Scheme of Teaching & Examination of Bachelor of Engineering V Semester B.Tech. Computer Science & Engineering (Artificial Intelligence & Machine Learning)

Sr. No.	Course Code	Category	Course Name	Hours/Week			Credits	Maximum Marks					Minimum Passing Marks	
								Theory		Practical		Total		
				L	T	P		Internal	University	Internal	University		Theory	Practical
1	BTCSEAI&ML501T	Professional core courses	Machine Learning	3	1	0	3	30	70	-	-	100	45	
2	BTCSEAI&ML502T	Professional core courses	Software Engineering & Project Management	3		0	3	30	70	-	-	100	45	
3	BTCSEAI&ML503T	Humanities Social & Management Courses	Effective Technical Communication	2		0	2	15	35	-	-	50	23	
4	BTCSEAI&ML504T	Professional core courses	Design & Analysis of Algorithms	3	1	0	4	30	70			100	45	
5	BTCSEAI&ML505T	Professional core courses	Elective I	3		0	3	30	70			100	45	
6	BTCSEAI&ML501P	Professional core courses	Machine Learning Lab	0	0	2	1	-	-	25	25	50		25
7	BTCSEAI&ML504P	Professional core courses	Design & Analysis of Algorithms Lab	0	0	2	1	-	-	25	25	50		25
8	BTCSEAI&ML506P	Professional core courses	Professional Skills III	0	0	2	1			25	25	50		25
9	BTCSEAI&ML507T	Mandatory Course	Yoga & Meditation (Audit Course)	2	0	0	Audit	-	-	-	-	Audit	-	
Total				**16**	**2**	**6**	**18**	**135**	**315**	**75**	**75**	**600**		

Elective I- 1. TCP/IP **2. Design Patterns** **3. Data Warehousing & Mining**

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B.Tech. SCHEME OF EXAMINATION 2024-25

Scheme of Teaching & Examination of Bachelor of Engineering VI Semester B.Tech. Computer Science & Engineering (Artificial Intelligence & Machine Learning)

Sr. No.	Course Code	Category	Course Name	Hours /Week			Credits	Maximum Marks					Minimum Passing Marks	
								Theory		Practical		Total		
				L	T	P		Internal	University	Internal	University		Theory	Practical
1	BTCSEAI&ML601T	Professional core courses	Compiler Design	4		0	4	30	70	-	-	100	45	
2	BTCSEAI&ML602T	Professional core courses	Elective II	3		0	3	30	70	-	-	100	45	
3	BTCSEAI&ML603T	Professional core courses	Elective III	3		0	3	30	70	-	-	100	45	
4	BTCSEAI&ML604T	Professional core courses	Open Elective I	3		0	3	30	70			100	45	
5	BTCSEAI&ML605T	Humanities Social & Management Courses	Economics of IT Industry	2		0	2	15	35			50	23	
6	BTCSEAI&ML601P	Professional core courses	Compiler Design Lab	0	0	2	1	-	-	25	25	50		25
7	BTCSEAI&ML606P	Professional core courses	Hardware Lab	0	0	2	1	-	-	25	25	50		25
7	BTCSEAI&ML607P	Professional core courses	Professional Skills IV	0	0	2	1			25	25	50		25
8	BTCSEAI&ML608P	Professional core courses	Mini Project	0	0	6	3			50	50	100		45
9	BTCSEAI&ML609P	Professional core courses	Intellectual Property right	2	0	0	Audit							
Total				**17**	**0**	**12**	**21**	**135**	**315**	**125**	**125**	**700**		

Elective II- 1. Mobile Application Development 2. Internet of Things 3. Clustering & Cloud Computing

Elective III- 1. Data Science 2. Distributed Operating Systems 3. Human Computer Interaction

Open Elective I- 1. Comprehensive Web Development 2. Artificial Intelligence 3. Database Management System

25/6/24

25/06/24

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Machine Learning** Subject Code: **BTECH_CSE(AIML)_501T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: The use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

Prerequisite(s): Statistics, Calculus, Linear Algebra, and Probability & Programming Knowledge.

Course Objectives:

1.	To enable the students with basic knowledge on Machine Learning Techniques.
2.	To develop skills of applying Machine Learning Techniques for solving real-world problems.

Course Outcomes:
At the end of this course, students will be able to:

CO1.	Understand the basics of Machine Learning Techniques.
CO2.	Understand different types of Regression Techniques.
CO3.	Be capable of applying classification techniques.
CO4.	Apply unsupervised machine learning techniques.
CO5.	Apply & evaluate the machine learning techniques to real world problems.

SYLLABUS:

UNIT I: Introduction to Machine Learning
Human Learning & it's types, Machine learning and it's types (Supervised unsupervised reinforcement), well-posed learning problems, Applications of Machine learning, issues in machine learning.
Types of data: Numerical and categorical data, data issues and remediation.

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UNIT II: Supervised Learning: Regression

Data pre-processing: Dimensionally reduction, feature subset selection Types of regression: Multiple linear regression, Polynomial regression model

UNIT III: Supervised Learning: Classification

Logistic regression, K-nearest neighbour (KNN), Naive Bayes Decision trees, Support vector machine, Recommendation Systems Content-based and collaborative techniques.

UNIT IV: Unsupervised Learning: Introduction

Clustering, K-means clustering. Apriori algorithm and association rule, anomaly detection algorithm, Hierarchial clustering, K- Medoids

UNIT V: Trends and applications in Machine learning

Ensemble learning, Bagging, randomization, Boosting. Applications of Machine learning: Image recognition, speech recognition, Prediction recommendation: email spam and malware filtering, virtual personal assistant, online fraud detection.

Textbooks:

1. Machine Learning by Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das
2. Introduction to Machine Learning by Dr. Nilesh Shelke, Dr. Narendra. V. Choudhary, Dr. Gopal Sakarkar, Das Ganu Publications, ISBN-978-93-84336-635-9
3. Machine Learning by Tom Mitchell, Mc.Graw Publications

Reference books:

I. Python Machine Learning Dr Randal S. Olson

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Software Engineering and Project Management**

Subject Code: **BTECH_CSE(AIML)_502T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	-	3	30	70	100

Course Objectives:

1	To understand general idea of software engineering
2	To develop skills to design various software process models
3	To develop skills required for software testing and various risk strategies

Course Outcomes:
At the end of this course students are able to:

CO1.	Understand software engineering methods, practices, process models and applications.
CO2.	Analyse various software engineering life cycle models and apply methods for design and development of software projects.
CO3.	Analyze and extract requirements for product and translate these into a documented design using different modeling techniques.
CO4.	Understand and apply software testing methods and types, And to understand debugging concept with various testing methods.
CO5.	Identify and apply the principles, processes and main knowledge areas for Software Project Management

SYLLABUS:

UNIT-1

Basics: Introduction to Software Engineering, Software Myths, Software Engineering-A Layered Technology. Software Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Agile Process Models

UNIT-II

Measures Metrics and Indicator, Metrics for process & projects: Software measurement, metrics for software quality. System Engineering: Hierarchy, Business Process Engineering, Product Engineering, System Modeling, Requirements Engineering: Requirements Analysis, Analysis Modeling Approaches, Data Modeling, Object-Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, Class-based Modeling, Behavioral Model.

