seminar:

- The seminar will consist of a typewritten report covering the topic related to his area of final year project.
- If more number of students are working on same project then they should separate the seminar topics from the project area which is relevant and which will contribute for completion of project.
- Weekly report of students work for finalization of his area of work and topic of seminar should be submitted to the faculty during designated hours meant for seminar
- Format of weekly report should be finalized by the department with sufficient inputs received from the students. It should have following stage wise reports:

  Project Area and Project Groups by 3rd week

  Tentative seminar topics by 4th week

  Literature/Field Study Mechanism identified sources and strategy by 5th week

  Weekly report on Literature/Field Study 6th, 7th& 8th week

  Presentation Format contents & Trial Presentations to student groups 9th, 10th week

  Journal on above stages and Final Presentation Report 11th week

- It is expected that the candidate prepares a report based on outcomes of literature studies, field visits, observation schedules, focus group meetings etc related to a problem in relevant technology area.
- The report shall be tested for any plagiarism out of books, journals and internet based articles and reports by appropriate web based tool.

- The candidate shall deliver seminar on the topic on first two occasions to students of his class for peer assessment.
- Format for peer group assessment should be designed by the faculty with approval of department. Peer assessment should not be given more than 15% weightage
- Final presentation for term work should be attended by minimum TWO faculty members. Each candidate may be given time minimum of 8 to 10 minutes.
- Assessment criteria for seminar delivery for term work should be designed by the faculty with inputs received from students of the class. It should include provision for peer group assessment as per the norm stated above.
- Assessment Criteria so designed will be displayed on the department notice board with the approval from department along with these guidelines.

Mapping of Course outcome with Program Outcomes

Course outcome	**Program Outcomes**												**PSO's**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	2				2		3		2	3	2	1	1
CO2	1	2	2				2		1		2	3	2	1	2
CO3	1	2	2				2		1		3	3	2	1	2
CO4	1	2	2				2	3	2		3	3	3	1	2

3 – High 2 – Medium 1- Low

Assessment Table

Assessment Tool	S2	S2	S4	S3
	CO1	CO2	CO3	CO4
ISE1/ Term work(**25** marks)	10	10	2	3

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**ISEI**
S1	Imitation	10
S2	Manipulation	05
S3	Precision	05
S4	Articulation	03
S5	Naturalization	02
Total		25

Special Instructions if any: Nil

Semester VI

CSPC3013: Computer Network

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisite: Basics of Computer & Information Technology

Course Description: This course introduces the architecture, functions, components, and models of the computer networks and Internet. The principles of IP addressing and fundamentals of Ethernet concepts, media, and operations are introduced. Students will be able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.

Course Outcomes:

After completing this course, students will able to:

Course Outcomes	
CO1	Various protocols, models in Networks.
CO2	Comprehend Network hardware, Media Types (cables, Wireless).
CO3	Compare UTP, Connectors, and Network interface Card.
CO4	Design, implement and analyze simple computer networks.
CO5	Apply the different strategies Operations of TCP/UDP, FTP, HTTP, SMTP, SNMP.

Detailed Syllabus:

Unit 1	**Introduction** Overview of computer network, Network hardware and software, Reference model-OSI and TCP/IP and their comparison Network layer- Network layer design issues, various routing Algorithms and congestion control algorithms
Unit 2	**TCP/IP** TCP/IP architecture, the internet protocols, IPv6, DHCP and Mobile IP, IP addressing, OSPF and BGP, multicast routing, the network layer in ATM networks
Unit 3	**Transport layer** The transport services, elements of transport protocols, internet, Transport protocols, ATM –AAL layer protocols, Performance issues.
Unit 4	**The Application layer** Network security – principle of cryptography, secret key and public key algorithm, digital signature, Domain name system-The DNS name space, resource records, name server, simple network management Protocol –SNMP model, Electronic, mail-architecture and services, Message formats and message transfer, email privacy.
Unit 5	**Multimedia Information and Networking** Lossless data compression, Video on Demand, Transmission in ATM network, Communication satellites.

Text and Reference Books:

1. Andrew .S. Tenenbaum, *Computer networks*, PHI
2. Alberto, Leon Garcia and Indrawidjaja, *Communication networks- Fundamental concepts and key architectures*, Tata mc-graw hill.

Mapping of Course outcome with Program Outcomes

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	1						1				2		
CO2		2	1						1				2		
CO3		2	1						1				2		1
CO4		2	2						2			1	3		1
CO5	1	1	1						1			1	2		1

3 – High 2 – Medium 1 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Tutorials
2) Problem Solving
3) Power point presentation of case studies
4) Question & answer / Numerical solution /Simulation

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I & II	ISE III	End Semester Examination
K1	Remember	15	5	25
K2	Understand	15	00	20
K3	Apply	00	5	15
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
Total Marks 100		30	10	60

Assessment table

Assessment Tool	K1	K2	K3	K1	K3
	C01	C02	C03	CO4	CO5
ISE I & II (30 Marks)	15	10	05	00	00
ISE III (10 Marks)	05	00	00	05	00
ESE Assessment (60 Marks)	10	20	10	10	10

Special Instructions if any: Nil

CSPC3014 : Software Engineering

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**1**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**4**		**ESE**	**60 Marks**

Prerequisites: Basic Programming Knowledge

Course Description: Software engineering is defined as a process of analyzing user requirements and then designing, building, and testing software application which will satisfy those requirements.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Know basic computer engineering concept through SDLC life cycle and Models in software engineering
CO2	Integrate the requirement from customer for software development
CO3	Apply the design concept to develop the system
CO4	Apply the "Golden Rules" for user interface level design
CO5	Formulate test strategy and ethically work to achieve the quality of product

Detailed Syllabus:

Unit 1	Introduction to Software Development process and Management Introduction to Software Engineering, Software Crisis and Myths, Software Development life cycle and Models: Maturity Model, Process models-waterfall, evolutionary, incremental etc, What is an agile view of process.
Unit 2	Requirements Engineering Requirements Engineering and Management. Initiating, Eliciting requirement, developing use cases, building the Analysis Model, Negotiating and Validating requirement.
Unit 3	An Architectural Design Software Architecture, Data Design, Architectural Styles and pattern, Architectural Design, Assessing alternative architectural Design Mapping Data flow in to software architecture
Unit 4	User Interface Level Design and Estimation The Golden rules, User Interface analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation, Project Estimation.
Unit 5	Introduction to Software Testing Test Strategies for conventional software, Validation testing, System Testing, The art of Debugging, Software testing fundamentals, Software quality, Framework for product Metrics.

Text and Reference Books:

1. Software Engineering – Practitioner Approach – Roger S. Pressman
2. Software Engineering by Ian Sommerville ; Pearson Edu
3. Object Oriented Analysis and Design, Grady Booch

Web Resources:

NPTEL course : https://onlinecourses.nptel.ac.in/noc20_cs68/preview

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1				3											
CO2	3												2		
CO3				2						3			2	2	
CO4	3												2	1	
CO5													3	1	

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation
5) **Assessment Pattern:**

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	05	05	00	10
K3	Apply	05	05	00	10
K4	Analyze	00	05	05	10
K5	Evaluate	00	00	00	20
K6	Create	00	00	05	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1,CO2	CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	20	40
Total Marks 100		

Special Instructions if any: Nil

CSPE3015 : Machine Learning

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Mathematics, Programming language.

Course Description: Machine learning is concerned with the question of how to make computers learn from experience. Machine learning techniques are used to create spam filters, to analyze customer purchase data, to understand natural language, or to detect fraudulent credit card transactions. This course will introduce the fundamental set of techniques and algorithms that constitute machine learning as of today, ranging from classification methods like decision trees and support vector machines, over structured models like hidden Markov models, to clustering and matrix factorization methods for recommendation

Course Outcomes:

After successful completion the course, students will be able to:

Course Outcomes	
CO1	Understand the learning models.
CO2	Describe the working of different algorithms like HMM, probabilistic models.
CO3	Apply regression to different application areas.
CO4	Illustrate Feature selection and reduction methods.
CO5	Describe the multiple criteria for analyzing RL algorithms

Detailed Syllabus:

Unit 1	Algorithmic models of learning. Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description length frameworks.
Unit 2	Parameter estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, ensemble classifiers.
Unit 3	Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear Discriminant Analysis. Gaussian Mixture Models, Expectation Maximization
Unit 4	Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. Dimensionality reduction, feature selection and visualization. Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering.
Unit 5	Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge. Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications, functional approximation, policy search, exploration, exploitation, Imitation Learning, policy iteration, value

	iteration, Q learning, web mining and text mining.

Text and Reference Books:

1. Bishop, C., *Pattern Recognition and Machine Learning*, Berlin: Springer-Verlag, 2006.
2. Tom Mitchell, *Machine Learning*, McGraw Hill, 1997.
3. Hastie, Tibshirani, Friedman, *The Elements of Statistical Learning*, Springer, 2001.
4. Sergios,Theodoridis, Konstantinos, Koutroumbas, *Pattern Recognition, Academic Press*, 2009.
5. Ethem Alpaydin, "*Introduction to machine learning*", second edition, PHI publication, 2010.
6. Tom Mitchell, "*Machine Learning*", McGraw Hill, 1997
7. Marco Wiering, Martijn Otterlo, *Reinforcement Learning State-of-the-Art,* ISBN: 978-3-642-27645-3

Web Resources:

NPTEL course : https://onlinecourses.nptel.ac.in/noc22_cs29/preview

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3				1	2	3		2		1	
CO2	3	3	1	2				1	2	3		2		1	
CO3	3	3	1	3				1	2	3		2	2	1	3
CO4	2	3	1	3				1	2	3		3	2	1	3
CO5	2	3	1	3				1	2	3		3	2	1	3

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05

K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,K5**
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE3016: Computer Vision

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Prerequisites: Programming, Mathematics

Course Description: This course provides an introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification and scene understanding.

