Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
FOUR YEAR B. TECH. COURSE
(Revised Curriculum as per AICTE Model Curriculum)
Scheme for Computer Engineering

Fifth Semester:-

S. N.	Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
			L	T	P	CA	UE	Total		
1	BTCME501T	Database Management System	3	1	-	30	70	100	4	PCC-CS
2	BTCME501P	Database Management System – Lab	-	-	2	25	25	50	1	PCC-CS
3	BTCME502T	Computer Graphics	3	-	-	30	70	100	3	PCC-CS
4	BTCME502P	Computer Graphics –Lab	-	-	2	25	25	50	1	PCC-CS
5	BTCME503T	Java Programming	3	-	-	30	70	100	3	PCC-CS
6	BTCME503P	Java Programming - Lab	-	-	2	25	25	50	1	PCC-CS
7	BTCME504T	Elective-I	3	-	-	30	70	100	3	PEC-CS
8	BTCME505T	Humanities - II – Effective Technical Communication	2	1	-	15	35	50	3	HSMC
9	BTCME506T	Yoga & Meditation	-	-	2	-	-	-	Audit	MC
		Total	**16**	**02**	**06**	**210**	**390**	**600**	**19**	

Elective-I:

BTCME504.1T - Microcontrollers & Applications,

BTCME504.2T - Artificial Intelligence,

BTCME504.3T - Software Engineering

(Dr. A. N. Thakare)

(Prof. V. P. Thakare)

Dr (Mrs) Sonali S. Golwit

(Prof. S. S Dewle)

Dr. S. V. Sonekar

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.TECH.) DEGREE COURSE

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

BRANCH: COMPUTER ENGINEERING

Subject : **DATABASE MANAGEMENT SYSTEM** Subject Code :**BTECHCME501T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
(3 Hrs. +1Hr.) (L+ T)	4	30	70	100

Aim: To realize the concepts of database Management System

Prerequisite(s): File structure, set theory concepts from discrete mathematics, Object Oriented Concepts

Course Objectives: *(02-04)*

1	To provide students with basic concepts in databases both in terms of usage and Implementation
2	To make the students understand all requirement and operations that the analyst needed to analyse, design, and implement the systems
3	To develop real time application using the Structure Query Language

Course Outcomes: *(06)*

At the end of this course Student are able to:

CO1	Explain the architecture and functioning of database management system as well as associated tools and techniques, Compare file processing system and DBMS
CO2	Illustrate database query and manipulation languages such as SQL (Structured query language) and Interpret real problem with SQL query
CO3	Classify various data models and construct Entity _Relationship diagram Apply normalization form to convert database tables into normal forms.
CO4	Query Processing and Query Optimization Measure of query cost for various Operators
CO5	Transaction Management Explain role of various components in the transaction management
CO6	Understand the concept of Concurrency Control system

Unit I: Introduction to DBMS **[6 Hours]**

General introduction to database systems, Database - DBMS distinction, Approaches to building a database, Data models, Three-schema architecture of a database, Challenges in building a DBMS, Various components of a DBMS

Unit II: Query Language **[8 Hours]**

Relational Data Model, Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys, Relational algebra operators, Tuple relation calculus, Domain relational calculus, SQL, PL/SQL .

Unit III: Data Models and Relational Database Design **[8 Hours]**

Evolution of Data Models, Entity Relationship Model, Development of ER Diagrams, Extended Entity Relationship Model. Relational model: Logical View of Data, Concepts of Functional dependency, Normalization 1NF, 2NF, 3NF, BCNF.

Unit IV: Query Processing & optimization **[6 Hours]**

Overview: Query Processing and Optimization, measures of query cost estimation in query Optimization, pipelining and Materialization, Structure of query evaluation plans.

Unit V: Transaction management **[8 Hours]**

Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, transaction isolation levels and implementations. **Concurrency control:** Lock Based Protocol, Deadlock Handling, Time-stamp Based Protocols, and Validation Based Protocols.

Text Books :-

1. Database System Concepts by AviSilberschatz , Henry F. Korth , S. Sudarshan, Tata McGraw Hill, Fifth Edition

2. An Introduction to database management Systemby Bipin Desai

Reference Books:-

1. Introduction to Database Management Systems by Kahate

Subject : **DATABASE MANAGEMENT SYSTEM** Subject Code : **BTCME501P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Practical based on above syllabus (Oracle , SQL, post gress Sql , Sqlite etc). Teachers can emphasis to do mini application using database knowledge to students. Faculty can assign case study to the students.

Subject : **Computer Graphics** Subject Code : **BTCME502T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of designing the computer graphics

Prerequisite(s): None

Course Objective

1	To introduce students with fundamental concepts and theory of Computer Graphics.
2	To understand &exhibit the line, circle, ellipse, polygon filling, clipping, hidden surface removal, Curves & surface, rendering algorithms and 2D & 3D transformations
3	To allows students to develop programming skills in Computer Graphics.

Course Outcomes:

Upon the completion of the course students will be able to :-

CO1	Understand the basics of computer graphics, and different graphics systems. Apply and compare the algorithms for drawing 2D images also explain aliasing &anti-aliasing
CO2	Apply and compare the Polygon Filling algorithms.
CO3	Solve the problems on viewing transformations. Analyze and apply clipping algorithms.
CO4	Analyze and apply transformation on 2D &Explain the projection 3D Graphics.
CO5	Explain the hidden surface removal, Curves & surface rendering algorithms

UNIT I: Introduction to Computer Graphics **[08 Hours]**

Geometry and line generation: points, lines, planes, pixels and frames buffers, types of display devices and its architecture DDA and Bresenham's algorithms for line generation, Bresenham's algorithm for circle generation, aliasing , anti-aliasing and its techniques.

UNIT II: **[07 Hours]**

Graphics primitives, Display files, Segment Table, Operations on Segment, data structures for

segments.

Polygon generation, Polygon filling algorithms: Simple order Edged List, Edge Fill, Edge Flag, Seed Fill, Scan Line Seed Fill

UNIT III: **[07 Hours]**

Windowing and clipping: window, viewport, viewing transformations, NDC (normalized device co-ordinates), WCS (World co-ordinates System)

Clipping,line : Cohen-Sutherland, Cyrus-Beck, Midpoint Subdivision algorithms&Polygon clipping: Sutherland-Hodgeman

UNIT IV: **[07 Hours]**

2D transformations: scaling, rotation, translation, rotation about arbitrary point, reflections, shearing.

3D Graphics: 3D Transformation, parallel, perspective and isometric projections.

UNIT V: **[07 Hours]**

Hidden surfaces and line removal: Painter's, Z-buffer, Warnock's, Back-face Removal algorithm

Curves and surfaces: Methods of interpolation, Bezier and B-splines, surface rendering methods: Gouraurd Shading, Phong Shading, Constant Intensity Shading, Fast Shading.

Text Books:-

1. Procedural elements for computer graphics by David F. Rogers, Mc-Graw Hill.

2. Computer Graphics 'C' Version, Second Edition By Donald Hearn and M.Pauline Baker, Pearson publication

3. Mathematical elements for computer graphics by David Rogers and J. AlanAdams, Tata Mcgraw Hill Education Private Limited

4. Computer graphics principles and practice in C by Foley, Vandam, Feiner and Huges (Pearson)

5. Principles of interactive computer graphics by Newman and Sproul.

Subject : **Computer Graphics** Subject Code : **BTCME502P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Practical based on above syllabus.

Subject: Java Programming Subject Code: **BTCME503T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To inculcate the Java programming concepts among the students in order to strengthen the programming logic.

Prerequisite(s): Basic programming Languages like C, C++ etc.

Course Objectives:

1	To teach principles of object oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism.
2	Impart fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3	Inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification;
4	Familiarize the concepts of packages and interfaces.
5	Facilitate students in handling exceptions.