UNIT-III

Design Engineering Concepts, Design Model, Pattern-Based Software Desipt Architectural Design, Mapping data flow into software architecture, Cohesion, Coupling, Ler interface analysis and Design.

UNIT-IV

Debugging, Software Teging Fundamentals, Black-Box Testing, White-Box Testing, Metrics for Source Code

Risk Management: Risk strategies, Software risks, Risk identification, Risk refinement,

UNIT-V

Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Software Reliability, Change Management: Software Confiration Management, SCM Repository, SCM Process, Reengineering Software engineering, Revene Engineering, Restructuring, Forward Engineering

Text Books:

1. Software Engineering-A Practitioner's Approach (Sixth Edition) by Roger Pressman (TMH)
2. Software Engineering (Ninth Edition}-lan Summerville (Pearson)
3. Software Engineering for students (4th Edition)- Douglas Bell(Pearson)

Reference Books:

1. Schaum's Outline of Theory and Problems of Software Engineering by David Gustafson (TMH)
2. Software Engineering (Third Edition) by K. K. Aggarwal and Yogesh Singh (New age International Publishers)
3. Software Engineering, Theory and Practice(4th Edition)- Pfleeger, Atlee(Pearson)

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Effective Technical Communication** Subject Code: **BTECH_CSE(AIML)_503T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 hrs / week	2	15	35	50

Course Objective: At the end of the semester, students will have enough confidence to face competitive examinations (IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.) to pursue master's degree. They will also acquire language skills required to write their Reviews/Projects/Reports. They will be able to organize their thoughts in English and hence face job interviews more confidently.

Course Outcomes: After completing the course, students will

1. Acquire knowledge of structure of language.
2. Bé able to face competitive exams and the interview process and can become Employable.
3. Develop business writing skills.
4. Become familiar with technology enabled communication and can develop technical And scientific writing skills,

SYLLABUS

Unit I: Functional Grammar:
Common errors, Transformation of Sentences- Change the Voice, Change the Narration, Simple, Compound Complex sentences, Use of Phrases, Idioms & Proverbs.

Unit II:. English for Competitive Exams & Interview Techniques:
Word building, English words/phrases derived from other languages, Prefixes and Suffixes Synonyms/Antonyms, Technical Jargons, Verbal Analogies, Give one word for, Types & Techniques of Interview.

Unit III: Formal Correspondence:
Business Letters, (Enquiry, Quotation, Order, Complaint), Job applications and Resume Writing, e mail etiquette, Writing Memorandum, Circulars, notices, Analytical comprehension

Unit IV: Technical & Scientific Writing:

Features of Technical Writing, Technical Report writing (Accident, Feasibility, Trouble, Progress) Writing Scientific Projects, Writing Manuals, Writing Project Proposals, Writing Research papers.

Reference Books:

1. Effective technical Communication by Barun K. Mitra, Oxford University Press,
2. Technical Communication-Principles and Practice by Meenakshi Raman & Sharma, Oxford University Press, 2011.
3. Functional English for Technical Students by Dr. Pratibha Mahato and Dr. Dora Thompson, Himalaya Publishing House.
4. How to Prepare a Research Proposal: Guidelines for Funding and Dissertations in the Social and Behavioral Sciences by Krathwohl & R David.
5. Technical Writing- Process and Product by Sharon J. Gerson & Steven M. Gerson, 3% edition, Pearson Education Asia, 2000.
6. Developing Communication skills by Krishna Mohan & Meera Banerjee.

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Design and Analysis of Algorithms** Subject Code: **BTECH_CSE(AIML)_504T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	-	3	30	70	100

Course Objective:

1	Analyze the asymptotic performance of algorithm
2	Apply important algorithmic design paradigms and methods of analysis
3	Solve simple to moderately difficult algorithmic problems arising in applications
4	Able to demonstrate the hardness of simple NP-complete problems

Course Outcomes:

CO1.	Ilustrate different approaches for analysis and design of efficient algorithms and Analyze performance of various algorithms using asymptotic notations.
CO2.	Determine and Apply various divide & conquer strategies and greedy approaches for solving a given computational problem
CO3.	Demonstrate and Solve various realtime problems using the concepts of dynamic programming
CO4.	Make use of backtracking and graph traversal techniques for solving real-world problems
CO5.	Recall and Classify the NP-hard and NP-complete problems

SYLLABUS:

UNIT-I

Definition of algorithms and brief explanation about the basic properties of algorithms Recurrence relations, solutions of recurrence relations using technique of characteristic equation, master theorem Asymptotic notations of analysis of algorithms, worst case, average case and best case analysis of insertion sort, selection sort and bubble sort, amortized analysis, application of amortized analysis, Biotonic sorting network.

UNIT-II

Divide and conquer strategies: Binary search, quick sort, merge sort, heap sort, Stressen's matrix multiplication algorithm, min-max algorithm.

Greedy Approach: Application to job sequencing with deadlines problem, knapsack problem, optimal merge pattern, Huffman code.

UNIT-III

Dynamic Programming: Basic Strategy, Multistage graph (forward and backward approach), Longest Common Subsequence, matrix chain multiplication, Optimal Binary Search Tree, 0/1 Knapsack problems, Travelling Salesman problem, single source shortest path using Bellman-Ford algorithm, all pair shortest path using Floyd- database systems and data warehouse (OLTP & OLAP), Multidimensional data models, Data warehouse architecture, OLAP Operations, Design and construction of data warehouses.

UNIT IV

Basic Traversal and Search Techniques:

Breadth first search and depth first search , connected components,

Backtracking:

Basic strategy, N-Queen Problem and their analysis (4 & 8-Queen), graph coloring, Hamilton cycles.

UNIT V

NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-Hard and NP-complete, Cook's theorem, decision and optimization problems, graph based problems on NP-Principle.

Text Books:

1. "Introduction to Algorithms", Thirs Edition, Prentice Hall of India by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
2. The Design and Analysis of Computer Algorithms", Pearson education by Alfred V. Aho, John E. Hopcraft, Jeffrey D. Ullman.
3. "Fundamentals of Computer Algorithms", Second Edition, University Press By Horowitz, Sahani, Rajsekharam
4, Fundamentals of Algorithms", Prentice Hall by Brassard, Bratley.
5. "Design and Analysis of Algorithms",Pearson Education, II nd Edition, Parag Dave, Himanshu Dave.