Course Outcomes:
After successful completion the course, students will be able to:

	Course Outcomes
CO1	Identify different image representation , their mathematical representation and different their data structures used
CO2	Classify different segmentation algorithm for given input.
CO3	Construct a 3D object from given set of images.
CO4	Detect a moving object in video using the concept of motion analysis.
CO5	Recognize the object using the concept of computer vision.

Detailed Syllabus:

Unit 1	**The image, its representations and properties –** image representations a few concepts, Image digitization, Digital image properties, Color images, Cameras : an overview. **Mathematical and physical background –** Linear integral transforms, Images as stochastic processes, Image formation physics.
Unit 2	**Data structures for image analysis**- levels of image data representation, traditional image data structures, and Hierarchical data structures. Image understanding-fitting via random sample consensus, point distribution model
Unit 3	**Segmentation II –** Mean Shift Segmentation , Active contour models – snakes, Geometric deformable model – level sets and geodesic active contours, Fuzzy connectivity, Towards 3D graph – based image segmentation, Graph cut segmentation.
Unit 4	**3 D Vision Geometry –** 3D Vision tasks, basics of projective geometry, A Single perspective camera, Scene reconstruction from multiple views, two camera stereopsis, **Use of 3D vision** Shape from X, Full 3D objects, 3D model-based vision, 2D view-based representations of a 3D scene.

Unit 5	**Motion Analysis-** Different Motion Analysis methods, Optical flow, analysis based on correspondence of interest points, Detection of specific motion patterns, video tracking, Human Analysis eg. pose estimation, facial analysis, attribute recognition, pedestrian detection

Text and Reference Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "*Digital Image Processing and Computer Vision*" Cengage Learning, 1st Edition, 2008 .
2. Richard Szeliski ,*Computer Vision: Algorithms and Applications* Available for free online.
3. Dana H. Ballard, Christopher M. Brown **, "***Computer Vision*"**,** Prentice Hall 198,**ISBN/ASIN**: 0131653164,**ISBN-13**: 9780131653160
4. Simon J.D. Prince, "*Computer Vision: Models, Learning, and Inference*", ISBN-13: 978-1107011793,ISBN-10: 1107011795

Web Resources:
NPTEL Course : Computer Vision - Course (nptel.ac.in)
NPTEL Course : Computer Vision and Image Processing - Fundamentals and Applications - Course (nptel.ac.in)

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3						2					2	2	
CO2	2	3						2		2			3	2	
CO3	2	3						2		2			3	1	
CO4	2	2			1			2	1	2			1	1	1
CO5	1	2			1			2	1	2		2	1	2	1

3 - High 2 – Medium 1 –Low

Assessment:
ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) Power Point presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE3017: Software Testing and Quality Assurance

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: None
Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Formulate problem by following Software Testing Life Cycle
CO2	Design Manual Test cases for Software Project
CO3	Identify the realistic problem for different category of software
CO4	Use automation testing tool students will be able test the software
CO5	Follow the process related activity and testing techniques to work as team member

Detailed Syllabus:

Unit 1	**Introduction** – s/w testing background - What is a bug? Why do bugs occur? The cost of bugs. Goals of a software tester. Characteristics of s/w tester. Software development process- product component, software project staff, software development lifecycle model. The realities of s/w testing – testing axioms, s/w testing terms and definitions, Software Testing Life Cycle(STLC)
Unit 2	**S/w testing fundamentals-** Examining the specifications - Black box and white box testing, Static and dynamic testing, Static black box testing, Performing a high level review of the specification, low level specification test techniques. Testing the s/w with blinders on – Dynamic black box testing, Test to pass and test to fail, Equivalence partitioning, data testing, State testing, Other black box test techniques. Examining the code – Static white box testing, Formal review, Coding standards and guidelines, Generic code review checklist. Testing the software with X-ray glasses – Dynamic white box testing, Dynamic white box testing, verses debugging testing the pieces
Unit 3	**Types of testing-I-** Configuration testing, Compatibility testing, Foreign language testing, Usability testing, Testing the documentation, Testing for software security
Unit 4	**Types of testing-II-** Web site testing, Automated testing and test tools- Benefits of automation and tools, various test tools, Software test automation, Random testing. Bug bashes and beta testing – Having other people test your s/w, Test sharing, Beta testing, Outsourcing your testing. Performance Testing – Introduction, Benefits of performance testing. Types of performance testing Tools for performance Testing, Process for performance testing, challenges.

Unit 5	**Test planning and quality assurance –**Planning the test – Goal of test planning, Various test planning topics, Writing and tracking test cases- Goal of test case planning, Test case planning overview, Test case organization and tracking, Reporting what you find - Getting the bug fixed, Isolating and replacing bugs, Bug's lifecycle, Bug tracking system, Measuring the success, Software quality assurance- Quality is free, Testing and quality assurance in the work place, Test management and organizational structures, capability maturity model (CMM), ISO 9000 Test Metrics and Measurement – Test Defect Metrics – Defect find rate, Defect fix rate, outstanding defects rate, priority outstanding rate, Defect trends, Defect classification trend, weighted defects trend, Defect cause distribution. Productivity Metrics – Defect per 100 hours of testing, Test Cases Educated per 100 Test Cases, Defects per 100 failed test cases, Test phase Effectiveness, Closed Defect Distribution

Text and Reference Books:

1. Ron Patton, "*Software Testing*" SAMS Publishing.
2. Marnei L. Hutcheson – "*Software Testing Fundamentals: Methods and Metrics*" WILEY Publication.
3. Pressman "*Software Engineering*" McGraw-Hill publications
4. Strinivasan Desikan and Gopalswami Ramesh, "*Software Testing – Principles and Practices*"

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1				3									1		
CO2	3														
CO3				2						3			1	3	
CO4	3			2						1			1	3	
CO5	2			2						1			3	2	

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	05	05	00	10
K3	Apply	05	05	00	10
K4	Analyze	00	05	05	10
K5	Evaluate	00	00	00	20
K6	Create	00	00	05	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3
	CO1,CO2	CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	20	40
Total Marks 100		

Special Instructions if any: Nil

CSPC3018: Lab Computer Network

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE-III (Term Work)**	**25 Marks**
Total Credits	**2**	**End Semester Exam**	**25 Marks**

Prerequisites: Basics of Computer & Information Technology

Course Outcomes:
After completion of this course student will be able to

CO1	Recognize the different internetworking devices and their functions.
CO2	Role of protocols in networking.
CO3	Design and apply subnet masks and addresses to fulfill networking requirements.
CO4	Features of TCP/IP Protocol
CO5	Analyze the features and operations of various application layer protocols such as Http, DNS

The term work shall consist of following practical

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level (all)				
1	Introduction to Networking Devices	S1	CO1	4
2	Understanding / Illustrate the network features of peer to peer network	S2	CO1	4
3	Understanding / Illustrate the network features of Client Server network .	S2	CO1	5
4	Build a Category 5 or Category 6 Unshielded Twisted Pair (UTP) Ethernet crossover cable	S2	CO3	5
5	Connecting 2 Computers together using a Crossover cable	S2	CO3	5
6	Configure TCP/IP in LAN	S3	CO5	5
7	File Transfer / Sharing/ Virtual Desktop Access	S2	CO3	5
8	Study of basic network command and Network configuration commands.	S1	CO1	5
9	Program for simple RSA algorithm to encrypt and decrypt the data.	S2	CO2	6
10	Client/Server chat application	S3	CO5	6

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								1		1
CO2		2	2		3					1		1
CO3		3	3		3					1		1
CO4		3	3		3					1		1
CO5		3	3		3							

3-High 2 – Medium 1- Low

Assessment Table

Assessment Tool	S1	S2	S2	S2	S3
	CO1	CO2	CO3	CO4	CO5
ISE1	05	05	05	05	05
ESE	05	05	05	05	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**End Semester Examination**
S1	Imitation	05	5
S2	Manipulation	15	15
S3	Precision	5	5
S4	Articulation	00	00
55	Naturalization	00	00
Total		25	25

Preparation (S1)	04	05
Conduct of Experiment (S2)	04	07
Observation and Analysis of Results (S3)	08	05
Record (S2)	03	03
Mini-Project / Presentation/ Viva-Voce (S3)	06	05
Total	**25**	**25**

Special Instructions if any: Nil

CSPC3019: Lab Programming

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III (Term Work)**	**25 Marks**
Credits: 1	**ESE**	**25 Marks**

Matlab Programming / React Programming

Matlab Programming

Course Outcomes:
After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the working of Matlab environment/toolbox
CO2	Demonstrate the working of basic commands ,variables
CO3	Demonstrate the working of plotting functions
CO4	Demonstrate the use of various ML algorithms
CO5	Implement different case studies

List of the Experiments:
The student shall perform minimum ten experiments of the following Matlab environment:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: (all)				
1	Introduction to MatLab basic commands.	S1	CO1	04
2	Working with flow control.	S2	CO1	04
3	Working with expressions.	S2	CO2	04
4	Working with relational & logical operations.	S2	CO2	04
5	Working with plotting functions.	S2	CO3	04
6	Working with matrices.	S2	CO2,CO3	05
7	Working with clustering algorithms.	S3	CO4	05
8	Working with regression algorithms.	S3	CO4	05
9	Working with classification algorithms.	S2	CO4	05
10	Analyze quality of life in USA using PCA.	S3	CO5	05
11	Analyze stock prices using factor analysis.	S3	CO5	05

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.
ESE: In ESE of 25 marks Practical conduction and Oral Examination.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4,CO5
ISE1/ Term work(**25** marks)	02	23
ESE (25 Marks)	02	23

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	02	02
S2	Manipulation	12	12
S3	Precision	11	11
S4	Articulation	00	00
S5	Naturalization	00	00
Total Marks		**25**	25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1					2	1	2		1	2	1	
CO2	3	3	1					2	1	1		1	2	1	
CO3	3	3	2					1	2	2		2	3	1	
CO4	3	3	2					1	1	1		2	1	1	
CO5	2	3						1	1	2		2		2	

3 – High 2 – Medium 1- Low

OR

React Programming

Prerequisites:

1. Basic knowledge of Computer & Installing Programs .
2. Basic Knowledge of HTML, CSS, and JavaScript
3. Knowledge of C or C++ Programming would be added advantage**.**

Course Description:

React can change how you think about the designs you look at and the apps you build. When you build a user interface with React, you will first break it apart into pieces called components. Then, you will describe the different visual states for each of your components. Finally, you will connect your components together so that the data flows through them.