Course Outcomes:

CO1	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP like encapsulation, Inheritance and Polymorphism
CO2	Design and develop java programs, analyze, and interpret object oriented data and report results.
CO3	Design an object oriented system, AWT components and multithreaded processes as per needs and specifications.
CO4	It help to succeed in competitive examinations like GATE, Engineering services, Technical interviews etc.
CO5	Plan their career in java based technologies like HADOOP etc

Unit I: **[7 Hours]**

JAVA BASICS: Review of Object oriented concepts, History of Java, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, simple java program, Static block, Static Data, Static Method. String handling and String Buffer Classes.

Unit II: **[7 Hours]**

OBJECT & CLASS: Object Oriented Programming , Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, methods, Inner Class & Anonymous Classes.

Unit III: **[8 Hours]**

INHERITANCE AND POLYMORPHISM: Basic concepts, Types of inheritance, Member access rules, Usage of this and super keyword, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword.

PACKAGES AND INTERFACES: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.

Unit IV: **[8 Hours]**

INPUT AND OUTPUT AND FILE HANDLING: Concepts of streams, Stream classes- Byte and Character stream, reading console Input and Writing Console output, Wrapper Classes, File Handling.

EXCEPTION HANDLING: Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes.

Unit V: **[6 Hours]**

MULTITHREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.

Text Books:

1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi

Reference Books:

1. Head First Java, O'rielly publications
2. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, PearsonEducation, India.
3. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
4. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India

Subject : **Java Programming** Subject Code : **BTCME503P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Practical based on above syllabus.

Subject: **Microcontrollers & Applications (Elective-I)** Subject Code: **BTCME504.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To realize the concepts of Microcontroller

Prerequisite(s): Microprocessor, Instructions set

Course Objectives: *(02-04)*

1	To provide understanding of basics of microcontroller
2	To enable students to understand features of 8051 microcontroller
3	Knowledge of working of microcontroller systems in various fields.

Course Outcomes: *(06)*

At the end of this course Student are able to:

CO1	Understand the difference between microprocessor & microcontrollers
CO2	Analyze the architecture of 8051 microcontroller.
CO3	Develop programs in assembly language.
CO4	Interface peripherals to microcontroller.
CO5	To impart the basic concepts of serial communication in 8051
CO6	Illustrate the use of microcontroller in different applications.

UNIT I: **[6 Hours]**

Introduction to Microcontroller: Block diagram of microcontroller: Comparison between microprocessor and microcontroller, Embedded Systems, Selection factors of microcontroller (Architecture type, speed, Word size, instruction set, memory, and I/O capability)

Types of Buses-Address, Data, Control, common features of Microcontrollers: On-chip Oscillator, program and data memory, I/O Ports, Watchdog- timer reset, Timers, Counters, and Interrupts.

UNIT II : **[8 Hours]**

The Microcontroller 8051: Features of 8051 microcontroller. Block diagram of 8051- program status word (PSW), accumulator, and program counter. Memory organization – RAM & ROM, register banks and stack, Pin out diagram- description of pins, special function registers (SFRs), I/O port organization, interrupts.

UNIT III: **[8 Hours]**

8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, and Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.

UNIT IV: **[8 Hours]**

8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.

UNIT V : **[6 Hours]**

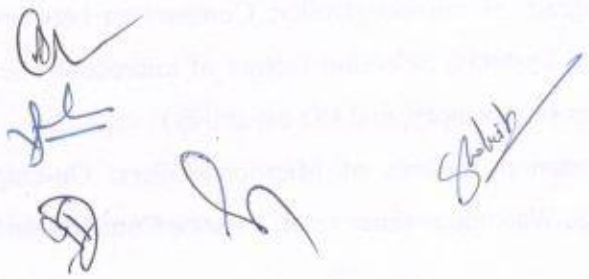
Applications based on IoT: Introduction of the Internet of Things, Types of sensors, Types of actuators, Introduction of Arduino Interfacing of the sensors and actuators with Arduino. Programming in Arduino. Design of a minor project based on Arduino

Text Books :-

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning
2. The 8051 Microcontrollers: Architecture, Programming and Applications, Rao Dr. K Uma, Pearson Education India, New Delhi, (Latest edition)

Reference Books:-

1. Microcontroller theory & application. Ajay Deshmukh, Tata McGraw- Hill
2. Microcontroller Architecture, programming, interfacing, & system design, Raj Kamal, Pearson Edition.



Subject: **Artificial Intelligence (Elective-I)** Subject Code: **BTCME504.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of Artificial Intelligence basics.

Prerequisite(s): None

Course Objectives:- ***(02-04)***

1	To understand the various characteristics of Intelligent agents.
2	To learn the different search strategies in AI.
3	To learn to represent knowledge in solving AI problems.
4	To understand the ways of planning and acting in the real world.

Course Outcomes:- **(06)**

At the end of this course Student are able to:

CO1	To design a plan for the real world problems and mapping it to the digital world
CO2	To identify problems that are amenably solved by AI methods
CO3	To apply the different knowledge representation for solving the problems
CO4	To apply the various planning strategies for real world problems.
CO5	To identify the uncertainty of solution to any problems and resolve it

UNIT I :- Introduction **[8 Hrs]**

Introduction - Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents – Typical Intelligent Agents - Problem Solving Approach to Typical AI problems.

UNIT II:- Problem Solving Methods **[8 Hrs]**

Problem solving Methods - Search Strategies - Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations -Backtracking Search

- Performance of search algorithms.

UNIT III:- Knowledge Representation **[7 Hrs]**

First Order Predicate Logic - Unification - Forward Chaining - Backward Chaining - Resolution – Knowledge Representation using First order Predicate logic - Reasoning Systems.

UNIT IV:- Planning **[6 Hrs]**

Planning with state-space search - partial-order planning - planning graphs - planning and acting in the real world- Plan generation systems.

UNIT V:- Uncertain Knowledge and Reasoning **[7 Hrs]**

Uncertainty - review of probability - probabilistic Reasoning - Bayesian networks - inferences in Bayesian networks - Temporal models - Hidden Markov models.

Text Book:-

1. S. Russel, P. Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Education, 2015.

Reference Books:-

1. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition, McGraw Hill, 2017.

2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007

Subject: **Software Engineering (Elective – I)** Subject Code: **BTCME504.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To Learn how to develop good quality software for a business system.

Prerequisite(s): None

Course Objectives: (02-04)

1	To comprehend the various software process models.
2	To understand the types of software requirements and SRS document.
3	To know the different software design and architectural styles.
4	To learn the software testing approaches and know about quality control and risk management.

Course Outcomes: ***(06)***

At the end of this course Student are able to:

CO1	To compare and select a process model for a business system.
CO2	To identify and specify the requirements for the development of an application.
CO3	To develop and maintain efficient, reliable and cost effective software solutions.
CO4	To critically think and evaluate assumptions and arguments of the client.
CO5	To understand the different software testing.
CO6	To understand the risk management and quality of software.

Unit I: **[6 Hours]**

Introduction to Software Engineering: The evolving role of software, Software myths. Software engineering- A layered technology, a process framework.

Process models: The waterfall model, Incremental process models, Evolutionary process models, Agile Process model.

Unit II: **[8 Hours]**

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation andanalysis, Requirements validation, Requirements management.

Requirements Analysis, Analysis Modeling Approaches, Data Modeling, Scenario-Based Modeling, Flow-Oriented Modeling, Class-based Modeling, Behavioral Model.

Unit III: **[9 Hours]**

Design Engineering: Design process and Design quality, Design concepts, the design model.
Creating an architectural design: Software architecture, Data design, Architectural Design.
Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution.
Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Unit IV: **[6 Hours]**

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black- Box and White-Box testing, Validation testing, System testing, the art of Debugging.
Product metrics: Software Quality, Metrics for Analysis Model, Metrics for Design Model

Unit V: **[7 Hours]**

Risk management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection
Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability.