Reference Books:

1. Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase and Gelder Pearson Education.

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Elective 1: TCP/IP** Subject Code: **BTECH_CSE(AIML)_505.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: The aim of the course is to provide students with an overview of the field of Internet technologies.

Prerequisite(s); Data Communication, Computer Networks

Course Objectives:

1	To, Create a comprehension of fundamental TCP / IP concepts, and how they function.
2	To, Build understanding of and functionality of TCP / IP protocol set.
3	To, Understand and evaluate various TCP / IP Interface protocols.
4	To, Introduce the student to basic definition of networking and train the students for advanced computer networking courses.

Course Outcomes:
At the end of this course Student are able to:

CO1.	Enumerate the layers of the TCP/IP model.
CO2.	Analyze the services of TCP/IP protocol and be able to deal with its layers. Also the concepts of IP addressing
CO3.	Acquire the knowledge of routing protocols
CO4.	Familiarize stuednts with the basic computer network protocols, and how they can be used to help develop and execute networks.
CO5.	Generate the solution for basic issues of Internet Mechanism and its security.

SYLLABUS:

Unit 1:

Networking Basics, TCP/IP Model, Router, Broadband router, Internet, NAP, ISPs RFCS and Internet Standards.

Unit II:

IP addressig, Classful and Classless Internet address, CIDR-Sub netting and Super netting, VLSM, IP Datagram, IP protocol, ARP, RARP, BOOTP, DHCP, VRRC vs HSRP. IP Routing & Packet Forwarding, RIP, OSPF, EIGRP, ICMP, IGMP.

Unit III:

Protocol-Independent Multicast (PIM), Optical Time-Domain Reflectometer (OTDR) TCP header, Services, Connection establishment and termination, Interactive data flow, Bulk data flow, Flow control and Retransmission, TCP Timers, Urgent Data processing, Congestion control, Extension headers.

Unit IV:

Switching technology, MPLS fundamentals, signalizing protocols, Carrier Ethernet, LDP, IP traffic engineering, ECMP, SBR, Routing extensions for traffic engineering. Traffic engineering limitations and future developments.

Unit V:

IP security protocol, IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation IPv4 and IPv6-QoS, Auto configuration, Stateless address auto configuration (SLAAC), ACL.

Text books:

1. TCP/IP Network Administration, Craig Haut, 3@ Edition, Shroff Publications, 2002.
2. Internetworking with TCP/IP - Principles, Protocols, and Architecture, Douglas E. Comer, 5th edition Volume-1, Prentice Hall, 2006.
3. The Internet and its Protocols- A Comparative approach, Adrian Farrel, Morgan Kaufmann, 2004
4. TCP/IP Illustrated - The Protocols, W. Richard Stevens, Volume-1, Pearson Education,2003.
5. TCP/IP Protocol Suite, Behrouz A. Forouzan. 3" Edition, Tata McGraw Hill, 2006,

Reference books:

1. IPv6 Theory, Protocol and Practice, 2" Edition By, Morgan Kaufmann, 2003.
2. Internetworking TCP/IP, Comer D.E and Stevens D.L, Volume 1, 4" Edition, Prentice Hall.
3. CCNA Cisco Certified Network Associate Study Guide, 7" Edition by Todd Lammle.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Elective 1: Design Patterns** Subject Code: **BTECH_CSE(AIML)_505.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: A design pattern offers a general comprehensive framework to particular challenges in software design to speed up the production process by offering a well-tested, validated development/design model.

Prerequisite(s): Intermediate knowledge of Object Oriented programming.

Course Objectives:

1	Understand the concept of Design patterns and its importance.
2	Understand the concept of Design patterns and its importance.
3	Apply the suitable design patterns to refine the basic design for given context.
4	Get perspectives that help render own design pattern more flexible, versatile, reusable and understandable.

Course Outcomes:
At the end of this course Student are able to:

CO1.	Understand common design patterns in the context of incremental/iterative development.
CO2.	Exploit well-known Creational design patterns.
CO3.	Distinguish between different types of structural design patterns.
CO4.	Remember the appropriate design patterns, purpose and methods and use of Behavioural Design Pattern to solve object oriented design problems.
CO5.	Demonstrate an understanding of Behavioural and other useful design patterns.

SYLLABUS:

Unit I:
Introduction to Design Patterns: Software design principles, Object oriented design principles, Overview of design pattern, benefits of design patterns. Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.

Unit II:
Creational Patterns: Abstract Factory, Builder, Factory Method, prototype, Singleton, Creational Patterns.

Unit III:
Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discussion of Structural Patterns.

Unit IV:
Behavioral Patterns Part I: Chain of Responsibility, Command, Interpreter, Iterator Mediator, Memento, Observer, Discussion of Behavioral Patterns.

Unit V:
Behavioral Patterns Part III: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. Expectations from Design Patterns.
Other useful Design Patterns: Model View Controller, Data Access Object and Transfer Object Design Pattern.

Text books:

1. Head First Design Patterns, by Eric Freeman and Elisabeth Freeman, Oreilly Media,
2. Design Patterns Elements of Reusable Object Oriented Software, by Erich Gamma, Addison-Wesley.
3. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, by Craig Larman, 3rd Edition, Pearson.

Reference books:

1. Pattern-Oriented Software Architecture: A System of Pattern by Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, John Wiley & Sons, 1996,
2. Design Patterns Explained: A New Perspective on Object Oriented Design by Alan Shalloway and James Trott, 2™ edition, Addison-Wesley.
3. Introduction to design Patterns in C++ with Qt by Alan Ezust, Paul Ezust, Prentice Hall,2011.

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Elective 1: Data Warehousing and Mining** Subject Code: **BTECH_CSE(AIML)_505.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: To understand the overall architecture of a data warehouse and methods for data ip gathering and data pre-processing, The different data mining models and techniques will be discussed in this course.

Prerequisite(s): Intermediate knowledge of Object Oriented programming.

Course Objectives:

1	To understand the basic concepts of Data Warehouse and Data Mining techniques.
2	Capable to create a data warehouse and to process raw data
3	Able to apply basic classification, clustering on a set of data,
4	Able to identify frequent data items and to apply association rule on a set of data.
5	To learn recent trends of data mining such as web mining.

Course Outcomes:
At the end of this course Student are able to:

CO1.	To understand the basic concepts of Data Warehouse and Data Mining techniques
CO2.	Capable to create a data warehouse and to process raw data.
CO3.	Able to apply basic classification, and clustering on a set of data.
CO4.	Able to identify frequent data items and to apply association rules on a set of data
CO5.	To learn recent trends in data mining such as web mining.

SYLLABUS:

UNIT I:

Introduction: Characteristics, Operational database systems and data warehouse(OLTP and OLAP), multidimensional data models, warehouse architecture, OLAP operations, Design and construction of data warehouses.