Course Objectives:

- To make students familiar with advantages of React Framework
- To enable students to Create their first React Component
- To write programs using Variables, Operators, Data Types & Conditional Statements
- To explore how to respond to events, object state etc. using React

Course Outcomes:

After completing the course, students will be able to

CO1	Understand installation procedure, environment setup for React
CO2	Work with Classes, Data Types, Variables, and other coding blocks in ES6 & React
CO3	Apply JSX in React, React Components
CO4	Use React Props, Events in programming
CO5	Create Forms using React, React Router, React Hooks

Detailed Syllabus:

Unit 1	Introduction: History, Features, setting up and Installation, Working with React, Introduction to Nodejs, NPM, Understanding ES6 Classes, Variable, Array Methods etc, running the first app
Unit 2	Introduction to JSX, Rendering Elements, Components & Props,
Unit 3	State and Lifecycle, Handling Events, Conditional Rendering
Unit 4	Lists & Keys, Forms, Composition vs Inheritance, Context in React
Unit 5	Introducing Hooks, Using the State Hook, Effect Hook, Rules of Hooks, Building your own Hooks

Text and Reference Books:

5. Alex Banks, Eve Porcello, “Learning React” O’Reilly Media, Inc.
6. Anthony Accomazzo, Nate Murray, Ari Lerner– “Fullstack React” Fullstack.io.
7. Robin Wieruch “The Road to React” Robin Wieruch

Web Resources:

1. Quick Start • React (reactjs.org)
2. React Tutorial (w3schools.com)

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (All)				
1	Creating Environment Setup for React	S1	CO1	04
2	Creating your first React Program	S2	CO1, CO2	04
3	Creating Webpages using JSX	S2	CO2	04
4	Creating Function and Class Components	S1	CO3	04
5	State and Lifecycle management using React	S2	CO3	04
Level: Moderate (All)				
6	Create a Webpage to handle events in React	S2	CO1, CO2	06
7	Demonstrate Conditional Rendering	S2	CO1, CO2	06
8	Creating Simple Forms using React	S2	CO2	06
9	Deploying Webpages on IIS and Demonstrate FileZilla	S2	CO4	06
10	Create program using Composition in React	S2	CO4	06
Level: Complex (All)				
11	Implementing Hooks in React	S2	CO2	06

Assessment:
ISEI: In-Semester Evaluation of 50 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2
	CO1	CO2,C03, CO4
ISE1/ Term work(25marks)	10	15
ESE (25 Marks)	10	15

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	10	00
S2	Manipulation	15	00
S3	Precision	00	10
S4	Articulation	00	15
S5	Naturalization	00	00
Total Marks		**25**	25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3		1		2				1						
CO2	3	2	2		2				1			1	1		
CO3	3	1	1		2				1			1		1	
CO4	3	1	1		2				1			1	1	1	

3 – High 2 – Medium 1- Low

CSPE3020 : Lab Machine Learning

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**End Semester Exam**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Generate bag of word model
CO2	Apply classification algorithms like EM , HMM to suitable data.
CO3	Demonstrate logistic regression, association rule mining.
CO4	Apply dimensionality reduction using SVM
CO5	Develop any application using RL

List of the Experiments:

The student shall perform minimum ten experiments of the following using Python

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Generate Bag of word model, ngram model	S1	CO1	02
2	Apply decision tree algorithm for suitable data	S2	CO2	02
3	Apply HMM for suitable data	S2	CO2	02
4	Classify using SVM	S2	CO2	03
5	Classify using ensemble methods	S2	CO2	03
Level: Moderate (all)				
6	Apply EM algorithm for suitable data	S3	CO3	02
7	Apply association rule mining	S3	CO4	02
8	Apply Logistic regression	S2	CO4	02
9	Apply hierarchical clustering to suitable data	S3	CO3	02
Level: Complex (all)				
10	Apply RL to suitable data	S3	CO3	02
11	Generate solution using RL for personal recommendation	S3	CO5	03

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4,CO5
ESE (25 Marks)	02	23

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	02
S2	Manipulation	12
S3	Precision	11
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	3				2	1	2		3	2	1	2
CO2	3	3	1	3				2	1	2		3	2	1	2
CO3	3	3	1	3				2	1	2		3	2	1	2
CO4	3	3	1	3				2	1	2		3	2	1	2
CO5	3	3	1	3				2	1	2		3	2	1	2

3 – High 2 – Medium 1- Low

CSPE3021: Lab Computer Vision

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Demonstrate countour detection
CO2	Implement the segmentation of image
CO3	Develop object detection system
CO4	Develop motion detection system

List of the Experiments:

The student shall perform minimum ten experiments of the following using Matlab/open CV

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implement Contours for boundaries of the shape to detect certain types of shapes.	S1	CO1	02
2	Implement the graph cut segmentation	S2	CO2	02
3	Implement the mean shift segmentation	S2	CO2	02
4	Implement image stitching	S2	CO2	03
5	Implement color detection	S2	CO2	03
Level: Moderate (all)				
6	Implement the 3D object	S3	CO3	02
7	Implement the hand gesture recognition	S3	CO4	02
8	Implement the pattern recognition	S2	CO3	02
9	Implement the vehicle counting	S3	CO4	02
Level: Complex (all)				
10	Implement the object counting	S3	CO3	02
11	Implement human counting	S3	CO3	03

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4
ESE (25 Marks)	02	23

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	End Semester Examination
S1	Imitation	02
S2	Manipulation	12
S3	Precision	11
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes											PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	1		1				1	3		2	1	2	
CO2	3	3	2		1			1	1	3		2	1	2	
CO3	3	2	1		1			1	1	3		3	1	2	
CO4	3	2	1		1			1	1	3		3	1	2	1

3 – High 2 – Medium 1- Low

CSPE3022: Lab Software Testing & Quality Assurance

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Classify the Software Testing Phase in various SDLC
CO2	Compare Manual and Automation testing techniques
CO3	Record Test Cases in various tools & modes
CO4	Test GUI and Bitmap Objects
CO5	Perform Penetration testing

List of the Experiments:

The student shall perform minimum ten experiments of the following.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Examine the role of Software Testing in SDLC with software development models	S1	CO1	05
2	Design and construct the test cases through Manual testing.	S2	CO1, CO2	05
3	Install and Configure the Automation Testing Tool: Selenium	S2	CO2	05
4	Create Test Cases using Bug Zilla and Selenium	S1	CO3	05
5	Examine the WinRunner Testing tool	S2	CO3	05
Level: Moderate				
6	Recording test cases in Context sensitive mode	S2	CO3	05
7	Recording test cases in Analog mode	S2	CO3	05
Level: Complex				
8	Design and construct the test cases through Synchronizing testing	S2	CO4	05
9	Design and construct the test cases for Checking GUI and Bitmap Objects	S3	CO4	05
10	Examine Penetration Testing with the help of Wireshark Tool	S3	CO5	05
11	Examine Penetration Testing with the help of BeEF Tool	S3	CO5	05

Assessment:
ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2
	CO1	CO2,C03, CO4,CO5
ESE (25 Marks)	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1										3					
CO2		2	2							2				1	
CO3		2	2							2					
CO4		3							2						
CO5		3	3		1				2	2			3		

3 – High 2 – Medium 1- Low

CSPR3023: Mini Project

Teaching Scheme		Examination Scheme	
Practical	**4Hrs/Week**	**ISE- III (Term Work)**	**25 Marks**
Total Credits	**2**	**ESE**	**25 Marks**

Course Description: A mini project is an assignment that you try to complete at the end of every semester, especially in engineering to strengthen the understanding of your fundamentals through effective application of theoretical concepts.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Identify area of interest / problem domain. .
CO2	Collect related latest standard research papers and analyze them
CO3	Apply & use required Toolbox/algorithms.
CO4	Apply the functions to solve problem / implement algorithm.
CO5	Develop solution and test it.

This project should develop on one the following technology which is not limited to :-.

I. Cloud Computing
II. Android Based Application
III. Computer Vision System
IV. Image Processing
V. Neural Network
VI. Bioinformatics
VII. Data Analytics
VIII. Natural Language processing
IX. Soft Computing
X. Big data

Assessment:

ISE I and ESE : In semester evaluations 25 marks, each will be based on evaluation of algorithms & tools or tool box with the group of 3 to 4 students. Final submission will be based on their project evaluation with Output.

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	5	5
S2	Manipulation	5	5
S3	Precision	5	5
S4	Articulation	5	5
S5	Naturalization	5	5
Total		25	25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		3		2		1		3	3	3
CO2	2	2		3		2		1		3	3	3
CO3	2	2		3		2		2		3	3	3
CO4	2	2		3		2		2		3	3	3
CO5	2	2		3		2		2			3	3

3 – High 2 – Medium 1- Low

Semester VII

CSPC4001: Artificial Intelligence

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Prerequisites: Nil

Course Description: To acquaint students with the meaning, purpose, scope, stages, applications, and effects of AI. To share the basic tasks and algorithms in Machine Learning .To provide understanding of how system learns in supervised learning

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management
CO2	Interpret the modern view of AI as the study of agents that receive percept from the environment and perform actions.
CO3	Build awareness of AI facing major challenges and the complexity of typical problems within the field.
CO4	Assess critically the techniques presented and apply them to real world problems.
CO5	Develop self-learning and research skills to tackle a topic of interest on his/her own or as part of a team.