Text books:

1. Software Engineering A practitioner's Approach, Roger S Pressman, 6th edition. McGrawHill International Edition.
2. Software Engineering, Ian Sommerville, 7th edition, Pearson education.

Reference books:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
2. Software Engineering: A Primer, Waman S. Jawadekar, Tata McGraw-Hill, 2008

Subject: **Effective Technical Communication** Subject Code: **BTCME505T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
(3 Hrs. +1Hr.) (L+ T)	3	15	35	50

Aim: To develop a confidence and communication skills among students in order to face the interviews confidently.

Prerequisite(s): None

Course Objectives: (02-04)

At the end of the semester,

1	Students will have enough confidence to face competitive examinations (IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.)
2	They will also acquire language skills required to write their Reviews / Projects / Reports.
3	They will be able to organize their thoughts in English and hence face job interviews more confidently.

Course Outcomes: ***(06)***

After completing the course, students will

CO1	Acquire knowledge of structure of language.
CO2	Be able to face competitive exams and the interview process and can become employable.
CO3	Develop business writing skills.
CO4	Become familiar with technology enabled communication and can develop technical and scientific writing skills.

Syllabus

Unit 1. Functional Grammar: **[7Hrs]**

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: **[5 Hrs]**

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 **[5 Hrs]**

Business Letters, (Enquiry, Quotation, Order, Complaint), Job applications and ResumeWriting, e-mail etiquette, Writing Memorandum, Circulars, notices, Analytical comprehension

Unit IV. Technical & Scientific Writing: **[7 Hrs]**

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, 2010,
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, 3rd edition, Pearson Education Asia, 2000
6. Developing Communication skills by Krishna Mohan & Meera Banerjee.

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Sixth Semester:-

S. N.	Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
			L	T	P	CA	UE	Total		
1	BTCME601T	Design and Analysis of Algorithms	3	-	-	30	70	100	3	PCC-CS
2	BTCME601P	Design and Analysis of Algorithms- Lab	-	-	2	25	25	50	1	PCC-CS
3	BTCME602T	TCP/IP	3	-	-	30	70	100	3	PCC-CS
4	BTCME602P	TCP/IP -Lab	-	-	2	25	25	50	1	PCC-CS
5	BTCME603T	Elective-II	3	-	-	30	70	100	3	PEC-CS
6	BTCME604T	Elective-III	3	-	-	30	70	100	3	PEC-CS
7	BTCME605T	Open Elective-I	3			30	70	100	3	OEC-CS
8	BTCME606P	Emerging Technology Lab -II	-	-	2	25	25	50	1	PCC-CS
9	BTCME607P	Mini Project & Internship	-	-	6	25	25	50	3	PROJ-CS
10	BTCME608	Seminar / Presentations on Current trends	-	-	2	50	-	50	Audit	MC
Total			**15**	**00**	**14**	**300**	**450**	**750**	**21**	

Elective-II: -

BTCME603.1T - Human Computer Interaction

BTCME603.2T - Internet of Things

BTCME603.3T - Soft Computing

Elective-III: -

BTCME604.1T - Distributed Computing

BTCME604.2T - Machine Learning

BTCME604.3T - Data Warehousing & Mining

Open Electives -I:

BTCME605.1T - Digital Image Processing

BTCME605.2T - Mobile Computing

(Dr. A.N. Thakare)

(Prof. V.P. Thakare)

(Prof. S.J Dudte)

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Sixth Semester:-

Subject : **Design and Analysis of Algorithms** Subject Code : **BTCME601T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To design the algorithm and analyze it for any real life problem.

Prerequisite(s): Data Structures, Programming Logic

Course Objectives:

1	To understand the importance of algorithm
2	To analyze the complexity of an algorithm in terms of time and space complexities
3	To understand various problem solving techniques
4	To learn about amortized analysis of algorithms
5	To design and implement various programming paradigms and its complexity

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

CO1	To design and analyse the time and space complexity for any algorithm
CO2	Apply the design techniques of algorithm in solving real life problems
CO3	Apply the design techniques of algorithm using dynamic programming in solving real life problems
CO4	Perform amortize analysis for any algorithm
CO5	Understand NP class of problems and propose approximation algorithms for the same

[08 Hrs]

UNIT I:- Introduction

Algorithms , Examples , Tournament method , Evaluating polynomial functions , pre,processing of coefficients ,solving recurrence equations, Asymptotic notations of analysis of algorithms, Complexity

UNIT II:- Divide & Conquer and Greedy Approaches **[08 Hrs]**

Divide and Conquer method , Strassen's matrix multiplication , Greedy method , Huffman code , Minimum spanning trees , Dijkstra algorithm , Knapsack problem , Job sequencing with deadlines.

UNIT III:- Dynamic Programming Approaches **[08 Hrs]**

Dynamic Programming , Knapsack problem , Matrix Chain Multiplication , longest common subsequence Multistage graphs , All pair"s shortest paths , Optimal binary search trees Travelling salesman problem.

UNIT IV:- Amortization **[06 Hrs]**

Randomized Algorithms and Amortized Analysis , Las Vegas and Monte Carlo types , Randomized quick sort and its analysis , Min-Cut algorithm.

UNIT V:- NP Problems **[06 Hrs]**

NP,Hard and NP,complete problems , Basic concepts , Reducibility , Vertex cover,3 , CNF , clique ,Hamiltonian cycle , TSP , Approximation algorithms , Vertex cover , TSP.

Text Book:-

1. Thomas H. Cormen, C. Lieserson, R. Rivest, C. Stein, "Introductions to Algorithms", Third Edition, Prentice,Hall/India, 2009.

2. "Fundamentals of Computer Algorithms", Horowitz, Sahani, Rajsekharan, Galgotia Publications.

Reference Books:-

1. M. Tenenbaum, Augestien, "Data Structures using C", Third Edition, Pearson Education, 2007.

2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Universities Press Pvt. Ltd., 2012.

Subject : **Design and Analysis of Algorithms** Subject Code : **BTCME601P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Practical based on above syllabus.

Subject: **TCP/IP** Subject Code: **BTCME602T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of networking and the different protocols.

Prerequisite(s): Introduction to Computer Network

Course Objectives: (02-04)

1	To understand the network architecture, internetworking concept and internet standards.
2	To know the classless addressing with address resolution protocols.
3	To gain the knowledge of IP layer protocols.
4	Comprehend the TCP and the IP Security.

Course Outcomes: ***(06)***

At the end of this course Student are able to:

CO1	Understand the basics concepts of internetworking.
CO2	Comprehend the various address resolution protocols.
CO3	Use and adapt the IP layer protocols.
CO4	Understand the concept of Transmission control protocol.
CO5	Apply the security to the IP layer.

Unit I: Introduction to Networking **[08 Hrs]**

Network architecture-Standards, Comparison of OSI & TCP/IP Model, Connecting Devices, Internetworking concept, Internet Backbones, NAP, ISPs, RFCs and Internet Standards.

Unit II: Internet Addresses & Address Resolution Protocols **[06 Hrs]**

Classless Internet address (IPV4), CIDR-Subnetting and Supernetting, IPV6 Addresses: Addressing, Packet Format, Transition from IPV4 to IPV6. ARP, RARP, DHCP.

Unit III: Internet Protocols **[07 Hrs]**

IP Datagram-IP Package-IP forwarding and routing algorithms, computing paths, RIP OSPF,BGP ICMPV4, IGMP.

Unit IV: Transmission Control Protocol **[08 Hrs]**

TCP header, services, Connection establishment and termination, Interactive data flow, Bulk data flow, Flow control and Retransmission, TCP timers, Urgent Data processing, Congestion control.