UNIT II:

Fundamentals of data mining: Data mining functionalities, classification of data mining systems, data mining class primitives, major issues and challenges in data mining, data pre-processing need for processing, data cleaning, integration, transformation, data reduction, data application areas.

Unit III:

Classification: Introduction, Decision tree, Building Decision tree-tree induction algorithm, split algorithm based on information theory, split algorithm based on gini index, Decision tree rules Naïve based methods.

Clustering: cluster analysis, Desired features, Types of data in cluster analysis, Computing distance. Categorization of major clustering methods- partioning methods (K-means, EM) , hierarchical methods(agglomerative, divisive).

Unit IV:

Mining frequent patterns and Association Rules: Market Basket Analysis, frequent items sets and association rules, Apriori algorithm, FP growth algorithm, improving efficiency of Apriori growth algorithm.

Unit V:

Web Data Mining: Introduction, Graph properties of web, web content mining, web structure mining, web usage mining, text mining, temporal and spatial data mining.

TEXTBOOKS:

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
2. A.K. Pujari, "Data Mining Techniques", Second Edition, University press, 2013.
3. Jason Bell, "Machine Learning for Big Data: Hands-on for Developers and Technical Professionals, Wiley India Publications, 2013.

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Machine Learning Lab** Subject Code: **BTECH_CSE(AIML)_501P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2hrs / Week (Practical)	1	25	25	50

Note: Practicals based on the above syllabus

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Design and Analysis of Algorithms LAB** Subject Code: **BTECH_CSE(AIML)_504P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2hrs / Week (Practical)	1	25	25	50

Note: Practicals based on the above syllabus

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SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Professional Skills Lab III** Subject Code: **BTECH_CSE(AIML)_506P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs/Week	1	25	25	50

Aim: The aim of this lab is to develop an ability to design and implement static and dynamic websites.

Prerequisite(s): Internet Programming, Fundamental of Computing and Programming

Course Objectives:

1	To understand the basic concepts of Web designing
2	Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.
3	Have a Good grounding of Web Application Terminologies, Internet Tools, E-Commerce and other web services.

Course Outcomes:

At the end of this course Student are able to:

CO1.	List various tags in HTML , DHTML and use these, apply Cascaded style sheet to create web page.
CO2.	Understand and evaluate web application architecture, technologies and frameworks
CO3.	Apply the knowledge of web technology in developing web applications
CO4.	Develop an interactive web applications using ASP.NET,
CO5.	Evaluate different solutions in field of web application development

Expected experiments to be performed (Not limited to):

- **Client Side Scripting / Coding -**

1. HTML (HyperText Markup Language)
2. CSS (Cascading Style Sheets)
3. JavaScript
4. Ajax (Asynchronous JavaScript and XML)
5. JQuery JavaScript Framework Library - commonly used in Ajax development)
6. MooTools (JavaScript Framework Library - commonly used in Ajax development)
7. Dojo Toolkit (JavaScript Framework Library - commonly used in Ajax development)

- **Server Side Scripting / Coding -**

1. PHP (very common Server Side Scripting language - Linux / Unix based Open Source – free redistribution, usually combines with MySQL database)
2. Zend Framework (PHP's Object Oriented Web Application Framework)
3. ASP (Microsoft Web Server (IIS) Scripting language)
4. ASP.NET (Microsoft's Web Application Framework - successor of ASP)
5. ColdFusion (Adobe's Web Application Framework)
6. Ruby on Rails (Ruby programming's Web Application Framework - free redistribution)
7. Perl (general purpose high-level programming language and Server Side Scripting Language - free redistribution - lost its popularity to PHP}
8. Python (general purpose high-level programming language and Server Side Scripting language - free redistribution)

- **Use of Program Libraries and Web Application Frameworks**

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Audit Course:** Yoga & Meditation **Subject Code: BTECH_CSE(AIML)_507T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs / Week	-	50 (Grade)	-	Grade

Aim:

The purpose of this course is to learn the specific skills and/or the techniques of the activity, By actively participating in an activity class, the student may gain health benefits such as improved body composition, increased flexibility, increased muscular endurance and increased muscular strength. Participating in activity classes leads to a healthier lifestyle.

Course Objectives:

1. Learn the rules, fundamentals, skills & strategies of yoga.
2. Teach various asanas (postures) using hatha yoga & the lyengar method.
3. Learn breathing techniques.
4. Improve strength, flexibility and the sense of well-being.
5. Increase relaxation of body and soul.

Instructional Methodology:

This class is an activity and participation course; the specific task/exercise(s) for students to complete will be demonstrated. Students will then complete the task/exercise(s) to the best of their ability.

Curriculum:

1. Two: Basic yoga asanas, breathing techniques and relaxation exercises.
2. Continuation of learning asanas, breathing techniques, and relaxation exercises.
3. Instructions for final yoga routine will be distributed to students,
4. Continuation of learning more advanced asanas, breathing techniques, relaxation exercises and meditation.

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SEMESTER: VI (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Compiler Design **Subject Code:** BTECHCSE(AIML)601T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
4 hrs / week	4	30	70	100

Aim: To understand the principles and concepts of Compiler Design

Prerequisite(s): Student should have basic knowledge of computers and mathematics.

Course Objectives:

1	Understand the phases of the Compiler and utilities of Automata.
2	Give the implementation details of Top-Down and Bottom-up Parsers and its types..
3	Describe the importance of the Semantic Phase and Symbol Table in Compiler.
4	Give the descriptions for the Synthesis Model of the Compiler w.r.t Analysis Model.
5	Understand the Architecture of the Computer and few advanced topics for a & Compiler

Course Outcomes:
At the end of this course students will be able to:

CO1	Define the Compiler along with phases and basic programs in LEX.
CO2	Develop programs for various kinds of the Parsers.
CO3	Write simple programs related to Type Checking, Parameter Passing and Overloading.
CO4	Implement the concepts of Code Optimizations and Code Generations.
CO5	Provide the Case Studies of Object-Oriented Compilers,

SYLLABUS:
UNIT-1:
Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular language GVs, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

Dr Lalit Malik 25/6/24
25/6/24
Dr Anthalene 25/6/24
25/6/24
A.M. Kuthe 25/6/24
25/06/24

UNIT-II:
Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O). SLR(1). LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

UNIT-III:
Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Basic structure, symbol attributes and management. Runtime environment: Procedure activation, parameter passing, value return, memory allocation.

UNIT-IV:
Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): control-flow, data low dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT-V: Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation. Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

TEXT BOOKS:
1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman.
2. Lex& Yaec, Levine R. John, Tony Mason and Doug Brown

REFERENCES:
1. The Design and Evolution of C++, Bjarne Stroustrup.