Detailed Syllabus:

Unit 1	**Artificial Intelligence**: Introduction, Typical Applications. State Space Search: Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search: Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent, Beam Search, Tabu Search. Optimal Search: A * algorithm, Iterative Deepening A* , Recursive Best First Search, Pruning the CLOSED and OPEN Lists.
Unit 2	**Problem Decomposition**: Goal Trees, Rule Based Systems, Rule Based Expert Systems. Planning: STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework For Planning. Constraint Satisfaction : N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies.
Unit 3	**Knowledge Based Reasoning**: Agents, Facets of Knowledge. Logic and Inferences: Formal Logic, Propositional and First Order Logic, Resolution in Propositional and First Order Logic, Deductive Retrieval, Backward Chaining, Second order Logic. Knowledge

	Representation: Conceptual Dependency, Frames, Semantic nets.
Unit 4	**Adversarial Search**: Games, Optimal Decisions in Games, The minimax algorithm, Optimal decisions in multiplayer games, Alpha-- Beta Pruning, Move ordering , Imperfect Real-Time Decisions, Evaluation functions, Cutting off search, Forward pruning, Search versus lookup, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Variations on the CSP formalism, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, Alpha-beta pruning and CSP, Implementation aspects of minimax algorithm and CSP.
Unit 5	**Natural Language Processi**ng: Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning: Supervised, Unsupervised and Reinforcement learning. Artificial Neural Networks (ANNs): Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine

Text Books and References Books

1. John Paul Mueller, Luca Massaron**, "***Artificial Intelligence For Dummies second edition*", For Dummies
2. Peter Norvig and Stuart Russel, " *Artificial Intelligence- A modern approach-3rd edition*", Pearson Publication.

Web Source:- https://nptel.ac.in/courses/106102220

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3											1	3		
CO2	1														
CO3	2	2	1										2		
CO4	3	1	2		1				2	1			1	1	1
CO5	3	1			1				1	1		1	1	1	1

3 - High 2 – Medium1 –Low

Assessment:
ISE I and ISE II: In semester evaluations (ISEI and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	00	00	00	10
K2	Understand	10	10	05	20
K3	Apply	05	05	05	30
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4002: Blockchain Technology

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Course Description: Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. Virtually anything of value can be tracked and traded on a blockchain network, reducing risk and cutting costs for all involved. Business runs on information. The faster it's received and the more accurate it is, the better. This course gives introduction about blockchain and how blockchain works, what are its uses etc.

Course Outcomes:

After successful completion the course, students will be able to:

Course Outcomes	
CO1	To incorporate the models of Blockchain- Ethereum.
CO2	To learn the models of Hyperledger Fabric.
CO3	To teach the concepts of Blockchain technologies
CO4	The primary objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus
CO5	To familiarize potential applications for Bit coin-like crypto currencies The course will enable an individual to learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies

Detailed Syllabus:

Unit 1	**INTRODUCTION:** Basic Cryptographic primitives used in Blockchain –Secure-CollisionResistant hash functions - Digital signature - Public key cryptosystems - Zeroknowledge proof systems - Need for Distributed Record Keeping - Modelling faults and adversaries- Byzantine Generals problem - Consensus algorithms and their scalability problems -Why Nakamoto Came up with Blockchain based cryptocurrency.
Unit 2	**BITCOIN:** Bitcoin -Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.
Unit 3	**MODELS FOR BLOCKCHAIN:** Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW + PoS) - Bitcoin scripting language and their use.

Unit 4	**ETHEREUM:** Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts.
Unit 5	**BLOCK CHAIN-RECENT TREND:** Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms.

Text and Reference Books:

1. Melanie Swan, "*Block Chain: Blueprint for a New Economy*", O"Reilly, first edition – 2015.
2. Daniel Drescher, "*Block Chain Basics*", Apress; 1stedition, 2017
3. Anshul Kaushik, "*Block Chain and Crypto Currencies*", Khanna Publishing House, Delhi.
4. Imran Bashir, "*Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained*", Packt Publishing, first edition – 2012.
5. Ritesh Modi, "*Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain*", Packt Publishing.
6. Joseph Bonneau et al, SoK: "*Research perspectives and challenges for Bitcoin and cryptocurrency*", IEEE Symposium on security and Privacy, 2015.
7. J.A.Garay et al, "*The bitcoin backbone protocol - analysis and applications*", EUROCRYPT 2015,Volume 2.
8. R.Pass et al, "*Analysis of Blockchain protocol in Asynchronous networks*", EUROCRYPT 2017.

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2								2				
CO2	1	1	2								2				
CO3	3	2	3	3										2	
CO4	3	2	3											1	
CO5	3	2	3	2				2			2		3	1	

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer

4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3,K4,K5
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4003: Neural Network

Teaching Scheme			Evaluation Scheme	
Lectures	**3 Hrs/Week**		**ISE I**	**15 Marks**
Tutorial	**0**		**ISE II**	**15 Marks**
			ISE III	**10 Marks**
Total Credits	**3**		**ESE**	**60 Marks**

Course Description: The course introduces the basic concepts and models of ANN for solving simple pattern recognition problems.

	Course Outcomes
CO1	Define what is Neural Network and model a Neuron
CO2	Analyze NN learning, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning and Boltzmann learning
CO3	Implement Simple perception, Perception learning algorithm, Modified Perception learning algorithm, and Adaptive linear combiner, Continuous perception, learning in continuous perception.
CO4	Explore the parameters for neural network.
CO5	Explore opportunities in NN applications & research area related with it.

Detailed Syllabus:

Unit 1	**Neural Networks:** History, Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation.
Unit 2	**Neural Network Structures Introduction:** Network Architecture, Threshold Logic Units (TLU) , Decision Surface.
Unit 3	**Updating Weights in Simplest Neural Network:** Simple Error Analysis Working with 1 Attributes Small Steps Extending Simplest Neural Network to Multiple Inputs Extending to Multiple Outputs Combining Multiple Input and Outputs.
Unit 4	**Recurrent networks, Modeling sequences:** A brief overview, Training RN with back propagation. A toy example of training an RNN, Why it is difficult to train an RNN?, Long short term memory, Echo state networks, Hessian free optimization, Learning to predict the next character.
Unit 5	Probabilistic neural bets, Boltzmann machines, RBMs, sigmoid belief, Generative models.

Text and Reference Books:

1. Martin T. Hagan, Howard B. Demuth, Mark H. Beale, *Neural Network Design*,
2. James A. Anderson, *An Introduction to Neural Networks*, MIT Press.

Web Resources:

1. NPTEL : https://nptel.ac.in/courses/117105084
2. NPTEL : https://archive.nptel.ac.in/courses/117/105/117105084/

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3											1	3		
CO2	1														
CO3	2	2	1										2		
CO4	3	1	2		1				2	1			1	1	
CO5	3	1			1				1	1		1	1	1	1

3 - High 2 – Medium1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISEI and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.
ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	10	05	20
K3	Apply	05	05	05	30
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4004: Cryptography and Network Security

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: None

Course Description: This course will introduce the concepts of Cryptography and Network Security. The course begins with basic cryptographic algorithms and extends to the advance ones. Several standards and frameworks like Kerberos, X.509 etc are included. Some aspects of firewalls, intrusion detection and cloud security are also a part of this course.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	To provide introduction to the concept of Network Security Model and Cryptography systems.
CO2	To give the knowledge of Digital Signature and other Security Measures available.
CO3	To familiarize with the various techniques like PGP and S/MIME.
CO4	To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
CO5	To explain the firewall design principles and various intrusion detection system.

Detailed Syllabus:

Unit 1	**Overview:** Computer Security Concepts, Security Attacks, Security Services, Security Mechanism, A Model for Network Security, Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Ciphers and the Data Encryption, Euclid's Algorithm, Placement of Encryption Function, Traffic Confidentiality, key distribution.
Unit 2	**Public Key Crypto System and RSA:** Prime Numbers, Fermat's and Euler's Theorems, Principles of Public-Key Cryptography, the RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Cryptographic Hash Function: Applications, Requirements & Security, SHA-3, Authentication Requirements, Authentication Functions. Introduction to Elliptic curve cryptography
Unit 3	Digital Signatures, Digital Signature Standards. Authentication Application & Electronic Mail Security: Kerberos, X.509 Authentication Service, Pretty Good Privacy, S/MIME.
Unit 4	IP Security and Web Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Transport Level Security, Wireless Network Security

Unit 5	System Security: Intruders, Intrusion Detection, Firewalls, Cloud Security: Threats, Cloud Security Controls, Mobile Security: Challenges, Attacks based on Communication, vulnerabilities in Software application, Countermeasures

Text and Reference Books:

1. William Stallings, "*Cryptography and Network Security: Principals & Practice*", Pearson Education
2. Atul kahate , "*Cryptography and Network Security"*, Mc Graw Hill Education.