Unit V: IP security protocol **[07 Hrs]**

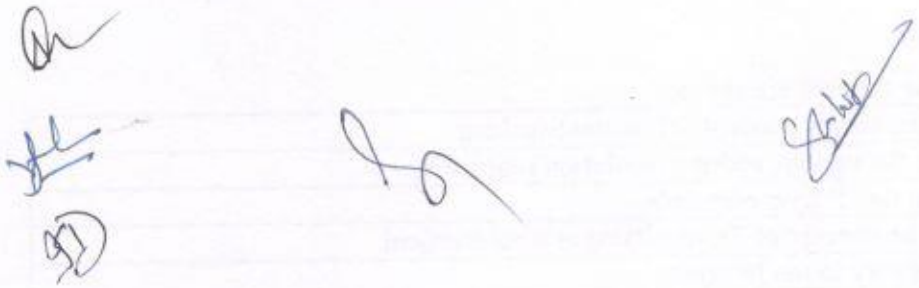
IPv6 addresses, Packet format, Multicast, ICMPv6, Interoperation between IPv4 and IPv6-QoS, Auto configuration.

Text Books:

TCP/IP Protocol Suite, Behrouz A. Forouzan, 4th Edition, Tata McGraw Hill Publication.

Reference Books:

Internetworking with TCP/IP - Principles, Protocols, and Architecture, Douglas E. Comer, 5th edition Volume-1, Prentice Hall, 2006.



Subject : **TCP/IP** Subject Code : **BTCME602P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Practical based on above syllabus.

Subject : **Human Computer Interaction (Elective-II)** Subject Code : **BTCME603.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of machine learning algorithms & apply to solve the real world problems.

Prerequisite(s): Knowledge of I/O devices, Mobile Application, Web Application,

Course Objectives:

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: After completing the course, students will be able to

CO1	Describe the capabilities of both humans and computers
CO2	Design effective dialog for HCI
CO3	Identify the stake holder's requirements and choose the appropriate models
CO4	Develop mobile HCI using mobile elements and tools
CO5	Design Web interfaces using different techniques.

UNIT I :- FOUNDATIONS OF HCI **[08 Hrs]**

The Human: I/O channels , Memory , Reasoning and problem solving; The computer: Devices, Memory ,processing and networks; Interaction: Models, frameworks , Ergonomics, styles, elements, interactivity-Paradigms.

UNIT II:- DESIGN & SOFTWARE PROCESS **[09 Hrs]**

Interactive Design basics , process , scenarios , navigation , screen design , Iteration and prototyping. HCI in software process , software life cycle , usability engineering , Prototyping in practice , design rationale. Design rules , principles, standards, guidelines, rules. Evaluation Techniques , Universal Design.

Subject : **Internet of Things (Elective-II)** Subject Code : **BTCME603.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To impart the concepts of Internet of Things

Prerequisites: Digital Electronics, Concepts in Computer Engineering

Course Objectives:

1	To provide understanding of design of Computer Architecture and organisation.
2	To provide understanding of issues involved in design of control unit.
3	To develop understanding of concepts of memory organisation and its interfacing.

Course Outcomes

CO1	Students will be able to analyze the development of computers.
CO2	Students will be able to identify the concept of CISC and RISC architecture
CO3	Students to understand Microprocessor, memory and its interfacing

Unit I: Introduction to IoT **[10 hours]**

Characteristics of IoT, IOT- ecosystem, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models/reference model of IOT.

Unit II : **[8 Hours]**

Data Link protocols- IEEE 802.15.4e , IEEE 802.11ah,

Transport an session layer protocols – Transport layer TCP, UDP

Session Layer protocols- HTTP, CoAP, XMPP, AMQP, MQTT

Unit III : **[5 Hours]**

Domin specific IOT: Home automation, smart cities, Environmental, retail, logistics, Agriculture, Health, Lifestyles

Unit IV : Building blocks of IOT analytics **[6 Hours]**

Introduction, IOT Data and BigData, Challenges of IOT analytics applications, cloud based IOT platform, IaaS, PaaS and SaaS paradigms.

UNIT III:- MODELS AND THEORIES **[06 Hrs]**

Cognitive models ,Socio-Organizational issues and stake holder requirements ,Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV:- MOBILE HCI **[07 Hrs]**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V:- WEB INTERFACE DESIGN **[06 Hrs]**

Designing Web Interfaces , Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Text Books:-

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III).

2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009 (UNIT ,IV).

3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly,2009.(UNIT-V).

Unit V : Tools **[7 Hours]**

A review of Tools : Tools and platforms and data reasoning. IOT analytics application and case studies.

Text Books :

1. Internet of Things, Srinivasa K. G, Siddhesh G.M, Hanumantha Raju.R, Cengage Publications
2. Building blocks for IOT Analytics, John Soldatos, River Publishers

Reference Books :

1. Internet of Things, Srinivasa K. G, Siddhesh G.M, Hanumantha Raju. R, Cengage Publications
2. Building blocks for IOT Analytics, John Soldatos, River Publishers

Subject : **Soft Computing (Elective-II)** Subject Code : **BTCME603.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of soft computing and apply to solve the problems.
Prerequisite(s): None
Course Objectives:-

To expose the ideas of Neural networks, fuzzy logic and concepts of Genetic algorithm and its applications to soft computing

Course Outcomes: The students will be able to:

CO1	Recognize the feasibility of applying a soft computing methodology for a particular problem
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO3	Apply Neuro-fuzzy modeling techniques to solve engineering problems
CO4	Apply genetic algorithms to combinatorial optimization problems.
CO5	Apply swarm optimization techniques to solve the particular problems.

Unit1 **[08 hrs]**

Artificial Neural Networks: Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohnen's self organizing networks - Hopfield network.

Unit2 **[08 hrs]**

Fuzzy Systems: Fuzzy sets and Fuzzy reasoning - Fuzzy matrices - Fuzzy functions - Decomposition -Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

Unit3 **[08 hrs]**

Neuro - Fuzzy Modeling: Adaptive networks based Fuzzy interface systems - Classification and Regression Trees -Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls -Simulated annealing – Evolutionary computation.

Unit4 **[06 hrs]**

Genetic Algorithms: Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction -Rank method - Rank space method.

Unit5 **[06 hrs]**

Swarm Optimization: Ant Colony Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization

Text Books/Reference Books:-

1. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall 1998.

2.Laurene Fausett, "Fundamentals of Neural Networks", Prentice Hall, 1994.

3.George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA 1995.

4.N. J. Nelsson, "Artificial Intelligence - A New Synthesis", Harcourt Asia Ltd., 1998.

5.D. E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y, 1989

Subject: **Distributed Computing (Elective-III)** Subject Code: **BTCME604.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To realize the concepts of Distributed Computing

Prerequisite(s): concept of data structure, networking and operating system

Course Objectives: *(02-04)*

1	To introduce students to the fundamental problems, concepts, and approaches in the design and analysis of distributed computing systems and applications.
2	To prepare students for an industrial programming environment.

Course Outcomes: *(06)*

At the end of this course Student are able to:

CO1	To develop and apply knowledge of distributed computing.
CO2	Design a model of distributed computation.
CO3	To understand the concept of logical and global time for message communication
CO4	To analyze the terminology of distributed algorithm
CO5	To apply the knowledge of termination detection algorithm

UNIT I **[7 Hours]**

Introduction: Definition, relation to computer system components, Motivation, Relation to parallel multiprocessor / multicomputer system, Message passing versus Shared memory, Primitive for distributed communication , Synchronous versus asynchronous execution.