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Elective II: Mobile Application Development

Subject Code: BTECHCSE(AIML)602.1T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: Introduction to Android development framework and programming.

Prerequisites: Oops through JAVA, XML.

Course Objectives:
Students should be able to:

1	Demonstrate their understanding of the fundamentals of cross-platform operating systems.
2	Demonstrate their skills in using mobile application development tools.
3	Develop software with reasonable complexity on mobile platforms.
4	Deploy software to mobile devices.
5	Debug programs running on mobile devices

Course Outcomes
Students would be able to:

CO1	Describe the components and structure of a mobile development framework
CO2	Understand the specific requirements, possibilities and challenges when developing for a mobile context.
CO3	Apply programming concepts to application development
CO4	Design and develop user Interfaces for the platform
CO5	Publish an application to the market

SYLLABUS:

UNIT-I:
Dart programming basics include variables, data types, operators, control structures, functions, collections, and exception handling. The unit progresses to Flutter basics such as Flutter architecture, widgets, building the first Flutter app, Material Design, and layouts. It concludes with advanced Flutter widgets, including lists and grids, navigation and routing, forms and input handling, and state management with setState and Provider.

UNTT-II:
Introduction to Firebase, setting up Firebase for Flutter, and Firebase Authentication with email/password and social media methods. The unit covers the Firebase Firestore database

with CRUD operations, querying data, and structuring Firestore data. It also includes Firebase Cloud Storage for uploading, downloading, and managing files.

UNIT-III:

This unit delves into advanced state management techniques in Flutter, using Provider, Riverpod, Bloc, and Redux. It covers Firebase Cloud Functions, including writing and deploying functions, and Firebase Cloud Messaging for push notifications. Students will explore real-time features with Firebase, comparing Realtime Database and Firestore, implementing real-time listeners, and offline capabilities. The unit also includes Firebase Analytics and Performance Monitoring, as well as Crashlytics for error reporting.

UNIT-IV

This unit addresses designing for mobile with principles of mobile UI/UX design, responsive design, and using Flutter widgets for beautiful UIs. It covers animations and transitions in Flutter, including hero animations and custom animations. The unit also includes internationalization and localization techniques, managing multiple languages, and testing and debugging with unit tests, widget tests, and integration tests.

UNIT-V:

This unit begins with project planning and development, setting up project structure, and agile methodologies for app development. It covers advanced Firebase services such as Firebase ML Kit, Firebase Remote Config, and Firebase In-App Messaging. The unit also includes preparing for app store submission, creating app bundles and APKs, and adhering to app store guidelines and best practices. It concludes with a capstone project, where students define the project scope, develop the project, and present their final work, including peer review and feedback.

Text Books:

- "Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter and Dart 2"
- **"Flutter in Action"** by Eric Windmill
- "Beginning App Development with Flutter: Create Cross-Platform Mobile Apps"

Reference Books:

- **"Flutter Cookbook: Over 100 proven techniques and solutions for app development with Flutter 2.2 and Dart"** by Simone Alessandria and Brian Kayfit

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Subject: Elective II: Internet of Things **Subject Code:** BTECHCSE(AIML)602.2T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: This course provides a way to understand the concepts and the basics of Internet of things, loT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics.

Prerequisite(s): Introductory knowledge in programming, Networking.

Course Objectives:

1	To learn the concepts about Internet of things.
2	To understand and implement smart systems.
3	To understand the Network & Communication aspects.
4	Ability to understand the Security requirements in IoT.

Course Outcomes:

At the end of this course Student will be able to:

CO1	Understand the vision of loT from a global context
CO2	Understand M2M to IoT — A Basic Perspective
CO3	Use of Devices, Gateways and Data Management in IoT,
CO4	Understand the Internet of Things Privacy, Security and Governance
CO5	Implement basic loT applications on embedded platform

SYLLABUS:

Unit I:

Introduction to IoT

Defining IoT, Characteristics of loT, Physical design of IoT, Logical design of IoT, Functional blocks of loT, Communication models & APIs

Unit II:

M2M to loT A Basic Perspective: Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

M2M to IoT-An Architectural Overview- Building an architecture, Main design principles

and needed capabilities, An IoT architecture outline, standards considerations.

Unit III:

Network & Communication aspects:

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Unit IV:

Internet of Things Privacy, Security and Governance:

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in loT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Unit V:

Developing IoTs:

Introduction to Python, Introduction to different IoT tools. Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.

Text books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)", 1" Edition, VPT, 2014.

Reference books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", | st Edition, Apress Publications, 2013.
2. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.
3. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practic

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SEMESTER: VI (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Elective II: Clustering & Cloud Computing

Subject Code: BTECHCSE(AIML)602.3T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: The aim of this course is to make students understand the concepts, characteristics, models and benefits of cloud computing.

Prerequisite(s): Database Management System, Data Structures, Operating Systems, Computer Networks.

Course Objectives:

1	To study fundamental concepts of cloud computing
2	To understand the implementation of Virtualization in Cloud Computing
3	To learn the application and security on cloud computing

Course Outcomes:
At the end of this course students will be able to:

CO1	Understand the different Cloud Computing environment
CO2	Analyze virtualization technology and install virtualization software application
CO3	Use appropriate data storage technique on Cloud, based on Cloud
CO4	Apply security in cloud applications
CO5	Use advance techniques in Cloud Computing

SYLLABUS:

UNIT 1:

Introduction: Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, laaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud Deployment Models. System Architecture, Cloud.

UNIT II:

Introduction to Virtualizations: Definition of Virtualization, Adopting Virtualization, Types of Virtualizations, Virtualization Architecture and Software, Virtual Clustering. Virtualization Application, Pitfalls of Virtualization. Grid, Cloud and Virtualization: Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security Virtualization and Cloud Computing Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization.

UNIT III:

Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing, Cloud Storage from LANs to WANs: Cloud Characteristics, Distributed Data Storage.

UNIT IV:

Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. Data Security in Cloud: Security Issues, Challenges, advantages, Disadvantages, Cloud Digital persona and Data security, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing

UNIT V:

Future Tends in Cloud Computing, Mobile Cloud, Automatic Cloud Computing Comet Cloud. Multimedia Cloud: IPTV, Energy Aware Cloud Computing, Jungle Computing, Distributed Cloud Computing Vs Edge Computing, Containers Docker, and Kubernetes, Introduction to DevOps. IOT and Cloud Convergence The Cloud and lot in your Home, The IOT and cloud in your Automobile, PERSONAL IoT in Healthcare.

