CSE Semester: V Sem	Code BC – 501	Subject Artificial Intelligence	L T P C 3 0 0 3
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure			
CO1	To understand the various characteristics of Intelligent agents		Level 2: Understand
CO2	To learn the different search strategies in AI		Level 3: Apply
CO3	Skills in various knowledge representation.		Level 3: Apply
CO4	Appreciate the uncertainty in designing AI systems and propose algorithms for the same		Level 3: Apply
CO5	Build awareness of AI facing major challenges and the complexity of typical problems within the field.		Level 3: Apply
Unit - I	**Introduction:** Introduction - Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents - Typical Intelligent Agents - Problem Solving Approach to Typical AI problems. State Space Search, Constraints Satisfaction Problems.		6 Hrs.
Unit - II	**Problem Solving Methods:** Problem solving Methods - Search Strategies - Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Backtracking Search - Performance of search algorithms.		7 Hrs.
Unit - III	**Knowledge Representation:** First Order Predicate Logic - Unification - Forward Chaining - Backward Chaining - Resolution - Knowledge Representation using First order Predicate logic - Reasoning Systems. Weak and Strong Slot and Filler System.		8 Hrs.
Unit - IV	**Uncertain Knowledge and Reasoning:** Uncertainty - review of probability - probabilistic Reasoning - Bayesian networks - inferences in Bayesian networks Temporal models		7 Hrs.
Unit – V	**Advance Topics:** **Game Playing, Planning and Expert System** minimax algorithm, Optimal decisions in multiplayer games, Alpha-Beta Pruning, move ordering, Evaluation functions, Cutting off search, Forward pruning. Expert system: Definition, Role of knowledge in expert system, Architecture of expert system, Expert system development life cycle.		7 Hrs.
Text Books			
• Artificial Intelligence by Elaine Rich, Kevin Knight and Nair ISBN-978-0-07- 008770-5,			

CSE Semester: V Sem	Code BC – 501	Subject Artificial Intelligence	L T P C 3 0 0 3

TMH

Reference Books

- Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig 3rd Edition, Prentice Hall, 2010
- Introduction to Artificial Intelligence, Dan W Patterson Pearson,2009
- Artificial Intelligence and Intelligent Systems by Padhy, Oxforfd University Press
- Artificial intelligence, Addisson wessley, Patrick Henry Winston 1992
- Heuristic Search: Theory and Applications, Stefan Edelkamp, Stefan Schroedl Morgan Kaufman, 2011

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2					2	2	1				3	1	
CO2	3		2	2	1	2	1	1				1	3	
CO3	3	3		2	2	2	2	2				2	2	1
CO4	3	3	2	3	3		3	1				1	2	1
CO5	2	3	2	2	3		2	3				2	3	

CSE Semester: V Sem	Code Subject BC – 502 Distributed System	LTP C 3 0 0 3
Prerequisite: Knowledge of Computer networks and Operating system		
CO1	Illustrate principles and importance of distributed operating .	Level 2: Understand
CO2	Illustrate the concept of Inter process communication and apply various distributed algorithms related to clock synchronization.	Level 3: Apply
CO3	Ability to understand Distributed shared memory.	Level 2: Understand
CO4	Designing and evaluation of algorithms and protocols for various distributed systems.	Level 3: Apply
CO5	Ability to understand Transactions and Concurrency control.	Level 2: Understand
Unit - I	**Introduction to distributed systems** :Architecture for Distributed System, Goals of Distributed system, Hardware and Software concepts, Distributed Computing Model, Advantages & Disadvantage distributed system, Issues in designing Distributed System.	6 Hrs.
Unit - II	**Inter Process Communication And Synchronization**: API for Internet Protocol, Data Representation & Marshaling, Group Communication, Client Server Communication, RPC-Implementing RPC Mechanism, Stub Generation, RPC Messages. Synchronization: - Clock Synchronization, Logical clocks, Lamport's & vectors logical clocks .Concepts in Message Passing Systems: causal order, total order, total causal order.	7 Hrs.
Unit - III	**Distributed Shared Memory And Distributed File System:** Basic Concept of Distributed Shared Memory (DSM), DSM Architecture & its Types, Design & Implementations Issues In DSM System, Consistency Model, and Thrashing. Desirable features of good Distributed File System, File Model, File Service Architecture, File Accessing Model, File Sharing Semantics, File Caching Scheme, File Application & Fault tolerance.	8 Hrs.
Unit - IV	**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized deadlock detection, distributed deadlock detection.	7 Hrs.

CSE Semester: V Sem	Code Subject BC – 502 Distributed System	LTP C 3 0 0 3
Unit - V	**Transactions and Concurrency Control:** Introduction, Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Methods for Concurrency Control. Distributed Transactions: Introduction, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery.	7 Hrs.