UNIT II **[7Hours]**

Distributed Computation:- A model of Distributed Computation:- A distributed program ,A model of distributed execution, model of communication network , Global state of a distributed system , Cuts of distributed computation , Model of process communication.

UNIT III **[7 Hours]**

Logical time:-Introduction, A framework for a system of logical clocks Scalar time, Vector

time, Efficient implementations of vector clock Global state and snapshot recording algorithms:- Introduction ,System model and definitions ,Snapshot algorithms for FIFO channels ,Variations of the Chandy–Lamport algorithm.

UNIT IV **[7 Hours]**

Terminology and basic algorithms: - Topology abstraction and overlays, Classifications and basic concepts Complexity measures and metrics, Program structure, Message ordering paradigms:- Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system

UNIT V **[8 Hours]**

Termination detection:-Introduction, System model of a distributed computation, Termination Detection using distributed snapshots, Termination detection by weight throwing, a spanning-tree-based termination detection algorithm , Message-optimal termination detection ,Termination detection in a very general distributed computing model.

Text Books :-

1. Distributed Computing :-- Principles , Algorithm and Systems by Ajay D. Kshemkalyani and Mukesh Singhal.

Reference Books:-

1. Programming Distributed Computing Systems: A Foundational Approach by Carlos A. Varela

   Elements of Distributed Computing by Vijay K. Garg

Subject : **Machine Learning (Elective-III)** Subject Code : **BTCME604.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the concept of machine learning algorithms & apply to solve the real world problems.

Prerequisite(s): Knowledge of Artificial Intelligence

Course Objectives:

1	To provide a broad survey of different machine learning approaches and techniques
2	To understand the principles and concepts of machine learning
3	To understand neural networks concepts
4	To learn regression and reinforcement learning
5	To develop programming skills that helps to build real world applications based on machine learning

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

CO1	Solve typical machine learning problems
CO2	Represent data to facilitate learning
CO3	Design and implement various machine learning algorithms for real world applications
CO4	Suggest supervised /unsupervised machine learning approaches for any application
CO5	Handle tools of machine learning

UNIT I: Introduction **[08 Hrs]**

Introduction: Machine learning: What and why? Types of Machine Learning, Supervised Learning, Unsupervised Learning, The Curse of dimensionality , Over and under fitting , Model selection, Error analysis and validation , Parametric vs. non, parametric models.

UNIT II: Machine Learning **[07 Hrs]**

Types of Machine Learning , Supervised Learning , Classification models , Naïve Bayes Classifier – Decision trees , Support Vector Machines , KNN model , Dimensionality reduction ,PCA.

UNIT III Clustering **[07 Hrs]**

Clustering approaches, Mean Shift clustering , Clustering data points and features – Bi, clustering, Multi, view clustering, K-Means clustering , K-medians clustering , Expectation Maximization (EM).

UNIT IV Neural Networks **[08 Hrs]**

Neural networks , Biological motivation for Neural Network , Neural network Representation , Perceptron – Feed forward networks , Multilayer Networks and Back Propagation Algorithms , Hidden layer representation ,Application of neural network.

UNIT V Applications and Tools **[06 Hrs]**

Linear models for regression, Reinforcement Learning, Machine Learning Tools, Engineering applications.

Text Books:-

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Ethem Alpaydin, "Introduction to Machine Learning", Second Edition, Prentice Hall of India, 2010.

Reference Books:-

1. Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms and Applications", Pearson Education, 2008.
2. Tom Mitchell, "Machine Learning", McGraw,Hill, 1997.
3. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007. CSE Dept. Flexible Curriculum NITTUGCSE21 183
4. Simon Haykin, "Neural Networks and Learning Machines", Pearson 2008

Subject : **Data Warehousing & mining (Elective-III)** Subject Code : **BTCME604.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim : To study the concepts in order to understand how to provide the organization with a reliable source of data and with hidden insights that cannot otherwise be gleaned from large-scale data.

Prerequisites : Database Management Systems

Course Objectives :

1	To understand the various concepts needed to design, develop, and maintain a data warehouse.
2	To analyze data, choose relevant models and algorithms for respective applications.

Course Outcomes

CO1	Understand the need, definition, applications, components, processes & Architecture of a Data Warehouse.
CO2	Learn business requirements, dimensional modeling for designing database schemas for a Data Warehouse.
CO3	Understand Data and Data Mining Principles
CO4	Illustrate frequent pattern mining methods, such as Apriori, ECLAT, and FPgrowth.
CO5	Identify appropriate data mining algorithms to solve real world problems
CO6	Apply different data mining techniques for classification and prediction.

Unit I : **[08 hours]**

Introduction to data warehousing, evolution of decision support systems, Data warehouse life cycle, building a data warehouse, Data Warehousing Components, Data Warehousing Architecture, Trends in data warehousing Data marts, Metadata

Unit II : **[08 Hours]**

Online Analytical Processing (OLAP), ROLAP, MOLAP, HOLAP, & DOLAP, OLAP Implementation, OLAP Tools, Multidimensional Databases (MDDBs), SQL Features for DW.

Unit III : **[06 Hours]**

Introduction to data mining: What is Data Mining? What is the Data Mining Process? Basic Data Mining Tasks, Problem Identification, Data Mining Metrics, Data Cleaning (pre-processing, feature

selection, data reduction, feature encoding, noise and missing values, etc.), Key Issues, Opportunities for Data Mining.

Unit IV : **[06 Hours]**

Mining frequent patterns, associations and correlations: Basic concepts, efficient and scalable frequent item set mining algorithms, mining various kinds of association rules – multilevel and multidimensional, association rule mining versus correlation analysis, constraint based association mining.

Unit V : **[08 Hours]**

Classification and prediction: Definition, decision tree induction, Bayesian classification, rule based classification, classification by backpropagation and support vector machines, associative classification, lazy learners, prediction, accuracy and error measures.

Text Books:-

1. Han, J. and Kamber, M., "Data Mining - Concepts and Techniques", 3rd Ed., Morgan Kaufmann Series.
2. Ali, A. B. M. S. and Wasimi, S. A., "Data Mining - Methods and Techniques", Cengage Publishers
3. Ponniah Paulraj, "Data Warehousing Fundamentals for IT Professionals", WSE, 2ed., 2010.

Reference Books:-

1. Tan, P.N., Steinbach, M. and Kumar, V., "Introduction to Data Mining", Addison Wesley – Pearson.
2. Pujari, A. K., "Data Mining Techniques", 4th Ed., Sangam Books.

E-Book:- Mining the Social Web Data Mining Facebook Twitter LinkedIn Instagram by Matthew A. Russell & Mikhail Klassen
https://www.pdfdrive.com/mining-the-social-web-data-mining-facebook-twitter-linkedin-instagram-e185781408.html

On line TL Material:- https://nptel.ac.in/courses/106/105/106105174/

Subject : **Digital Image Processing (Open Elective-I)** Subject Code : **BTCME605.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand the fundamentals of digital image processing and to develop the students ability to apply these tools in various image processing techniques.

Prerequisites : Signals and systems, Calculus and probability, Basic programming skills.

Course Objectives : The student should be made to:

1	Learn digital image fundamentals and will be exposed to simple image processing techniques.
2	Be familiar with image compression and segmentation techniques and learn to represent image in form of feature

Course Outcomes: - Upon successful completion of this course, students will be able to:

CO1	Discuss digital image fundamentals.
CO2	Apply image enhancement and restoration techniques.
CO3	Use image compression and segmentation Techniques.
CO4	Represent features of images.

Unit I:- Introduction **[08 hours]**

Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbours and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

Unit II:-Image Enhancement In The Spatial Domain **[08 Hours]**

Some Basic Grey Level Transformations, Histogram Processing, Enhancement Using Arithmetic / Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit III:- Image Enhancement In Frequency Domain **[06 Hours]**

Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.