Text/Reference Books:

1. A.Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and implementation", Pearson, ISBN: 978- 81-317-7651-3
2. RajkumarBuyya, Christian Veechiola, 5. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN- 13:978-1-25-902995-0
3. 3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A practical approach" McGraw Hill Tim Mather, Subra K, Shahid L.,""Cloud Security and Privacy", Oreilly, ISBN-13 978.
4. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", WileyPublications, ISBN: 978-0-470- 97389-9

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SEMESTER: VI (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Elective III: Data Science** Subject Code: **BTECHCSE(AIML)603.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	**3**	**30**	**70**	**100**

Aim: To apply data science concepts and methods to solve problems in real- world contexts and to communicate these solutions effectively.

Prerequisite(s): Preliminary Linear Algebra

Course Objectives:

1	To understand the basic concepts of Data science.
2	Demonstrate an understanding of statistics and classification concepts that are vital for data science
3	Demonstrate the implementation of Data Science experiments through Python or R Language.

Course Outcomes:
At the end of this course Student will be able to:

CO1	Understanding the significance of exploratory data analysis in Data Science.
CO2	Demonstrate the usage of Random Sampling and bias in a given dataset.
CO3	Analysis of various Statistical Experiments through various types popular Testing methods.
CO4	Design and analysis of regression techniques to estimate outcomes and detect anomalies.
CO5	Ability to implement classification Techniques.

SYLLABUS:
UNIT I
Exploratory Data Analysis
Elements of Structured Data, Rectangular Data, Estimates of Location, Estimates of Variability, Exploring the Data Distribution, Exploring Binary and Categorical Data, Correlation, Exploring Two or More Variables.

UNIT II

Data and Sampling Distributions

Random Sampling and Sample Bias, Selection Bias, Sampling Distribution of a Statistic, The Bootstrap, Confidence Intervals, Normal Distribution, Long-Tailed Distribution, Student's 1-Distribution, Binomial Distribution, Chi-Square Distribution, F-Distribution.

UNIT III

Statistical Experiments and Significance Testing

A/B Testing, Hypothesis Tests, Resampling, Statistical Significance and p-Values, Multiple Testing, Degrees of Freedom, ANOVA, Chi-Square Test, Multi-Arm Bandit Algorithm. Power and Sample Size.

UNIT IV

Regression and Prediction

Simple Linear Regression, Multiple Linear Regression, Prediction Using Regress, Factor Variables in Regression, Interpreting the Regression Equation, Repression Diagnostics, Polynomial and Spline Regression

UNIT V

Classification

Naive Bayes, Discriminant Analysis, Logistic Regression, Evaluating Classification Models, Strategies for Imbalanced Data.

Text books:

1. Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists, 2™ Edition, Oreilly.
2. R Programming for Data Science — Roger D.Peng, Learn Pub Book, Learn Publishing.
3. Sanjivranjan Das, Data Science: Theories, Models, Algorithms and Analytics.
4. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk.

Reference books:

1. Allen B, Downey, Think Python: How to Think Like a Computer Scientist, (2nd Edition), O' Reilly, 2015. ISBN-978-1-49 | -93936-9,
2. R for dummies — Andrie de vries and Joris Meys, A John Wiley sons, Ltd. Publication.

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Elective III: Distributed Operating Systems **Subject Code:** BTECHCSE(AIML)603.2T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Aim: A distributed operating system is a software over a collection of independent, networked, communicating and physically separate computational nodes. They handle jobs which are serviced by multiple CPUs. Each individual node holds a specific software subset of the global aggregate operating system.

Prerequisite(s): Distributed Operating systems holds concepts such as threads, processes, mutual exclusion, deadlock. It also works on Computer networking concepts such as Internet, protocols, sockets, network application programming.

Course Objectives:

1	To understand the principles and techniques behind the design of distributed systems, such as locking, concurrency, scheduling, and communication across networks.
2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Course Outcomes:
At the end of this course Student will be able to:

CO1	Learn the principles, architectures, algorithms and programming models used in distributed systems.
CO2	Understand the core concepts of distributed systems.
CO3	Design and implement sample distributed systems, using different algorithm.
CO4	Understand the Distributed File System, Architecture, and Mechanism,
CO5	Analyze the Distributed Scheduling, Issues in Load Distributing, components of a Load Distributing Algorithm, Load Distributing Algorithms.

SYLLABUS:

Unit I

Fundamentals: Introduction, Models and Features, Concept of Distributed Operating system, Issues in Design of a Distributed Operating System. Foundations of Distributed System: Limitations of Distributed Systems.

Unit II

Broadcast Algorithm, Distributed Mutual Exclusion: Requirement of Mutual Exclusion Non Token Based Algorithms: Lamport's Algorithm, Ricard-Agrawala Maekawa's Algorithm.

Unit III

Distributed Deadlock Detection: Introduction, Deadlock Handling strategies in Distributed System, Centralized and Distributed Deadlock Detection Algorithms.

Unit IV

Distributed File system, Architecture, and Mechanism for Building Distributed File System. General Architecture of DSM systems, Algorithm for Implementing DSM, Memory coherence and Coherence Protocols.

Unit V

Distributed Scheduling, Issues in Load Distributing, Load Distributing Algorithms, T Sender-Initiated Algorithm, Receiver-Initiated algorithm, Symmetrically Initiated Algorithm, Adaptive Algorithm.

Text books:

1. Advanced Concepts in Operating Systems, Shivaratri, Tata McGraw Hill, 2001. Mukesh Singhal and Niranjan
2. Distributed Systems - Concepts and Design, Coulouris, Dollimore and Kindberg, Sth Edition, Addison-Wesley, 2012.

Reference books:

1. Distributed Operating System, Andrew S. Tanenbaum, Pearson Education, 2003.

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Elective III: Human Computer Interaction **Subject Code:** BTECHCSE(AIML)603.3T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**3**	**30**	**70**	**100**

Aim:. The course focuses on human-computer interaction and interface design. Prerequisites: Fundamental knowledge of programming,

Course Objectives:
Students should be able to:

1	Describe what interaction design is and how it relates to human computer interaction and other fields.
2	Use, adapt and extend classic design standards, guidelines, and patterns
3	Apply core theories, models and methodologies from the field of HCI
4	Types of Mobile Application along with Designing
5	Learn the guidelines in designing user interfaces

Course Outcomes:
Students would be able to:

CO1	Understand the Importance of user Interface
CO2	Design effective dialog for HCI
CO3	Develop navigation panes in windows
CO4	Understand HCI using software tools, prototypes and golden rules
CO5	Analyse and apply various evaluation techniques.

SYLLABUS:
UNIT-I
Introduction: Importance of user Interface-definition, importance of good denim Benefits of good design. A brief history of Screen design. The graphical user interface- popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user Interface popularity, characteristics Principles of user interface.

UNIT-II

Design process Human Interaction with computers, importance of human characteristics human characteristics, Human interaction speeds, understanding business junctions. Screen Designing: Design goals: Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics.

UNIT-III

Windows- New and Navigation schemes selection of window, selection of devices based and screens based controls. Components-text and messages, Icons and increases- colors, uses problems, choosing colors.