Web Resources:

NPTEL course : Cryptography and network security(IITK): Cryptography and Network Security - Course (nptel.ac.in)

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2								2				
CO2	1	1	2								2				
CO3	3	2	3	3										2	
CO4	3	2	3												
CO5	3	2	3	2				2			2		3		

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.
ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	05	05	00	10
K3	Apply	05	05	00	10
K4	Analyze	00	05	05	10

K5	Evaluate	00	00	00	20
K6	Create	00	00	05	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1,CO2	CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	20	40
Total Marks 100		

Special Instructions if any: Nil

CSPE4005 : Data Analytics

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Nil

Course Description: Identify and explain fundamental ingredients that constitute a recommendation engine. Describe what data science is and the skill sets needed to be a data scientist.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Describe the data science process and how its components interact
CO2	Use API's And other tools to scrap the web and Collect data.
CO3	Build Your Own Recommendation system using existing Components
CO4	Work effectively in teams of data science projects.
CO5	Reason around ethical and privacy issues in data science conduct and apply ethical practices

Detailed Syllabus:

Unit 1	Introduction to data science Big Data and Data science Hype, Datafication, The emergence of data lakes, Introduce the federation business data lakes, data lake ingests ,stores and processes data
Unit 2	Recommendation systems Algorithmic ingredients of a recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Building your own recommendation systems.
Unit 3	Mining Social Network Graphs: Social Networks as graphs, clustering of graphs, direct discovery of communities in graphs, partitioning of graphs, neighborhood properties in graphs.
Unit 4	Data Science and Ethical Issues Discussions on privacy, security and ethics
Unit 5	Data Wrangling and Forecasting Web Scraping and API's , Compare various types of time-series components, Discuss Time Series, Forecasting methods(ARIMA model),Evaluation Criteria of Forecasting Model

Text and Reference Books:

1.David Dietrich, Barry Hiller, "*Data Science and Big Data Analytics*", EMC education services, Wiley, publications, 2012, ISBN0-07-120413-X

2. Ashutosh Nandeshwar , "*Tableau Data Visualization Codebook*", Packt Publishing, ISBN 978-1-84968-978-6

3. Maheshwari Anil, Rakshit, Acharya, "*Data Analytics*", McGraw Hill, ISBN: 789353160258.

4. Mark Gardner, "*Beginning R: The Statistical Programming Language*", Wrox Publication, ISBN: 978-1-118-16430-3

3. Luís Torgo, "*Data Mining with R, Learning with Case Studies*", CRC Press, Talay and Francis Group, ISBN9781482234893

4. Carlo Vercellis, "*Business Intelligence - Data Mining and Optimization for Decision Making*", Wiley, Publications, ISBN: 978047075386

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3											1	3		
CO2	1														
CO3	2	2	1										2		
CO4	3	1	2		1				2	1			1	1	
CO5	3	1			1				1	1		1	1	1	

3 - High 2 – Medium1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISEI and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	10	05	20

K3	Apply	05	05	05	30
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3**
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4006: Internet of Things

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Course Outcomes:

After successful completion the course, students will be able to:

Course Outcomes	
CO1	Understand the applications of IOT
CO2	Describe the working of different sensors & circuit modules.
CO3	Demonstrate working of different types of connectivity.
CO4	Illustrate Feature of different microcontrollers.
CO5	Discuss different case studies related to IOT eg. AWS smart city

Detailed Syllabus:

Unit 1	**IOT-MOTIVATION AND APPLICATIONS**: Importance of IoT. Motivating Applications of IoT: Smart Cities- Smart Waste Management, Smart Street Lights, Smart Street Parking, Security without Surveillance, Connected Vehicles. Healthcare- Baby Monitoring, Elderly Monitoring, Mood Enhancing, Disease Treatment and Progression Monitoring, Enhance Adherence, Challenges. Agriculture- Precision Agriculture, Connected Livestock, Food Safety. Manufacturing and Logistics- Smart Manufacturing- Smart Packaging, Smart Label. Smart Electricity Grid- Managing Supply and Demand. Home Automation.
Unit 2	**SENSORS and CIRCUITS:** Sensor – Introduction, Terminology, Behaviour, Selection, Circuits – Overview and Applications, Battery Issue and Energy Management, Wireless Link, Digital and Analog – Digital Computing, Analog to Digital Interfaces
Unit 3	**Embedded Systems, Connectivity and Networking:** Embedded Systems – Overview, Technology Drivers, Energy, Microcontrollers, Software Connectivity and Networking – Introduction, Connectivity Challenges in IoT, Energy Harvesting Transmitters, Massive Multiple Access, Computation vs Communication.
Unit 4	**BUILDING IoT WITH RASPBERRY PI & ARDUINO:** Building IOT with RASPERRY PI- IoT Architectures – embedded System, Gateway and Cloud (MGC) Architecture and other reference models and architectures. IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.
Unit 5	**CASE STUDIES AND REAL-WORLD APPLICATIONS:** Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models &

	Communication APIs - Cloud for IoT - Amazon Web Services for IoT. **TECHNOLOGY CHALLENGES** Security, Connectivity, Compatibility and Longevity, Standards, Intelligent Analysis and Actions Business Challenges – Consumer IoT, Commercial IoT, Industrial IoT Society Challenges – Privacy, Regulatory Standards.

Text and Reference Books:

1. Pethuru Raj and Anupama C. Raman , "*The Internet of Things: Enabling Technologies, Platforms, and Use Cases*", (CRC Press)
2. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things*", John Wiley & Sons Ltd., UK, 2014.
3. ArshdeepBahga and Vijay Madisetti , "*Internet of Things: A Hands-on Approach*", (Universities Press)
4. David Boswarthick, Omar Elloumi and OlivierHersent, "*M2M Communications: A Systems Approach*", John Wiley & Sons Ltd, UK, 2012.
5. Dieter Uckelmann, Mark Harrison and Florian Michahelles, "*Architecting the Internet of Things*", Springer, NewYork, 2011.

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1							1							
CO2		2	3					1						1	
CO3		2	3					2					1	1	
CO4	2	2	3					2	3			3	1	1	
CO5		2	3					2	3			3	1		

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	10
K2	Understand	10	05	02	15

K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,K5**
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4007: Natural Language Processing

Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	ESE	**60 Marks**

Prerequisites: Compiler Design

Course Description: This course teaches the students the leading trends and systems in natural language processing & make them understand the concepts of morphology, syntax, semantics and pragmatics of the language . It also describes the application based on natural language processing and to show the points of syntactic, semantic processing.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Describe the mathematical and linguistic foundations underlying approaches to the areas in NLP. (Measured by problem sets and quizzes).
CO2	Design, implement and test algorithms for NLP problems (measured by problem sets).
CO3	Apply basic algorithms in the field, Morphology syntax semantics and pragmatics as well as the resources of natural language data corpora.
CO4	Grape basics of knowledge representations, inference and relations to the artificial intelligence
CO5	Find opportunities for research and prepare to conduct research in NLP or related fields.

Detailed Syllabus:

Unit 1	Motivation for studying NLP; Natural Language Processing as the forcing function of AI; Classical approaches to NLP with knowledge bases and linguistic rules; Data Driven and Machine Learning Approaches to NLP; Efficient, Robust and Scalable NLP
Unit 2	Classical NLP: Linguistics Fundamentals: Syntax and Parsing, Morphological analysis, Text and speech processing.
Unit 3	Empirical or Statistical NLP: Probabilistic Methods on Introductory Graphical Models for NLP: Shallow Parsing: Probabilistic Parsing
Unit 4	Applications: Machine Translation, Information Retrieval, Question Answering, Summarization, Information Extraction
Unit 5	Biology and Sociology of NLP: Neuro-linguistics, Child Language Acquisition

Text and Reference Books:

1. Jurafsky, Daniel, and James H. Martin, *Speech and Language Processing:An Introduction to Natural Language Processing, Speech Recognition,and Computational Linguistics*, PrenticeHall, 2000.
2. Christopher D. Manning and Hinrich Schütze, *Foundations of Statistical Natural Language Processing. Cambridge*, MIT Press, 1999.
3.James Allen, *Natural Language Understanding*, Benjamin/Cummings, 2ed, 1995.
4. Eugene Charniak, *Statistical Language Learning*, MIT Press, 1996.
5. P. Lieberman, *Toward an evolutionary biology of language*,
Harvard university Press, 2006.

Web Resources:
NPTEL course : IIT Kharagpur:- https://nptel.ac.in/courses/106105158.

IIT Madras :- https://nptel.ac.in/courses/106106211

IIT Bombay:- https://nptel.ac.in/courses/106101007

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2												1	1	
CO2	2									2			1	1	
CO3	3	3								2		2	1	1	1
CO4	3	3								2		2	1	1	1
CO5	3	3								2		2	1	1	1

3 - High 2 – Medium 1 –Low

Assessment:
ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

5) Quiz
6) Assignments
7) Class room Question & answer
8) Power point presentation of Topic which is related but out of syllabus
5) Overall approach towards learning, creativity.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination

K1	Remember	05	00	02	10
K2	Understand	05	05	02	20
K3	Apply	05	05	03	20
K4	Analyze	00	05	03	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4**
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4008: Deep Learning

Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	ESE	**60 Marks**

Prerequisites: Artificial Intelligence, Machine Learning

Course description: This course is focusing on the basics of Deep Learning concept to the implementation level of Deep Learning Algorithms**.**

Course Outcomes:
After completing the course, students will able to:

	Course Outcomes
CO1	Comprehend the basic concept Deep Learning and get the exposure to use of mathematical concept in deep learning models.
CO2	Will acquire the knowledge about learning model algorithms, cognize the application of deep learning algorithms.
CO3	Will be able to implement the Deep Learning Network.
CO4	Will be able to optimize the training model in Deep Learning Network.
CO5	Implement the solution for deep learning application.