Unit IV:- Image Segmentation **[06 Hours]**

Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

Unit V:- Image Compression: **[08 Hours]**

Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.

Text Books:- Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition, 2008.

Reference Books:-

1. William K Pratt, "Digital Image Processing", John Willey, 2002.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India
3. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Ed, 2016
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
5. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

On line TL Material:-

http://eeweb.poly.edu/~onur/lectures/lectures.html.

http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

Subject : **Mobile Computing (Open Elective-I)** Subject Code : **BTCME605.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To impart the concepts of Mobile Computing

Prerequisites: Digital Electronics, Concepts in Computer Engineering

Course Objectives:

1	To provide understanding of design of Mobile Wireless Networking
2	To provide understanding of issues involved in Mobile Computing
3	To develop understanding of concepts of Methods involved in Mobile Computing

Course Outcomes

CO1	Students will be able to analyze the Mobile networking
CO2	Students will be able to identify the issues involved in it.
CO3	Students to understand Methods used in Mobile Computing

Unit I : WIRELESS COOMUNICATION **[8 Hours]**

Introduction to Wireless communication, Objectives, The cellular Concept, System design & fundamentals, Frequency reuse, Channel Assignment & handoff strategies, Adjacent Channel interference, cell splitting, Sectoring.

Unit II : INTRODUCTION TO GSM **[6 Hours]**

Architecture, Radio Subsystem, Channel types, GSM frames structure, SDMA-FDMA-TDMA-CDMA, Cellular wireless networks, Wireless LAN-IEEE 802.11 standards: Architecture, services, MANET: Wifi & Wimax,

Unit III : MOBILE NETWORKS **[6 Hours]**

Sensor Networks, Peer to Peer networks, mobile routing protocols:- DSR, AODV, reactive routing-Location Aided routing- Mobility models- Entity based-group mobility-Random ways point mobility model.

Unit IV : MOBILE NETWORKS LAYER **[8 Hours]**

Mobile IP, dynamic host, configuration protocols, Adhoc Networks. MOBILE TRANSPORT LAYER: Traditional TCP, Indirect TCP, Snooping TCP, Mobile -TCP, Transaction oriented TCP.

Unit V : MOBILE NETWORKS **[8 Hours]**

Issues & challenges- Security issues, Authentication in Mobile application, privacy issues, power management, Energy awareness computing, Mobile IP& Adhoc Network -VOIP application.

Text Books :-

1. Theodore S. Rappaport- Wireless Communication Principals & Practice Prentice Hall
2. Mobile Communication-Jochen Schiller, Adison Wesley, 2000
3. Wireless Communication & Networks-W. Stallings, Prentice Hall.

Reference Books :-

1. Lee. W. C.Y- Mobile Communication Engineering, Theory & Application ,II Edition
2. Principles of wireless Networks- Pahlavank & krishnamurthy. P
3. Mobile & wireless Networks-Black U.D.
4. Mobile Computing Technology, Applications and Service Creation Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw HiLL

Subject : **Emerging Technology Lab-II** Subject Code : **BTCME606P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Practical List

Emerging Technology Lab-II is based on the following tools.

AI	Natural Language Toolkit (NLTK),SpaCy, PyTorch-NLP, Natural,Retext, TextBlob
DS	KNIME, Spark, Neo4J, MongoDB, Hive, Storm,
IoT	Devicehub, Zetta, Node-RED, Flutter, M2MLabs Mainspring

Subject : **Mini Project & Internship** Subject Code : **BTCME607P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs (Practical)	1	25	25	50

Course Objective:

1	To develop an understanding of applications in real life
2	To develop research skills of students
3	To help the students in exploring career opportunities in their areas of interest
4	To give an insight into the overall functioning of the organizations where students visited
5	To develop Industry Institute Interaction
6	To provide means to immerse students in actual supervised professional experiences.

Constraints:

1. Students shall work in groups of 4-5 each and work on small application or research based / Industry Oriented real time problems.
2. Local Mentor and Industry mentor shall work in coordination.
3. Industry visit should be planned to explore students about real time problems.
4. Students shall work on providing solutions to identified problems.
5. Detailed reports are expected to be submitted at the end using Standard Technical Writing Tool.
6. Evaluation should be done based on feedback of Local and Industry Mentor.

Expected Outcome:

1. Real Time Problem Identification
2. Requirement analysis and identification of relevant data sources
3. Literature survey / Industrial survey
4. Overall Project development as per the phases of SDLC

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

Fifth Semester:-

S. N.	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1	Artificial Intelligence	3	1	-	30	70	100	4	PCC-CS
2	Artificial I Intelligence-Lab	-	-	2	25	25	50	1	PCC-CS
3	Design & Analysis of Algorithms	3	1	-	30	70	100	4	PCC-CS
4	Design & Analysis of Algorithms –Lab	-	-	2	25	25	50	1	PCC-CS
	Software Engineering & Project Management	3	-	-	30	70	100	3	PCC-CS
5	Elective-I	3	-	-	30	70	100	3	PEC-CS
6	Effective Technical Communication	2	-	-	15	35	50	2	HSMC
7	Profesional Skills Lab I			2	25	25	50	1	ESC
8	Yoga and Meditation (Audit Course)	2	-	-	50	-	-	Audit	MC
	Total	**16**	02	**06**			**600**	**19**	

Elective-I: 1. TCP/IP 2. Design Patterns 3. Data Warehousing and Mining

[Mrs. B. P. Dharaskar]

Dr. S. V. Sonekar
chairman

[Ms. Mona Nilchandani]

Dr. M. V. Bramhe

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

Subject: **Artificial Intelligence** Subject Code: **BTECH_CSE-501T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12]=48 Hrs	**3+1=4**	**30**	**70**	**100**

Aim: To understand the basic principles and concepts of Artificial Intelligence.

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

Course Objectives:

1	To create appreciation and understanding the achievements of AI and the theory underlying those achievements
2	To create an understanding of the basic issues of knowledge representation

Course Outcomes:

At the end of this course students are able to:

CO1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	To create an understanding of the basic issues of knowledge representation
CO4	Formulate and solve problems with uncertain information using Bayesian approaches.
CO5	Attain the capability to represent various real life problem domains using logic based techniques and

SYLLABUS:

UNIT-I

Introduction: What is AI? History & Applications, Artificial intelligence as representation & Search, Production system, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.

UNIT-II

Search Techniques: Uninformed Search techniques, Informed Heuristic Based Search, Generate and test, Hill-climbing, Best-First Search, Problem Reduction, and Constraint Satisfaction.

UNIT-III

Knowledge representation: Knowledge representation Issues: First order logic, Predicate Logic, Structured Knowledge Representation: Backward Chaining, Backward Chaining, Resolution,Semantic Nets, Frames, and Scripts, Ontology.

UNIT-IV

Uncertainty: Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks, Exact and Approximate inference in Bayesian Networks, Fuzzy Logic.

Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

UNIT-V

Learning: What is learning?, Knowledge and learning, Learning in Problem Solving, Learning from example, learning probabilistic models

Expert Systems: Fundamental blocks, Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Basic understanding of Natural language

Text Books:

1. E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
3. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers
4. Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd Edition

Reference Books:

1. Introduction to Artificial Intelligence – Charniak (Pearson Education)

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Artificial Intelligence LAB 501P**

Subject Code: **BTECH_CSE-**

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

Aim: This lab is aimed to provide students a complete insight of the implementation of different Artificial Intelligence algorithms.