UNIT-IV

HCI in the software process. The software life cycle Usability engineering Iterative design and prototyping Design Focus Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns

UNIT-V

Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal designs, Universal design principles Multi-anodal interaction Cognitive models Goal and task hierarchies Design Focus GOMS saves money Linguistic models. The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech, Units 1, 2,3
2. Human — Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education Units 4,5

Reference Books:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human —Computer Interaction, D, R. Olsen, Cengage Learning.
5. Human —Computer Interaction, Smith - Atakan, Cengage Learning,

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SEMESTER: VI (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: Open Elective 1: Comprehensive Web Development

Subject Code: BTECHCSE(AIML)604.1T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 hrs / week	3	30	70	100

Unit 1: Introduction to Web Development and Frontend Basics

Overview of web development covering core concepts and technologies including HTTP, browsers, and servers. HTML topics include elements, attributes, forms, and semantic HTML. CSS topics encompass selectors, the box model, flexbox, grid, and responsive design. JavaScript basics include syntax, variables, data types, operators, control structures, functions, and DOM manipulation.

Unit 2: Advanced Frontend Development

Modern JavaScript features including ES6+ syntax, modules, and asynchronous programming with promises and async/await. Advanced DOM manipulation, event handling, debugging, and testing in JavaScript. Introduction to frontend frameworks and libraries focusing on React.js, including components, state and props, lifecycle methods, hooks, routing with React Router, and state management with Redux. Best practices for frontend development including code organization, version control with Git, and collaboration using GitHub.

Unit 3: Backend Development with Node.js and Express

Introduction to Node.js covering its architecture, event-driven programming, and runtime environment. Setting up a Node.js project, working with npm, and creating a basic server. Introduction to Express.js for building web applications, covering routing, middleware, and templating engines. RESTful API design, implementing CRUD operations, and handling authentication and authorization. Working with databases focusing on MongoDB and Mongoose for schema design and data manipulation.

Unit 4: Full Stack Integration and Advanced Backend Topics

Client-server communication using tools like Axios and Fetch API for making HTTP requests. Session management and authentication strategies including JWT and OAuth. Advanced backend topics including real-time communication with WebSockets, using

GraphQL for efficient data querying, and deploying Node.js applications. Security best practices including data validation, error handling, and protection against common vulnerabilities like SQL injection and cross-site scripting (XSS).

Unit 5: Development and Deployment

Project planning including defining scope, requirements, and architecture of the application. Setting up project structure, integrating frontend and backend components, and implementing key features. Testing and debugging including unit tests, integration tests, and end-to-end tests. Deployment strategies using platforms like Heroku, AWS, or Netlify. Capstone project presentation demonstrating applications, receiving peer feedback, and reflecting on the development process.

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SEMESTER: VI (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Open Elective 1:** Subject Code: **BTECHCSE(AIML)604.2T**

Artificial Intelligence

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**3**	**30**	**70**	**100**

Course Objectives

1. To understand challenges involved in designing intelligent systems.

2. To represent given problem using state space representation and solve it by using different search techniques.

3. To understand knowledge representation methods using logic programming.

4. To understand uncertainty theory in designing AI systems. 5. To understand learning methods in solving AI problems.

SYLLABUS

UNIT I

Introduction: Basics of problem solving, problem representation; Search Techniques: Problem size, complexity; Uninformed search techniques: Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS.

UNIT II

Informed search techniques: Heuristic Based Search, Greedy Based First Search, A* Search; Local Search algorithms: Hill-climbing, Simulated Annealing, Genetic Algorithms. Constraint Satisfaction Problems, Adversarial Search: Two player Games, The min- max algorithm, Alpha-Beta pruning.

UNIT III

Propositional Logic: Inference, Equivalence, Validity and satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Syntax and Semantics of FOL, Inference in FOL, Unification, Forward Chaining, Backward Chaining, and Resolution.

UNIT IV

Uncertainty Knowledge and Reasoning: Probability and Baye's Theorem, Statistical reasoning: Bayesian networks, Naïve bayes algorithm, Fuzzy Logic, Introduction to expert system

UNIT V

Learning: Types of Learning, k-nearest neighbor, Decision Tree Learning, Artificial Neural Network, Perceptron Learning algorithm

Course Outcomes

On successful completion of the course, students will be able to:

1. Represent given problem using state space representation and apply uninformed and informed search techniques on it.

2. Solve the fully informed two player games using different AI techniques.

3. Solve the AI problems by using logic programming

4. Apply uncertainty theory based on techniques like probability theory and fuzzy logic.

5. Apply learning methods in solving AI problems.

Text Book

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition; Pearson Education, 2009.

Reference Book

1. E.Rich, K. Knight, S. B. Nair; Artificial Intelligence; 3rd Edition; Tata McGraw Hill, 2014.
2. Denis Rothman; Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases; Kindle Edition, Packt Publishing Ltd, 2018

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Open Elective 1:** Subject Code: **BTECHCSE(AIML)604.3T**

Database Management System

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**3**	**30**	**70**	**100**

Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

SYLLABUS

UNIT I

Introduction to Database System Concepts and Architecture Databases and Database Users, Characteristics of the Database Approach, Advantages of Using the DBMS Approach, When Not to Use a DBMS, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment. Introduction to NoSQL databases and In-Memory databases.

UNIT II

The Relational Data Model and SQL Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations, SQL Data Definition, Data Types and Constraints, Data Management in SQL, Transforming ER Model into Relational Model.

UNIT III

Database Design and Normalization Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms.

UNIT IV

Indexing and Hashing Ordered Indices, B+-Tree Index Files and its Extensions, Static Hashing and Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Some General Issues Concerning Indexing.

UNIT V

Query Processing and Optimization Measures of Query Cost, Query Operation: Selection, Sorting and Join Operation, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

UNIT VI

Transaction Processing, Concurrency Control and Recovery Introduction to Transaction Processing, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Deadlock Handling and Multiple Granularity, Database Recovery Techniques.

Outcomes

On completion of the course the student will be able to

1. Identify the basic concepts and various data model used in database design.
2. Recognize the use of normalization and functional dependency.
3. Understand the purpose of query processing and optimization.
4. Apply and relate the concept of transaction, concurrency control and recovery in database.

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; "Database System Concepts" Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; "Fundamentals of Database Systems", Sixth Edition, Addison Wesley 2011.

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; "Database Management Systems"; Third Edition; Tata McGraw Hill Publication, 2003. 2. C. J. Date; "Database in Depth – Relational Theory for Practitioners"; O`Reilly Media, 2005.

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Subject: Economics of IT industry **Subject Code:** BTECHCSE(AIML)605T

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 hrs / Week	2	15	35	50

Course Objective:
Objective of the course is to make learners aware about the impact of Information Communication technology (ICT) and Information Technology (IT) revolution on Indian Economy and their seamless interaction.