Detailed Syllabus:

Unit 1	Introduction to Deep Learning, Linear Algebra: Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Eigendecomposition, Singular Value Decomposition, Principal Components Analysis. Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, The Chain Rule of Conditional Probabilities, Independence and Conditional Independence, Expectation, Variance and Covariance, Useful Properties of Common Functions, Bayes' Rule.
Unit 2	Numerical Computation: Overflow and Underflow, Poor Conditioning, Gradient-Based Optimization, Constrained Optimization, Example: Linear Least Squares. Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Challenges Motivating Deep Learning.
Unit 3	Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Regularization for Deep Learning: Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent

	Classifier.
Unit 4	Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms. Convolutional Networks: The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning.
Unit 5	Sequence Modeling: Recurrent and Recursive Nets, Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies. Applications: Large Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Text and Reference Books

1. Ian Goodfelllow, Yoshua Benjio, Aaron Courville , *Deep Learning-*, The MIT Press
2. Richard O. Duda, Peter E. Hart, David G. Stork *Pattern Classification-*, John Wiley & Sons Inc.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 - Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1) Quiz
2) Assignments
3) Question and answer
4) PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	02	10
K2	Understand	10	05	02	15
K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K1, K2	K3,K4,K5
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	25	35
Total Marks 100		

Special Instructions if any:

CSPE4009: Design of Linux OS

Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	ESE	**60 Marks**

Course description: This course covers design principles of Linux Operating System, algorithms for process management, memory management. Structure of File system and virtual file system is also elaborated. This course contains details of shell programming and introduces system administration.

Course Outcomes:

After successful completion the course, students will be able to:

	Course Outcomes
CO1	Classify Linux Kernel mode with user mode & contrast between Kernel structures. (K3) (Process creation) (K2)
CO2	Identify and estimate process management & thread management strategies along with their different operations
CO3	Implement different system calls for various file handling operations. (K2)
CO4	Determine paging and Caching techniques related to Virtual Memory. (k2,K4)
CO5	Construct shell scripts. (k3,k6)

Detailed Syllabus:

Unit 1	**Introduction to Linux operating and Kernel:-** Overview of operating system and kernel, Features of linux, Linux Distributions ,Obtaining the Kernel source ,Building & configuring the kernel, Types of kernels , Kernel modules, Design principles of Linux system.
Unit 2	**Process Management :-**Process management: The Process Descriptor and task structure, Process creation, , process termination.Thread definition, Motivation for Threads,Thread States: Life Cycle of a,Thread,Thread Operations Threading Models -User-Level Threads *Kernel-Level Threads.Process scheduling-Policy,* preemption and context switching
Unit 3	**Filesystem and system calls:** Inodes, directories, . System calls & their implementation: Open, create, read, write, fseek, pipe, dup, chair, chown, change, mode, state & stat etc
Unit 4	**Memory Management & I/O:-**Pages, Zones, Slab layer and Slab allocator interface, Virtual file system, Ext2 filesystem ,Ext3 filesystem **,** Device drivers **,**Anatomy of block device,Character device ,Network Device , I/O scheduler.

Unit 5	**Shell Programming and System Administration:** Writing simple shell scripts , command line arguments, if then else, case, do while, for loop, until loop, operators, advanced shell programming, requirements of system administration. Case study of R programming with linux

Text and Reference Books:

1. Maurice Bach , "*The Design of Unix Operating System*", Pearson Education
2. Robert Love, "*Linux Kernel Development* ", Person Education
3. Harvey M. Deitel, "*Operating Systems*", Prentice Hall, 3rd Edition,2003, ISBN-10: 0131828
4. Abraham Silberschatz ,Peter Baer Galvin Greg Gagne , "*Operating System Concepts*", 7th edition
5. Maurice J. Bach, *The Design Of The Unix Operating System*, AT & T labs

Web Resources:

1. https://linuxconfig.org/running-gnu-r-on-linux-operating-system

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3	3						3				2	1	
CO2		3	3										2	1	
CO3		2											2	1	
CO4		2							3				2	1	
CO5		2	3						2		1	2	1	1	1

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Class room Question & answer
4. Power point presentation of Topic which is related but out of syllabus
5. Overall approach towards learning, creativity.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	05	02	10
K2	Understand	05	05	02	10
K3	Apply	03	03	02	20

K4	Analyze	02	02	02	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	02	10
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,k6**
	CO1	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	10	05
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	30	30
Total Marks 100		

Special Instructions if any: Nil

CSPE4010: Information Retrieval

Teaching Scheme		Examination Scheme	
Lectures	**3Hrs/Week**	**ISE- I**	**15 Marks**
Tutorial	**0**	**ISE-II**	**15 Marks**
Total Credits	**03**	**ISE- III**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Mathematics, Programming language.

Course Description: This is an introductory course for students covering the practices, issues, and theoretical foundations of organizing and analyzing information and information content for the purpose of providing intellectual access to textual and non-textual information resources. This course will introduce students to the principles of information retrieval systems and models, query expansion, queries, web crawling, taxonomy and ontology. Students will learn how effective information search and retrieval is interrelated with the organization and description of information to be retrieved. Students will also learn to use a set of tools and procedures for organizing information, will become familiar with the techniques involved in conducting effective searches.

Course Outcomes:
After successful completion the course, students will be able to:

Course Outcomes	
CO1	Understand the Information retrieval models.
CO2	Illustrate the different query properties.
CO3	Determine retrieval metric by various methods.
CO4	Compare different search engine ranking techniques
CO5	Describe different ontology and taxonomy architectures and processes.

Detailed Syllabus:

Unit 1	I**ntroduction:** Information Retrieval Early Developments, Information Retrieval in Libraries and Digital Libraries, IR at the Center of the Stage, The IR Problem, The IR System, The Web **Modeling:** IR Models, Classic Information Retrieval, Other Models
Unit 2	**Queries: Languages and Properties** Query Languages, Keyword-Based Querying, Beyond Keywords, Structural Queries, Query Protocols Query Properties, Characterizing Web Queries, User Search Behavior, Query Intent Query Topic, Query Sessions and Missions, Query Difficulty
Unit 3	**Retrieval Evaluation and Query Expansion:** Introduction, Retrieval Metrics, Implicit Feedback Through Global Analysis, Query Expansion based on a Similarity Thesaurus, Query Expansion based on a Statistical Thesaurus
Unit 4	**Web Retrieval and Web Crawling** Introduction, The Web, Search Engine Architectures, Search Engine Ranking,

	Managing Web Data, Search Engine User Interaction, Browsing, Beyond Browsing, Web Crawling
Unit 5	**Taxonomy and Ontology:** Creating domain specific ontology, Ontology life cycle Distributed and Parallel IR: Relationships between documents, Identify appropriate networked collections, Multiple distributed collections simultaneously, Parallel IR - MIMD Architectures, Distributed IR – Collection Partitioning, Source Selection, Query Processing

Text and Reference Books:

1. Ricardo Baeza-Yates ,Berthier Ribeiro-Neto *Modern Information Retrieval, The Concepts and Technology behind Search Second edition* Addison Wesley Publication
2. Butcher, larke, Cormak *Information Retrieval : Implementing and Evaluating Search Engines*
3. William Frakes, *Information Retrieval : Data Structures and Algorithms*
4. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze. *Introduction to Information Retrieval*, Cambridge university press. 2008

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3						2					1		
CO2	2	3						3		2			1		
CO3	2	3						3		2			1	1	2
CO4	2	3			1			3	1	2			1	1	2
CO5	1	3			1			2	1	2		2	1	1	2

3 - High 2 – Medium 1 –Low

Assessment:

ISE I and ISE II: In semester evaluations (ISE I and ISEI II) of 15 marks, each will be based on Class Test I and Class Test II respectively.

ISE III: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following:

1. Quiz
2. Assignments
3. Question and answer
4. PowerPoint presentation

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	02	10
K2	Understand	10	05	02	15

K3	Apply	05	05	02	15
K4	Analyze	00	05	02	15
K5	Evaluate	00	00	02	05
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1, K2**	**K3,K4,K5**
	CO1,CO2	CO2,CO3, CO4,CO5
ISE I (15 Marks)	10	05
ISE II (15 Marks)	00	15
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	25	35
Total Marks 100		

Special Instructions if any: Nil

CSPC4011: Lab Artificial Intelligence

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Identify and apply suitable Intelligent agents for various AI applications
CO2	Design smart system using different informed search / uninformed search or heuristic approaches.
CO3	Design knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem
CO4	Apply the suitable algorithms to solve AI problems
CO5	Design and provide best solution to AI problems by measuring the performance of different algorithms and comparing them.

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implement Tic-Tac-Toe using A* algorithm .	S1	CO1	05
2	Implement 3 missionaries and 3 cannibals problem depicting appropriate graph. Use A* algorithm.	S2	CO1,CO2	05
3	Solve 8-puzzle problem using A* algorithm. Assume any initial configuration and define goal configuration clearly	S2	CO2	05
Level: Moderate (any three)				
4	Implement any one of the following Expert System , Medical Diagnosis of 10 diseases based on adequate symptoms. Identifying birds of India based on characteristics	S2	CO1, CO2	05
5	Implement alpha-beta pruning graphically with proper example and justify the pruning.	S2	CO1, CO2	05
6	Develop elementary chatbot for suggesting investment as per the customers need.	S2	CO2	06
Level: Complex (any two)				
7	Implement goal stack planning for the following configurations from the blocks world.	S2	CO2	05
8	Use Heuristic Search Techniques to Implement Hill-Climbing Algorithm.	S2	CO2	05

9	Use Heuristic Search Techniques to Implement Best first search (Best-Solution but not always optimal) and A* algorithm (Always gives optimal solution).	S2	CO4	05
10	Constraint Satisfaction Problem: Implement crypt-arithmetic problem or n-queens or graph coloring problem (Branch and Bound and Backtracking)	S2	CO4	05
11	Implement syntax analysis for the assertive English statements. The stages to be executed are, • Sentence segmentation • Word tokenization • Part-of-speech/morpho syntactic tagging • Syntactic parsing (Use any of the parser like stanford)	S2	CO5	05