Course Objectives:

1	To create appreciation and understanding the achievements of AI and the theory underlying those achievements
2	To create an understanding of the basic issues of knowledge representation

Course Outcomes:

Expected experiments to be performed (Not limited to):

Using the Python Libraries for Artificial Intelligence

1. **AIMA-Python**
2. **PyDatalog**
3. **Simple**
4. **Easy**

Write programs based on the following:

1. Graph search algorithms
2. Adversarial search
3. Knowledge representation
4. Logical inference
5. Probability theory
6. Bayesian networks
7. Markov models
8. Constraint satisfaction
9. Machine learning
10. Reinforcement learning
11. Neural networks
12. Natural language processing

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Design and Analysis of Algorithms** Subject Code: **BTECH_CSE-502T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12]=48 Hrs	**3+1=4**	**30**	**70**	**100**

Course Objectives:

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 Outcome:

At the end of this course students are able to:

CO1	Illustrate 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- Warshall algorithm.

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, Hamiltonian 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.

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

Subject: **Design and Analysis of Algorithms LAB** Subject Code: **BTECH_CSE-502P**

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

Course Objectives:

1	To learn the importance of designing an algorithm in an effective way by considering space and time complexity
2	To learn graph search algorithms.
3	To study network flow and linear programming problems
4	To learn the dynamic programming design techniques.
5	To develop recursive backtracking algorithms.

Course Outcome:

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

CO1	Calculate the time complexity of algorithm.
CO2	Sort the given numbers using various sorting algorithms.
CO3	Develop programs for the problems using Divide and Conquer and greedy methods.
CO4	Develop programs for the problems using Dynamic programming.
CO5	Students will be able to write programs for the problems using Backtracking.

Expected experiments to be performed (Not limited to):

1. To find Time complexity of an algorithm.
2. To find Space complexity of an algorithm.
3. To find HCF and LCM of two numbers
4. Code and analyses to find median element in an array of integers.
5. Code and analyse to find majority element in an array of integers.
6. Code and analyse to sort an array of integers using merge sort
7. Code and analyse to sort an array of integers using quick sort
8. To implement maximum and minimum problem using divide and conquer strategy
9. To implement binary search using divide and conquer strategy
10. To implement program of Heap Sort.
11. WAP of minimum spanning tree using Kruskal algorithm.
12. WAP of minimum spanning tree using Prim's algorithm.
13. WAP to implement matrix chain multiplication
14. Code to find the shortest path in graph using Dijkstra's algorithm.
15. Code to find the shortest path using Bellman-Ford algorithm.
16. To implement LCS problem using Dynamic Programming.
17. To implement matrix chain multiplication problem using dynamic programming.
18. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
19. Code and analyze to find all occurrences of a pattern P in a given string S.
20. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as:
    (i) to find the topological sort of a directed acyclic graph.
    (ii) to find a path from source to goal in a maze.
21. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as
    (i) to find connected components of an undirected graph.
    (ii) to check whether a given graph is bipartite.

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

Subject: **Software Engineering and Project Management** Subject Code: **BTECH_CSE-503T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**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 application.
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 Projec Management

SYLLABUS:

UNIT-I

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 Design,
Architectural Design, Mapping data flow into software architecture, Cohesion, Coupling, User interface analysis and Design.

UNIT-IV

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

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

UNIT-V

Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Software Reliability, Change Management: Software Configuration Management, SCM Repository, SCM Process, Reengineering: Software reengineering, Reverse Engineering, Restructuring, Forward Engineering

Text Books:

1. Software Engineering-A Practitioner's Approach (Sixth Edition) by Roger Pressman (TMH)
2. Software Engineering (Ninth Edition)-Ian 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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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 1: TCP/IP** Subject Code: **BTECH_CSE-504.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	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 I:

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-Subnetting and Supernetting, 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, signaling 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 between IPv4 and IPv6-QoS, Auto configuration, Stateless address auto configuration (SLAAC), ACL.

Text books:

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

Reference books:

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

Subject: **Elective 1: Design Patterns** Subject Code: **BTECH_CSE-504.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.(Theory)	**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	Be capable of applying knowledge to create an architecture for given application.
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, 2nd 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

Subject: **Elective 1: Data Warehousing and Mining** Subject Code: **BTECH_CSE-504.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.(Theory)	**3**	**30**	**70**	**100**

Aim: To understand the overall architecture of a data warehouse and methods for data 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, clustering on a set of data.
CO4	Able to identify frequent data items and to apply association rule on a set of data.
CO5	To learn recent trends of data mining such as web mining.

SYLLABUS:

UNIT I

Introduction: Characteristics, Operational database systems and data warehouse (OLTP & OLAP), Multidimensional data models, Data 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 task primitives, Major issues and challenges in data mining, Data preprocessing- need for processing, data cleaning, integration, transformation, data reduction, data mining 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, Naive based methods.

Clustering: Cluster analysis, Desired features, Types of data in cluster analysis, Computing distance. Categorizations of major clustering methods – Partitioning methods (K-means, EM), Hierarchical methods (agglomerative, divisive).

UNIT IV

Mining frequent patterns and Association Rules: Market basket analysis, Frequent item sets and association rules, Apriori algorithm, FP growth algorithm, Improving efficiency of Apriori and FP growth algorithms.

UNIT V

Web Data Mining: Introduction, Graph properties of web, Web content mining, Web structure mining, Web usage mining, Text mining, Visual web data mining, Temporal and Spatial data mining.

TEXT BOOKS:

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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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Professional Skills Lab I** Subject Code: **BTECH_CSE-505P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/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**

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

Subject: **Effective Technical Communication** Subject Code: **BTECH_CSE-506T**

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 masters 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. Be 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.

Unit 1. 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 otherlanguages, 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 ResumeWriting, 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 UniversityPress, 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 andBehavioral Sciences by Krathwohl & R David

5. *Technical Writing- Process and Product* by Sharon J. Gerson & Steven M. Gerson, 3rd edition, Pearson Education Asia, 2000
6. *Developing Communication* skills by Krishna Mohan & Meera Banerjee

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Audit Course:** Yoga & Meditation Subject Code: **BTECH_CSE-507T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/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 Iyengar 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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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Audit Course:** Yoga & Meditation Subject Code: **BTECH_CSE-507T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/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.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Examination Scheme and Syllabus

Sixth Semester:-

S. N.	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1	Compiler Design	4	-	-	30	70	100	4	PCC-CS
2	Compiler Design -Lab	-	-	2	25	25	50	1	PCC-CS
3	Elective-II	3	-	-	30	70	100	3	PEC-CS
4	Elective-III	3	-	-	30	70	100	3	PEC-CS
5	Open Elective-I	3	-	-	30	70	100	3	OEC
6	Professional Skills Lab II	-	-	2	25	25	50	1	PCC-CS
7	Hardware Lab	-	-	2	25	25	50	1	ESC
8	Mini Project	-	-	6	50	50	100	3	PROJ-CS
9	Economics of IT Industry	2	-	-	15	35	50	2	HSMC
10	Intellectual Property Rights (AuditCourse)	2	-	-	50	-	-	Audit	PCC
	Total	**17**	**-**	**12**			**700**	**21**	

Elective-II: - 1. Machine Learning 2. Internet of Things 3. Cluster and Cloud Computing

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

Open Elective 1:- 1. Linux Fundamentals 2. Android Application Development 3. Blockchain Technologies

[Mrs. B. P. Dharaskar]

Dr. S. V. Sonekar
Chairman

[Ms. Nova Nulchandani]

Dr. M. V. Bramhe

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

Subject: **Compiler Design** Subject Code: **BTECH_CSE-601T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
48 Hrs	**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-I:
Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

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-flow 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&Yacc, Levine R. John, Tony Mason and Doug Brown

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

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

Subject: **Compiler Design Lab** Subject Code: **BTECH_CSE-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 generating 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.