Text Books

- Distributed Systems, Concepts and Design, George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, Edition. 2009.

Reference Books

- Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
- Pradeep K. Sinha, Distributed Operating Systems, PHI, 2005.
- Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
- Tenanuanbaum, Steen," Distributed Systems", PHI
- Gerald Tel, "Distributed Algorithms", Cambridge University Press

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1			1					1			1	1
CO2	2	3	2	2	1								2	2
CO3	3	1								1			1	1
CO4	2	2	3	3	2		2						3	2
CO5	2	3	1		2								1	1

CSE Semester: V Sem	Code BC – 503	Subject Cryptography and Network Security	L T P C 3 1 0 4
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure			
CO1	To Understand cryptography concepts and application		
CO2	To Identify and investigate network security threats		
CO3	Apply security principles to system design		
CO4	To Apply cryptography algorithms to design secure system		
CO5	To Understand and Apply authentication requirements		
UNITs	**Descriptions**		**Hrs.**
UNIT I	**Introduction:** Introduction to Cryptography, Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.		**4**
UNIT II	**Block Ciphers and the Data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, Simplified DES, DES Modes of Block Cipher Encryptions (Electronic Code Book, Cipher Block Chaining, Cipher Feedback Mode, Output Feedback Mode, Counter Mode), Symmetric Ciphers, Asymmetric Ciphers.		8
UNIT III	**Public-Key Cryptography:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. RSA algorithm, Diffie-hellman key exchange, Elliptic curve cryptography		10
UNIT IV	**Hash and MAC Algorithms: A**uthentication Requirement, Functions, Message Authentication Code, Hash Functions, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures		10
UNIT V	**AUTHENTICATION APPLICATION & WEB SECURITY:** Kerberos, intruders, Viruses and related threats. FIREWALL: Firewall Design principles.		8
Total Hours			40
Text Books & Reference Books-			
● William Stallings: Cryptography and Network Security, Pearson 6th edition. ● "Cryptography & Network Security", Mc Graw Hill Atul Kahate ● V K Pachghare: Cryptography and Information Security, PHI 2nd Edition			

CSE Semester: V Sem	Code BC – 503	Subject Cryptography and Network Security	L T P C 3 1 0 4

- W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.
- Jonathan Katz and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press.
- Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2										1	2
CO2	2	2	2										1	2
CO3	2	1	2										1	2
CO4	2	1	2											2
CO5	2	2	1										1	2

CSE Semester: V Sem	Code Subject BC – 504(A) Web Technology	L T P C 3 0 0 3
Prerequisite: Basic Knowledge of Internet Concepts, Software Engineering		
CO1	Apply cascading style sheet concept to design web page	Level 2: Understand
CO2	Create Web Page with functionalities using Java Script.	Level 3: Apply
CO3	Understand the event handling in web technology.	Level 3: Apply
CO4	Understand and demonstrate the uses of PHP in web page design and Development of websites.	Level 3: Apply
CO5	Apply cascading style sheet concept to design web page	Level 3: Apply
Unit - I	BASICS OF HTML: Html tags, entities, links, frames, Text Alignment and Lists, Text Formatting, Fonts Control, head, meta, Email Links and link within a Page, creating a Table, rules of web designing, Creating HTML Forms. page design, home page layout, Design concepts, create a Web page with Graphics, Custom Backgrounds and Colors, Creating Animated Graphics, scripts, attributes, events, URL encode.	6 Hrs.
Unit - II	CASCADING STYLE SHEET: CSS, Defining Style with HTML Tags, Features of Style Sheet, Style Properties, Style Classes, External Style Sheet, Creating Style Sheet, working with block elements and objects, working with list and table, CSS advance.	7 Hrs.
Unit - III	JAVASCRIPT: Introduction to JavaScript: Writing First JavaScript, External JavaScript, Variables: Rules for variable names, Declaring the variable, Assign a value to a variable, Scope of variable, Arrays, Using Operators, Control Statements, JavaScript loops, JavaScript Functions: Defining a Function, Returning value from function, User defined function, Dialog Box	8 Hrs.
Unit - IV	JAVASCRIPT DOM: Introduction Object in HTML, Event Handling, Window Object, Document Object, Browser Object, Form Object, Navigator Object, Screen Object, Built in Object, User defined Objects, Cookies.	7 Hrs.

CSE Semester: V Sem	Code Subject BC – 504(A) Web Technology	L T P C 3 0 0 3
Unit - V	PHP BASICS: Origin and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operators and Expressions, Output Statement, Control Statements, Arrays, Built-in Functions, User-defined Validating Data Entry, Form Handling, Cookies, Session Tracking	7 Hrs.