Assessment:
ISEI: In-Semester Evaluation of 50 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2
	CO1	CO2,C03, CO4
ESE (25Marks)	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3		1		2				1						
CO2	3	2	2		2				1			1	1		
CO3	3	1	1		2				1			1		1	
CO4	3	1	1		2				1			1	1	1	

3 – High 2 – Medium 1- Low

CSPE4012: Lab Blockchain Technology

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**ESE**	**25 Marks**

Minimum of 8 Programs should be completed which will be based on the subject and record for the same shall be submitted. Topic can be Block chain technologies Blockchain- Ethereum Hyperledger Fabric,cryptocurrencies etc

CSPE4013: Lab Neural Network

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Generate bag of word model
CO2	Apply classification algorithms like EM , HMM to suitable data.
CO3	Demonstrate logistic regression, association rule mining.
CO4	Apply dimensionality reduction using SVM
CO5	Develop any application using RL

List of the Experiments:

The student shall perform minimum 8 experiments of the following using NLP tools & algorithms

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level -all				
1.	Parallel and distributed processing-I: Interactive activation and competition models.	SO1	CO1	4
2.	Parallel and distributed processing-II: Constraint satisfaction neural network models.	SO1	CO1	4
3.	Perceptron learning	SO2	CO2	4
4.	Multilayer feed forward neural network	SO2	CO2	4
5.	Hop field model for pattern storage task.	SO3	CO3	5

6.	Hop field model with stochastic update	SO3	CO3	6
7.	Competitive learning neural networks for pattern clustering	SO3	CO3	5
8.	Solution to travelling salesman problem using self organizing maps.	SO3	CO5	6
9.	Solution to optimize problems using Hopfield models	SO3	CO5	6
10.	Weighted matching problem: Deterministic, stochastic and mean-field annealing of a Hopfield model.	SO3	CO4	6

Assessment:

ISEI: In-Semester Evaluation of 25 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2, S3
	CO1	CO2,C03, CO4,CO5
ESE (25 Marks)	02	23

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	02
S2	Manipulation	12
S3	Precision	11
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	3				2	1	2		3	2	1	2
CO2	3	3	1	3				2	1	2		3	2	1	2
CO3	3	3	1	3				2	1	2		3	2	1	2
CO4	3	3	1	3				2	1	2		3	2	1	2
CO5	3	3	1	3				2	1	2		3	2	1	2

3 – High 2 – Medium 1- Low

CSPE4014: Lab Cryptography and Network Security

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**End Semester Exam**	**25 Marks**

Course Outcomes:
After completion of this course students will be able to:

	Course Outcomes
CO1	Identify Vulnerabilities in a Network
CO2	Solve Problems using various Algorithms
CO3	Identify Various Attacks and Formulate Defense Mechanism
CO4	Understand Wireless Security
CO5	Understand Web Security for email transfers

List of the Experiments:
The student shall perform minimum ten experiments of the following using Oracle databases.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	1. Network/Vulnerability scanner (case study: nmap and nessus)	S1	CO1	04
2	2. Write a program to implement Caesar Cipher and play fair cipher Algorithms	S2	CO2	04
3	3. Programs on RSA and Diffie Hellman algorithms	S2	CO2	04
4	DoS and other Network Attacks	S1	CO3	04
5	Implement Hill cipher Encryption technique	S2	CO2	04
Level: Moderate				
6	Firewalls - Case Study	S2	CO3, CO4	05
7	Wireless network security – Case Study	S2	CO4	05
Level: Complex				

8	Packet Sniffers: Tcpdump, Ettercap, Dsniff	S2	CO4	05
9	Intrusion Detection/Prevention Systems (case study: snort IDS)	S2	CO4	05
10	Using PGP Mail freeware to encrypt and sign email messages and individual files	S2	CO5	04

Assessment:
ISEI: In-Semester Evaluation of 50 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2
	CO1	CO2,C03, CO4,CO5
ESE (25 Marks)	10	15

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**End Semester Examination**
S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1									3					
CO2	2									2				1	
CO3	2									2				1	
CO4	2								2	2		1		1	1
CO5	2	1	1	1	1			2	3	2	3	1	3	1	1

3 – High 2 – Medium 1- Low

CSPE4015: Lab Data Analytics

Teaching Scheme		Examination Scheme	
Practical	**2Hrs/Week**	**ISE III**	**25 Marks**
Total Credits	**01**	**End Semester Exam**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Use Python and other tools to scrape, clean, and process data
CO2	Use data management techniques to store data locally and in cloud infrastructures
CO3	Use statistical methods and visualization to quickly explore data

List of the Experiments: From any of the following Domains Health Care, Finance, It for Analytics, Marketing Analytics & Decision & Operations Analytics.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
	Level: Basic (all)			
1	Download the Iris flower dataset or any other dataset into a DataFrame. (eg https://archive.ics.uci.edu/ml/datasets/Iris) Use Python/R and Perform following – • How many features are there and what are their types (e.g., numeric, nominal)? • Compute and display summary statistics for each feature available in the dataset. (eg. minimum value, maximum value, mean, range, standard deviation, variance and percentiles • Data Visualization-Create a histogram for each feature in the dataset to illustrate the feature distributions. Plot each histogram. • Create a boxplot for each feature in the dataset. All of the boxplots should be combined into a single plot. Compare distributions and identify outliers	S1	CO1	05
2	Download Pima Indians Diabetes dataset. Use Naive Bayes‟ Algorithm for classification. • Load the data from CSV file and split it into training and test datasets. • summarize the properties in the training dataset so that we can calculate robabilities and make predictions. • Classify samples from a test dataset and a summarized training dataset.	S2	CO1,CO2	05
3	Write a Hadoop program that counts the number of occurrences of each word in a text file.	S2	CO2	05

Level: Moderate (any three)				
4	Write a program that interacts with the weather database. Find the day and the station with the maximum snowfall in 2013.	S2	CO1, CO2	05
5	Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.	S2	CO1, CO2	05
6	Trip History Analysis: Use trip history dataset that is from a bike sharing service in the United States. The data is provided quarter-wise from 2010 (Q4) onwards. Each file has 7 columns. Predict the class of user. Sample Test data set available here https://www.capitalbikeshare.com/trip-history-dat	S2	CO2	06
Level: Complex (any two)				
7	Bigmart Sales Analysis: For data comprising of transaction records of a sales store. The data has 8523 rows of 12 variables. Predict the sales of a store. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problem-big-mart-sales-iii/	S2	CO2	05
8	Twitter Data Analysis: Use Twitter data for sentiment analysis. The dataset is 3MB in size and has 31,962 tweets. Identify the tweets which are hate tweets and which are not. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtwitter-sentiment-ana	S2	CO2	05
9	Time Series Analysis: Use time series and forecast traffic on a mode of transportation. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtime-series-2/	S2	CO3	05

Assessment:
ISEI: In-Semester Evaluation of 50 marks based on performance of students in practical hours, practical assignments completed, and timely submission.

Assessment Table:

Assessment Tool	S1	S2
	CO1	CO2,C03,
ESE (25Marks)	10	15

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	End Semester Examination
S1	Imitation	02
S2	Manipulation	12
S3	Precision	11
S4	Articulation	00
S5	Naturalization	00
Total Marks		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3		1		2				1	1		1	2		
CO2	3	2	2		2				1	1		1	2	2	1
CO3	3	1	1		2				1	2		2	2	2	1
CO4	3	1	1		2				1	2		2	1	2	1

3 – High 2 – Medium 1- Low

CSPE4016: Lab Internet Of Things

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Demonstrate use of Arduino
CO2	Demonstrate use of Raspberry Pi.
CO3	Performance of task based on Arduino
CO4	Implementing programs using of Raspberry Pi.

List of the Experiments:

The student shall perform minimum 8 experiments of the following using Arduino.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level -all				
1.	Sense the Available Networks Using Arduino.	SO1	CO1	4
2.	Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino.	SO1	CO1	4
3.	Detect the Vibration of an Object Using Arduino.	SO2	CO2	4
4.	Connect with the Available Wi-Fi Using Arduino.	SO2	CO2	4
5.	Sense a Finger When it is Placed on Board Using Arduino.	SO3	CO3	4
6.	Temperature Notification Using Arduino.	SO3	CO3	6
7.	LDR to Vary the Light Intensity of LED Using Arduino.	SO3	CO3	6
8.	MySQL Database Installation in Raspberry Pi.	SO4	CO4	6
9.	SQL Queries by Fetching Data from Database in Raspberry Pi.	SO4	CO4	6
10.	Switch Light On and Off Based on the Input of User Using Raspberry Pi.	SO4	CO4	6

Assessment:

ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.

End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S4
	CO1	CO2	CO3	CO4
ESE	07	07	06	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**End Semester Examination**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

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

3 – High 2 – Medium 1- Low

CSPE4017: Lab Natural Language Processing

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Learn how to apply basic algorithms in NLP field
CO2	Get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data - corpora
CO3	Conceive basics of knowledge representation, inference, and relations to the artificial intelligence.
CO4	Implement mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text

List of the Experiments:

The student shall perform minimum 8 experiments of the following using NLP tools & algorithms

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level -all				
1.	Implement Word Analysis task	SO1	1	4
2.	Implement Word Generation program	SO1	1	4
3.	Implement task of Morphology	SO2	2	4
4.	Implement N-Grams program	SO2	2	4
5.	Implement POS Tagging: Hidden Markov Model	SO3	3	4
6.	Building POS Tagger	SO3	3	6
7.	Write a program for Chunking words	SO3	3	4
8.	Building Chunker	SO4	4	6

Assessment:
ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.
End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S4
	CO1	CO2	CO3	CO4
ESE	07	07	06	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**End Semester Examination**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

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

3 – High 2 – Medium 1- Low

CSPE4018: Lab Deep Learning

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Get familiar with deep learning environment.
CO2	Create the image classification model using deep learning model.
CO3	Build the text summarization model.
CO4	Develop the Application of deep learning like

List of the Experiments

The student shall perform minimum eight experiments of the following using PYTHON

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1	Introduction and Installation of Notebooks, Keras fundamentals Jupyter notebook: keras-test-setup.ipynb	S1	CO1	04
2	Classification using Multilayer Perceptron (MLP)	S1	CO1	04
3	Image classification with CNNs	S1	CO2, CO1	04
4	Image classification: dogs vs. cats; traffic signs	S2	CO2	04
5	Text categorization and labeling	S2	CO3, CO1	04
6	Text sentiment classification with CNNs, RNNs	S2	CO3	04
7	Image Classification with CIFAR Dataset	S3	CO5, CO2	04
8	Human Face Detection	S3	CO5, CO2	04
9	The traffic sign classification using GTSRB dataset	S3	CO5	04
10	Chatbot Using Deep Learning	S3	CO5	04

Assessment:

ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.