1. The learners will be able to distinguish between Micro and Macro economics.
2. The learners will be able to relate economics concept with IT industry.
3. The learners will be able to identify key trends in IT industry.
4. The learners will be able to understand the key economic drivers of IT industry.

SYLLABUS:

UNIT-I
Difference between Micro and Macroeconomics, law of demand and supply, concept and types of elasticity of demand, deflation and recession.

UNIT-II:
Role of Information and technology industry in economic growth of the country, labour intensive verses capital intensive industry, the concept of digital economy and digital age. digital divide, various phases of business cycle.

UNIT-III:
Merger and acquisition, types of merger, advantages of merger, hostile takeover, concept of top line and bottom line growth, Contribution of E-Commerce in economic growth, information technology and environment- the challenge of E-waste.

UNIT-IV
Venture and angel funding as sources of finance, organic verses inorganic growth model, 5 level capability maturity model of IT industry, Concept of agile organization.

List of Reference Books:

1. Modern economic theory by K.K.Dewett,
2. Information and economic development by Yutuka Khurana, [GI Global publisher.
3. The economics of information technology by Paul Jowett, Margaret Rothwell. St Martin Press New York.
4. Industrial Economics. By, Ranjana Seth, Ane Book Pvt Ltd.

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BRANCH: COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Subject: **Compiler Design Lab** Subject Code: **BTECHCSE(AIML)601P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 hrs / week	1	25	25	50

Course Objectives:

1	To learn usage of tools LEX, YAAC
2	To develop a code generator
3	To implement different code optimization schemes

Course Outcomes:
At the end of this course students will be able to:

CO1	Generate scanner and parser from formal specification.
CO2	Generate top down and bottom up parsing tables using Predictive parsing, SLR and LR Parsing techniques.
CO3	Apply the knowledge of YACC to syntax directed translations for nerating intermediate code —3 address code.
CO4	Build a code generator using different intermediate codes and optimize the target code.
CO5	Generate scanner and parser from formal specification.

Practicals based on above syllabus

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BRANCH: COMPUTER SCIENCE AND ENGINEERING
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Subject: Hardware Lab **Subject Code:** BTECHCSE(AIML)606P

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 hrs / week	1	25	25	50

Course Objectives:
To skill the students in the H/W field.
To enhance research activities in different application areas of loT, Robotics and Embedded systems.

Expected experiments to be performed (Not limited to):

1. Front panel indicators & switches and Front side & rear side Connectors.
2. Familiarize the computer system Layout: Marking positions of SMPS, Motherboard, EDD, HDD, CD, DVD and add on cards.
3. Configure BIOS setup program and troubleshoot the typical problems using BIOS utility.
4. Install Hard Disk and configure to the Pc's
5. Install and Configure a DVD Writer and a Blu- ray Disc writer and recording DVD and Blu-ray disk.
6. Printer Installation and Servicing and troubleshoot.
7. Install and configure Scanner, Web cam, Cell phone and bio-metric device with system and troubleshoot the problems.
8. Assemble a system with add on cards and check the working condition of the system and install OS.
9. Install and Configure Dual OS Installation.
10. Assembling and Disassembling of Laptop to identify the parts and to install OS and configure it.

Expected experiments to be performed Based on the Electives and Open Electives opted by students

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Subject: Professional Skills Lab IV **Subject Code:** BTECHCSE(AIML)607P

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Aim:

This lab has focus on hands-on project and assignment-based learning space where students will gain strong practical and technical skills in various programming languages and advanced tools.

Course Objectives:

The interactive experiments in this lab will give the students an opportunity for learning and better understanding of the basic concepts and constructs of computer programming as well as advanced methodology concepts.

Expected experiments to be performed Based on the Electives and Open Electives opted by students (Not limited to):

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Subject: **Mini Project** Subject Code: **BTECHCSE(AIML)608P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
6 Hrs / Week	**3**	**50**	**50**	**100**

Aim:
The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, academic institutions and computer science research. The course Mini Project is one that involves practical work for understanding and solving problems in the field of computing.

Course Objectives:
Mini-Project is intended develop investigative, research and report writing skills and will provide an opportunity to investigate a chosen topic in considerable depth so as to demonstrate the application of their programming and research skills, and to apply their knowledge to complex computing problems.

Course Outcomes:
At completion of mini-project:
Students will get knowledge of all the necessary details required for the development of a software project and its documentation using software engineering approach.

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Subject: **Intellectual Property Rights** Subject Code: **BTECHCSE(AIML)609P**
(Audit Course)

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	-	50(Will be Converted to grade)	-	-

Aim: To introduce the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

Prerequisite(s): Nil

Course Objectives:

1	To introduce fundamental aspects of Intellectual property Rights]
2	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3	To disseminate knowledge on copyrights and its related rights and registration aspects
4	To disseminate knowledge on trademarks and registration aspects
5	To disseminate knowledge on Design, Geographical Indication (G1), Plant Variety and Layout Design Protection and their registration aspects

Course Outcomes:
At the end of this course students will be able to:

CO1	Understand fundamental aspects of Intellectual property Rights
CO2	Apply knowledge on patents, patent regime in India and abroad and registration aspects
CO3	Be capable of getting copyrights and its related rights and registration aspects
CO4	Be capable of getting trademarks and registration aspects
CO5	Apply knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

SYLLABUS:

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR) Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design- Genetic Resources and Traditional Knowledge Trade Secret IPR in India Genesis and development-IPR in abroad Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967 the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT-II:

Patents Elements of Patentability: Novelty, Non Obviousness (Inventive Steps) Industrial Application-Non-Patentable Subject Matter-Registration Procedure, Rights and Duties of Patentee, Assignment and Licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties-Patent office and Appellate Board

UNIT-III:

Copyrights Nature of Copyright Subject matter of copyright original literary dramatic, musical, artistic works, cinematograph films and sound recordings Registration Procedure, Term of protection, Ownership of copyright, Assignment and Licence of copyright-Infringement, Remedies & Penalties - Related Rights-Distinction between related rights and copyrights.

UNIT-IV

Trademarks-Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT-V:

Other forms of IP-

Design: Design meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection Geographical Indication (GI): Geographical indication meaning, and difference between GI and trademarks registration, effect of registration and term of protection Procedure for registration, effect of registration & term of protection.

Plant Variety Protection: Plant variety protection meaning and benefit sharing and farmers' rights-Procedure for registration, effect of registration and term of protection Layout Design Protection **Layout Design protection meaning :**Procedure for registration, effect of registration and term of protection.

Text books:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference books:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

E-resources:

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights — An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook. pdf
2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook, Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf

Reference Journal:

1. Journal of Intellectual Property Rights (JIPR): NISCAIR