Reference Books

- "HTML & CSS: The complete reference" by Thomas A. Powel, 5th Edition, McGraw Hill, 2017
- "JavaScript Bible" by Danny Goodman, 7th Edition, Wiely, 2010.
- "Beginning PHP 5" by Dave W & others, Wiley-dreamtech, Edition 2004

CO-PO-PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	2	2	2	1								
CO2	3	2	3	2	2	1								
CO3	3	2	3	2	2	1						1		2
CO4	3	2	3	2	2	1						1		
CO5	3	2	3	2	2	1								2

CSE **Semester: V Sem**	**Code** **BC – 504 (B)**	**Subject** **Introduction to Cryptography**	**L T P C** **3 0 0 3**

Prerequisite: Linear Algebra

CO1	Understand Bitcoin Technology.	Level 2: Understand
CO2	To understand Cryptographic algorithm and analyze them	Level 3: Apply
CO3	To understand and build bitcoin transactions	Level 3: Apply
CO4	To understand hashing and mining	Level 3: Apply
CO5	To understand bitcoin data and addresses	Level 2 Understand

UNITs	**Descriptions**	**Hrs.**
UNIT I	**Introduction to Bitcoin Technology,** P2P Networks, Intro to Consensus, Keys and Signatures,	4
UNIT II	**Cryptographic Algorithms**, Cryptographic Keys, The Basics of Hashing, Privacy on a public blockchain, Proof of Stake	8
UNIT III	**Signatures and Transactions**, Introduction to Bitcoin Transactions, Bitcoin Scripts	10
UNIT IV	**Bitcoin Mining,** Merkle Trees, Bitcoin Mining, task of Bitcoin miners,Mining Pools	10
UNIT V	**Bitcoin Data,Bitcoin Addresses and Keys,** How Bitcoin Stores Data in the Block Structure, Transactions and Scripting	8
Total Hours		40

Text Books & Reference Books-

- Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder

CO-PO Mappings:

COs	**Programme Outcomes (POs)**												**PSO**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO-1	3	3	3	2	2	1								
CO-2	3	3	3	2	2	1								
CO-3	3	3	3	2	2	1								
CO-4	3	3	3	2	2	1						1		
CO-5	3	3	3	2	2	1						1		2

CSE Semester: V Sem	Code BC –504 (C) Subject Software Testing	L T P C 3 0 0 3
Prerequisite: Software Engineering and UML		
CO1	Understand importance of testing techniques in software quality management and assurance (Understand)	Level 2: Understand
CO2	Understand and apply the concepts of software testing and its application in various scenarios with the help of different testing strategies, methods and tools.	Level 3: Apply
CO3	Create test case scenarios for different application softwares using various testing techniques. (Create)	Level 3: Apply
CO4	Apply different testing methodologies used in industries for software testing. (Apply)	Level 3: Apply
CO5	Identify various types of software risks and its impact on different software applications. (Analyze)	Level 4: Analyze
Unit - I	**Introduction:** Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, V-Model, Test Case Generation , SDLC Vs STLC, Software Testing Life Cycle-in detail. **Types of Testing:** Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing. CleanRoom Software Engineering. Functional/Non-Functional Testing. Testing Tools, Categorization of testing methods:Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing.	6 Hrs.
Unit - II	**Non Functional Testing**: Performance Test, Memory Test , Scalability Test, Compatibility Test, Security Test, Cookies Test, Session Test, Recovery Test, Installation Test, Ad-hoc Test, Risk Based Test, Compliance Test. McCall's Quality Factors, FURPS. **Software Testing Methodologies:** Validation & Verification, White**/**Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI	7 Hrs.
Unit - III	**Software Testing Life Cycle:** Requirements Analysis/Design, Traceability Matrix, Test Planning, Objective, Scope of Testing, Schedule, Approach, Roles & Responsibilities, Assumptions, Risks & Mitigations,Entry & Exit Criteria, Test Automation, Deliverables.	7 Hrs.
Unit - IV	**Test Cases Design:** Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and	7 Hrs.

	Test Cases. Test Environment setup, Understand the SRS, Hardware and software requirements, Test Data. Entry & Exit Criteria, Test Automation, Deliverables.	
Unit - V	**Test Execution:** Execute test cases, Error/Defect Detecting and Reporting, DRE(Defect Removal Efficiency), Object ,Types of Bugs , Art of Debugging,. Debugging Approaches, Reporting the Bugs, Severity and priority, Test Closure, Criteria for test closure, Test summary report. **Test Metrics:** Test Measurements, Test Metrics, Metric Life Cycle, Types of Manual Test Metrics. **QA & QC & Testing:** Quality Assurance, What is Quality Control, Differences of QA , QC & Testing.	8 Hrs.