Expected experiments to be performed (Not limited to):

1. Sample programs using LEX.
2. Scanner Generation using LEX.
3. Elimination of Left Recursion in a grammar.
4. Left Factoring a grammar.
5. Top down parsers.
6. Bottom up parsers.
7. Parser Generation using YACC.
8. Intermediate Code Generation.
9. Target Code Generation.
10. Code optimization

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Machine Learning** Subject Code: **BTECH_CSE-602.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**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 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.

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-978-93-84336-63-9
3. Machine Learning by Tom Mitchell, Mc.Graw Publications

Reference books:

1. Python Machine Learning Dr Randal S. Olson

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Internet of Things** Subject Code: **BTECH_CSE-602.2T**

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

Aim: This course provides a way to understand the concepts and the basics of Internet of things, IoT 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 IoT 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 IoT applications on embedded platform

SYLLABUS:

Unit I:

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

Unit II:

M2M to IoT – 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 IoT-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)", 1st Edition, VPT, 2014 .

Reference books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 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 ofWireless Sensor Networks: Theory and Practice".

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Cloud Computing** Subject Code: **BTECH_CSE-602.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**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
CO3	Use appropriate data storage technique on Cloud, based on Cloud application
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 CloudComputing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models.

UNIT 2:

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 3:

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 4:

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 5:

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 IoT 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 andImplementation", Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering CloudComputing", McGraw Hill Education, ISBN-13:978-1-25-902995-0
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A PracticalApproach" McGraw Hill Tim Mather, Subra K, Shahid L.,"Cloud Security and Privacy", Oreilly, ISBN-13 978-81- 8404-815-5

4. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", WileyPublications, ISBN: 978-0-470-97389-9

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: Elective 3: **Data Science** Subject Code : **BTECH_CSE-603.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**03**	**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:

1	Understanding the significance of exploratory data analysis in Data Science.
2	Demonstrate the usage of Random Sampling and bias in a given dataset.
3	Analysis of various Statistical Experiments through various types popular Testing methods.
4	Design and analysis of regression techniques to estimate outcomes and detect anomalies.
5	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 2

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 t-Distribution. Binomial Distribution, Chi-Square Distribution, F-Distribution

UNIT 3

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 4:

Regression and Prediction

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

UNIT 5:

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, 2nd 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-978-1-491-93936-9.
2. R for dummies – Andrie de vries and Joris Meys, A John Wiley sons, Ltd. Publication.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 3: Distributed Operating Systems** Subject Code: **BTECH-CSE-603.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**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:

1	Learn the principles, architectures, algorithms and programming models used in distributed systems.
2	Understand the core concepts of distributed systems.
3	Design and implement sample distributed systems, using different algorithm.
4	Understand the Distributed File System, Architecture, and Mechanism.
5	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, Sender-Initiated Algorithm, Receiver-Intiated 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, 5th Edition, Addison-Wesley, 2012.

Reference books:

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

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 3: Human Computer Interaction** Subject Code: **BTECH-CSE-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 design. 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 consideration, 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 screen based controls. Components – text and messages, Icons and increases – Multimedia, 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 design, Universal design principles Multi-modal 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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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Open Elective 1: Linux Fundamentals** Subject Code: **BTECH-CSE-604.1T**

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

Aim: To provide knowledge of Linux including the directory structure, basic commands, the shell, and using the command line.

Prerequisites: Basic knowledge of networks, and computer skills.

Course Objectives:

Students should be able to:

1	Understand basic terminology of Linux.
2	Conduct basic activities such as installation, troubleshooting, and navigation.
3	Understand and write shell scripta and management of Failure recovery.

Course Outcomes
Students would be able to:

1	Understand Linux Architecture, different Linux installation and Linux commands.
2	Effectively use Linux Environment using shell, file system, scripts, filters and program development tools
3	Perform user, group management , package management through commands
4	Perform storage management and failure recovery through commands.
5	Automate tasks and write simple programs using shell scripts.

SYLLABUS:

UNIT-I

History of Linux OS, Architecture of Linux OS, Linux Dist ribution s, Installation of Linux OS

UNIT- II

Introduction to terminal, Basic commands, File system, File handling commands, process and process management commands, VI editor.

UNIT- III

Users and Group management- Creation, Updating, Deletion of user and group, Commands - password, Shadow, user add, user mod , user del, group add, group mod, group del.

UNIT-IV

Package Management - Introduction to package manager, function of package manager, Package management commands - rpm, yum. Storage management- Types of storages, creating partitions using f disk command.

UNIT-V

Logical volume management (LVM), Creating file system, mounting file system. Shell and Shell script.

Text Book

1. Unix and Shell Programming-B. M. Harwani, OXFORD University Press.

Reference Books

1. Linux Administration: A Beginner's Guide-Wale Soyinka, McGraw **Hill** Publication

2. Unix Concepts and Applications-Sumitabha Das, McGraw Hill Publication

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Open Elective 1: Android Application Development** Subject Code: **BTECH-CSE-604.2T**

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

Aim: Introduction to Android development framework and programming.

Prerequisites: 1.Oops through java 2.XML

Course Objectives:

Students should be able to:

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

Course Outcomes

Students would be able to:

1	Describe the components and structure of a mobile development framework
2	Understand the specific requirements, possibilities and challenges when developing for a mobile context.
3	Apply Java programming concepts to Android application development
4	Design and develop user Interfaces for the Android platform
5	Publish an application to the Android Market

SYLLABUS:

UNIT- I:

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT-II:

Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components.

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT- III:

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT- IV:

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

UNIT- V:

Advanced Topics: Alarms – Creating and using alarms. Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location

Text Books:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012

2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

Reference Books:

Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

Web Course:

1. https://www.nptel.ac.in/courses/106106156/

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: **Open Elective 1: Block-chain Technologies** Subject Code: **BTECH-CSE-604.3T**

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

Aim: To make students aware of Block Chain Technology and how it works. T

Prerequisites: Data Structures and algorithms and basic knowledge of Cryptography.

Course Objectives:

1	To teach the concepts of blockchain technologies.
2	To cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus.
3	To familiarize potential applications for Bit coin-like crypto currencies
4	To learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

Course Outcomes:
Students would be able to:

1	Understand emerging abstract models for Block chain Technology
2	Analyse the concept of cryptocurrency and mathematical background behind it
3	Apply the tools for understanding the background of bitcoins
4	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain
5	Understanding of latest advances and its applications in Block Chain Technology

SYLLABUS:

UNIT- I:

Introduction Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis, Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)

UNIT-II:

Cryptographic Fundamentals Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger-Hyperledger framework - Public and Private Ledgers.

UNIT- III:

Bit Coin Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT- IV:

Ethereum Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

UNIT- V:

Block Chain-Recent Trend Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, first edition 2015.
2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012.

Reference Book:

Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing.

Websites:

1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/
2. https://docs.docker.com/get-started/
3. https:/console.ng.bluemix.net/docs/services/block%2520chain/index.html

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

Subject: **Professional Skills Lab II** Subject Code: **BTECH_CSE-605P**

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):

Android Application Development

Or

Block Chain Technology

Or

Machine Learning

Or

Data science

Or

Human Computer Interface

Or

Linux Fundamentals

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Hardware Lab** Subject Code: **BTECH_CSE-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 IoT, Robotics and Embedded systems.

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

Internet of Things
Or
Microprocessors and Micro-controllers
Or
Components of ROBOTs

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject:**Mini Project** Subject Code: **BTECH_CSE-607P**

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: **Economics of IT industry** Subject Code: **BTECH-CSE-608T**

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 1:
Difference between Micro and Macroeconomics, law of demand and supply, concept and types of elasticity of demand, deflation and recession.

UNIT 2:
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 3:
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 4:
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, IGI 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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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Intellectual Property Rights (AuditCourse)**

Subject Code: **BTECH_CSE-609T**

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 (GI), 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 1:

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 2:

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 3:

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 4:

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 5:

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 - Procedure for registration, effect of registration and 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