End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S3	S2

	CO1	CO2	CO3	CO4	CO5
ESE	05	05	05	05	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**End Semester Examination**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2	3	1							1		1	1	
CO2	1	3	3	1				1	1	3	1	1	2	2	1
CO3	1	3	3	2				1	2	3	2	3	3	2	1
CO4	2	3	3	2	1	1		1	2	3	3	3	3	2	2

CSPE4019: Lab Design of Linux OS

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Understand the basic commands & logging in Linux.
CO2	Apply different process management commands.
CO3	Demonstrate the programs various system calls.
CO4	Apply various memory management , allocation & I/O commands
CO5	Develop programs using shell scripting.

List of the Experiments:

The student shall perform minimum ten experiments of the following using Ubuntu, Fedora or any Linux platform

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: (all)				
1	Installation of Linux OS	S1	CO1	04
2	Study & Analyzing Gnome & KDE desktop environment	S1	CO1	04
3	Write a C program in Gedit	S1	CO1	04
4	Implement different basic commands in Linux	S1	CO2	04
5	Study of VI editor with implementing commands	S2	CO1, CO3	04
6	Study of nano editor with implementing commands	S2	CO1, CO3	04
7	Study of Emacs editor with implementing commands	S2	CO1,CO3	04
8	Implement a program for process management	S2	CO2	04
9	Implement a program to create a new process	S2	CO2	04
10	Write a C program for I/O management.	S2	CO3	04
11	Write a shell script for loops	S2	CO4	04
12	Write shell scripts using advanced commands	S2	CO5	06

Assessment:

ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.

End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S3	S2
	CO1	CO2	CO3	CO4	CO5
ESE	05	05	05	05	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**End Semester Examination**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcome	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PS O1	PS O2	PSO3
CO1	2	3								1	1		3	3	1
CO2	2	3								1	1		3	3	1
CO3	2	3								1	1	1	3	3	1
CO4	2	3								1	1	1	3	3	1
CO5	2	3								1	1	1	3	3	1

3 **– High 2 – Medium 1- Low**

CSPE4020: Lab Information Retrieval

Teaching Scheme	Examination Scheme	
Practical: 2Hrs/Week	**ISE III**	**25 Marks**
Credits:01	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Implement Conflation Algorithm using File Handling.
CO2	Illustrate clustering algo
CO3	Implementation of Web crawler
CO4	Implementation based on Multimedia.
CO5	Implementation based on Digital Libraries.

List of the Experiments:

The student shall perform the experiments of the following.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: (all)				
1	To implement Conflation Algorithm using File Handling.	S1	CO1	04
2	To implement single pass algorithm for clustering.	S1	CO1	04
3	To implement a program Retrieval of documents using inverted files.	S1	CO1	04
4	To implement a simple Web Crawler in Java.	S1	CO2	04
5	To implement a program for feature extraction in 2D color images (any features like color, texture etc.)	S2	CO1, CO3	04
6	To study recent papers on IR / search engine / Digital Libraries/ content management system for document .	S2	CO1, CO3	04
7	Assignments based on Multimedia.	S2	CO1,CO3	04
8	Assignments based on Digital Libraries.	S2	CO2	04

Assessment:

ISEI: In Term work of 25 marks based on performance of students in practical hours, attendance ,practical assignments completion , and timely submission.

End Semester Evaluation: In ESE of 25 marks Practical conduction and Oral Examination

Assessment Table:

Assessment Tool	S1	S2	S3	S3	S2
	CO1	CO2	CO3	CO4	CO5
ESE	05	05	05	05	05

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**Practical Examination & viva voce**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

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

3– High 2 – Medium 1-Low

CSPR4021: Project I

Teaching Scheme	Examination Scheme	
Practical: 6Hrs/Week	**ISE III (Term Work)**	**50 Marks**
Credits:03	**ESE**	**50 Marks**

Course Outcome:

After applying this course, students will able to:

CO1	Identify and finalize problem statements by surveying variety of domains.
CO2	Perform requirement analysis and identify design methodologies.
CO3	Apply advance programming techniques.
CO4	Present technical report by applying different visualizations tools and evaluation metrics.

The project will consist of the work on the topic selected for the project. The project must be done in a group not exceeding 4 Students.

The candidate is expected to select the project do the requirement analysis, and carry out the necessary design procedure.

Term Work:

The assessment of the term work should be done by two internal examiners, one of which will be the guide and the other will be the HOD or senior staff member from the department.

Practical Examination:

Practical exam will be consist of a presentation along with actual demonstration of the project. The said examination will be conducted by a panel of two examiners (one internal guide and one external examiner).

Guideline for completing the PROJECT I:

- Weekly report of students work for finalization of his area of work and topics of projects should be submitted to the faculty during designated hours meant for seminar.
- Format of weekly report should be finalize by the department with sufficient inputs receive from the student it should have following stage wise reports:
  Project area and project groups by 3rd week.
  Tentative project problem statement by 5th week.
  Literature/ field study mechanism identified source and strategy by 6th week.
  Weekly report on literature, field study 6th,7th, and 8th week
  Trial design sheets, SRS, ER diagrams completion of the field data, trial database design and normalization, hardware design documents, prototype software or hardware modules design/develop 9th to 11th week.
- It is expected that the group of candidates prepare a report based on outcomes of literature studies, field visits, observation schedules, focus group meeting etc related to the problem statement. It shall include trial design documents, SRS, hardware and software prototypes, testing strategy.
- The report shall be tested for any plagiarism out of books, journals, and internet based articles and reports by appropriate web based tools.

- Assessment criteria of term work assessment should be viva-voce examinations by two examiners appointed by the department.
- Assessment criteria of seminar delivery for the term work should be design by the faculty with inputs receive form student of the class. It should include provision for peer group assessment if possible.
- Assessment criteria so designed will be displayed on the department notice board with the approval from department along with this guidelines.

Assessment Pattern

Assessment Pattern Level No.	**Knowledge level**	**ISE1**	**End Semester Examination**
S1	Imitation	15	15
S2	Manipulation	15	15
S3	Precision	15	15
S4	Articulation	15	15
55	Naturalization	15	15
Total		75	75

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course outcome	**Program Outcomes**												**PSO's**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	2	3						3	3	1	2	3	2
CO2	1	1	2	3						3	3	1	2	3	2
CO3	1	1	2	2				3	3	3	3	2	2	3	2
CO4	1	1	2	2		3				3	3	2	1	3	2

3– High 2 – Medium 1-Low

CSPR4022: Industrial Training

Teaching Scheme	**Examination Scheme**	
Practical: Hrs/Week	**ISE III (Term Work)**	
Credits:00	**ESE**	

Industrial training of minimum four weeks may be completed after second/ third years(work in the industry or within the department/Institute or any reputed academic / research organization).ISE III will be accessed on basis work done and presentation.

CSPR4023: Project II

Teaching Scheme	Examination Scheme	
Practical: 20 Hrs/Week	**ISE I (Term Work)**	**100 Marks**
Credits:10	**ESE**	**100 Marks**

Course Outcomes:

After applying this course, students will able to:

CO1	Identify and finalize problem statements by surveying variety of domains.
CO2	Perform requirement analysis and identify design methodologies.
CO3	Apply advance programming techniques.
CO4	Present technical report by applying different visualizations tools and evaluation metrics.
CO5	Apply engineering and management principles to achieve project goal.

Student may complete the said project work in the industry or within the department/Institute or any reputed academic / research organization. Performance of the student will be evaluated in the midterm and at the end of the semester .Students are required to prepare a complete project report duly signed by the appropriate authorities at the time of examination, where the work done by the student will be evaluated by the examiners.

The project will consist of the work on the topic selected for the project. The project must be done in a group not exceeding four students.

Term Work:

The assessment of the term work should be done by two internal examiners, one of which will be the guide and the other will be the HOD or senior staff member from the department. Guidelines for the term work and assessment shall be as described in the Project I of the same program.

Practical Examination:

Practical exam will be consist of a presentation along with actual demonstration of the project. The said examination will be conducted by a panel of two examiners (one internal guide and one external examiner).

Assessment Pattern

Assessment Pattern Level No.	Knowledge level	ISE1	End Semester Examination
S1	Imitation	10	20
S2	Manipulation	10	20
S3	Precision	10	20
S4	Articulation	10	20
55	Naturalization	10	20
Total		50	100

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes:

Course	PO1	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO

Outcome		2	3	4	5	6	7	8	9	10	11	12
CO1	1	1	2	3						3	3	1
CO2	1	1	2	3						3	3	1
CO3	1	1	2	2				3	3	3	3	2
CO4	1	1	2	2		3				3	3	2
CO5	1	1	2	3						3	3	1

3- High 2 – Medium 1-Low