Text Books

- Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Editions

Reference Books

- Ian Sommerville, Software engineering, Pearson education Asia
- Software Testing Techniques, 2nd edition, Boris Beizer, 1990
- Software Testing: Principles and Practices by Srinivasan Desikan
- Software Testing and Quality Assurance: Theory and Practice by Kshirasagar Naik and Priyadarshi Tripathy
- Software Quality Approaches: Testing, Verification, and Validation: Software Best Practice by Michael Haug and Eric W Olsen

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2										2		
CO2	3	3	3									2		
CO3	3	3	3					2		1		2	1	
CO4	3	3	3	3	2	2	2	2	2	2	1	2	1	1
CO5	3	3	3	3	2	2	2	2	2	2	1	2	3	3

CSE Semester: V Sem	Code BC– 505 (A)	Subject Foundation of Data Science	L T P C 3 0 0 3
Prerequisites: Mathematics			
CO1	To explain how data is collected, managed and stored for data science.		
CO2	To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.		
CO3	To implement data collection and management scripts using Mongo DB.		
CO4	Examine the techniques of Data Visualization.		
CO5	Identification of various applications of Data Science.		
UNITs	**Descriptions**		**Hrs.**
UNIT I	Data Science-What is Data Science, Need for Data Science, Difference between Data Science & Business Intelligence, Data Science Components, Tools for Data Science, Data Science Life cycle, Applications of Data Science, Data Science Ethics. Representation of Data- Types of data, primary, secondary, quantitative and qualitative data. Types of Measurements, nominal, ordinal, discrete and continuous data.		6
UNIT II	Presentation of data by tables, construction of frequency distributions for discrete and continuous data. Graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions. Data Pre-processing- Knowing Data, Data Cleaning, Data Integration, Data Selection, Data Transformation		8
UNIT III	Descriptive Statistics-Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean. Partition values: Quartiles, Deciles and percentiles. Measures of dispersion: Mean deviation, Quartile deviation, Standard deviation, Coefficient of variation. Moments: measures of skewness, Kurtosis		8
UNIT IV	Correlation-Scatter plot, Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations. Regression: Concept of errors, Principles of Least Square, Simple linear regression and its properties. Types of Regressions		10
UNIT V	Basics of Big Data, Problem handling large data, general techniques for handling large data, Basic concept of Machine Learning, training model, validating model, supervised & unsupervised learning.		8
Total Hours			40
Text Books & Reference Books			
● Joel Grus, Data Science from Scratch, Shroff Publisher/O'Reilly Publisher Media ● Annalyn Ng, Kenneth Soo, Num sense Data Science for the Layman, Shroff Publisher			

CSE Semester: V Sem	Code BC– 505 (A)	Subject Foundation of Data Science	L T P C 3 0 0 3

Publisher
- Cathy O 'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.

CO-PO-PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1	3	2											3	
CO-2	3	3			1									
CO-3	3	3	1		1							3		3
CO-4	3	3	2	1								1	2	3
CO-5	3	3										1	2	

CSE Semester: V Sem	Code BC – 505(B)	Subject Cryptography and Network Security	L T P C 3 1 0 4
Prerequisite: Discrete mathematics, Basic probability theory and Data Structure			
CO1	To Understand cryptography concepts and application		
CO2	To Identify and investigate network security threats		
CO3	Apply security principles to system design		
CO4	To Apply cryptography algorithms to design secure system		
CO5	To Understand and Apply authentication requirements		
UNITs	**Descriptions**		**Hrs.**
UNIT I	**Introduction:** Introduction to Cryptography, Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.		**4**
UNIT II	**Block Ciphers and the Data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, Simplified DES, DES Modes of Block Cipher Encryptions (Electronic Code Book, Cipher Block Chaining, Cipher Feedback Mode, Output Feedback Mode, Counter Mode), Symmetric Ciphers, Asymmetric Ciphers.		8
UNIT III	**Public-Key Cryptography:** Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. RSA algorithm, Diffie-hellman key exchange, Elliptic curve cryptography		10
UNIT IV	**Hash and MAC Algorithms: A**uthentication Requirement, Functions, Message Authentication Code, Hash Functions, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures		10
UNIT V			
Total Hours			
Text Books & Reference Books-			

- William Stallings: Cryptography and Network Security, Pearson 6th edition.
- “Cryptography & Network Security”, Mc Graw Hill Atul Kahate
- V K Pachghare: Cryptography and Information Security, PHI 2nd Edition
- W. Mao, “Modern Cryptography – Theory and Practice”, Pearson Education.

CSE Semester: V Sem	Code BC – 505(B)	Subject Cryptography and Network Security	L T P C 3 1 0 4

- Jonathan Katz and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press.
- Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall

CO – PO – PSO Mappings

COs	Programme Outcomes (POs)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2										1	2
CO2	2	2	2										1	2
CO3	2	1	2										1	2
CO4	2	1	2											2
CO5	2	2	1										1	2