RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

(Revised Curriculum as per AICTE Model Curriculum)
SCHEME OF EXAMINATION FOR
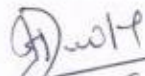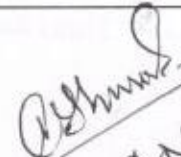## FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech.) DEGREE COURSE
SEMESTER: FIFTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

S. N.	Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
			L	T	P	CA	UE	Total		
1	BEIT501T	Software Engineering & Project Management	3	-	-	30	70	100	3	PCC
2	BEIT501P	Software Engineering & Project Management Lab	-	-	2	25	25	50	1	PCC
3	BEIT502T	Design and Analysis of Algorithms	2	1	-	30	70	100	3	PCC
4	BEIT503T	Java Programming	3	-	-	30	70	100	3	PCC
5	BEIT503P	Java Programming Lab	-	-	2	25	25	50	1	PCC
6	BEIT504T	Theory of Computation	2	1	-	30	70	100	3	PCC
7	BEIT505T	Elective- I	3	-	-	30	70	100	3	PEC
8	BEIT506P	Software Lab (Basics of AR &VR/Web Technology)	-	-	2	25	25	50	1	LC
9	BEIT507T	Effective Technical Communication	2	-	-	15	35	50	2	HSMC
10	BEIT508T	Yoga & Meditation	2	-	-					Audit
		Total	**17**	**02**	**06**	**240**	**460**	**700**	**20**	

(Dr. M. V. Bramhe)

Prof. S. J Duote

(Dr. A N Thakare)

(Prof. V. P. Thakare)

Dr. S. V. Sonekar
Chairman

Elective --I (BEIT505T)

1. Gaming Architecture & Programming (BEIT505T.1)

2. High Performance Computer Architecture (BEIT505T.2)

3. Human Computer Interface(BEIT505T.3)

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Software Engineering & Project Management   **Subject code: BEIT501T**

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

Aim: To learn quality software development and project management for a business system.

Prerequisite(s): None

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 Outcome:

At the end of this course students are able to:

CO1	Acquire Knowledge of software engineering methods, practices, process models and application.
CO2	Understand measure, metrics and indicators and learn various Modeling Approach
CO3	Analyze and extract requirements for the product and translate these into a documented design using different modeling techniques.
CO4	Learn software testing methods and types, And to understand debugging concept with various testing methods.
CO5	Understand project management, and to know software risks and principles of quality management, further the concept of re-engineering and reverse engineering.

Unit 1	Basics: Introduction to Software Engineering, Software Myths, Software Engineering - A Layered Technology. Software Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Agile Process Models
Unit 2	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 3	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 4		Unit Testing, Integration Testing, Validation Testing, System Testing, Art of Debugging, Software Testing Fundamentals, Black -Box Testing, White-Box Testing, Metrics for Source Code
Unit 5		Risk Management: Risk strategies, Software risks, Risk identification, Risk refinement, RMMM 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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SEMESTER: FIFTH (C.B.C.S)

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Software Engineering & Project Management Lab   **Subject code: BEIT501P**

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

Aim: To develop quality software projects for given business system

Prerequisite(s): Basic Programming Knowledge

Course Objectives

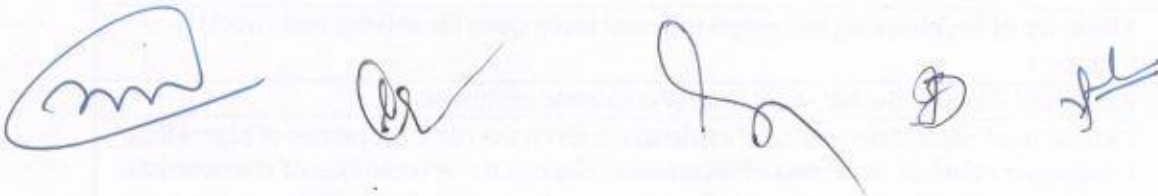|	
1	To understand general idea of software engineering
2	To develop skills to understand creation of object and interaction between them
3	To develop skills required for creation of various UML models

Course Outcome:

At the end of this course students are able to:

CO1	Learn the concept of requirement gathering & to learn the development of use case model
CO2	Understanding the object creation and the interaction between various objects & their collaboration
CO3	Understanding various states of objects & different component views
CO4	Learning the development of various UML models & understanding the complete design phase.

List of Practicals:-

Ten Practicals based on the above syllabus.
Course coordinator should make sure that all units will be covered in their list. No study experiment should be included in the list.

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Design and Analysis of Algorithms   **Subject code: BEIT502T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	02	1	3	30	70	100

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

Prerequisite(s): Data Structures, Programming Logic

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	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 real time 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
Unit 1	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 algorithm s, 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 2	**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, minimum cost spanning tree using Prim's and Kruskal's algorithm,
Unit 3	**Dynamic Programming**: Basic Strategy, Multistage graph (forward and backward approach), Longest Common Sub sequence, matrix chain multiplication, Optimal Binary Search Tree, 0/1 Knapsack problems, Traveling Salesman problem, single source shortest path using Bellman-Ford algorithm, all pair shortest path using Floyd - Warshall algorithm.
Unit 4	**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 5	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", Third 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, Rajasekharam
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 A.V. Gelder Pearson Education.

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Java Programming   **Subject code: BEIT503T**

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

Aim: To inculcate the Java programming concepts among the students in order to strengthen their programming logic and skills

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

Course Objectives:

1	This course introduces fundamentals of object - oriented programming in Java, including creating, defining classes, invoking methods, using class libraries, collections frameworks
2	It is aimed at building software development skills using java programming for creating real world applications which can be also used as prerequisite to Mobile app development programming.
3	Use a development environment to design, code, test, and debug simple programs, including multi -file source projects using the concepts of pure object oriented programming.

Course Outcome:

At the end of this course students are able to:

CO1	Understand the basic data types and control flow constructs using J2SE.
CO2	Make use of various Object Oriented Concepts like inheritance, data hiding, Exception Handling etc., to implement various programs in Java
CO3	Understand the concepts of Multi threading & Multi programming
CO4	Implementation of String class, Date class, Time class and Calendar class in various micro projects
CO5	Understand the concepts of Collections Framework.

Unit 1	Introduction to data types, operators and control statements, Classes: fundamentals of classes, declaring objects, Assigning objects, reference variables, methods, constructor, variable handling. Methods and classes: Overloading methods, understanding static and final.
Unit 2	Introduction to Array, Vectors, Wrapper class & Inheritance, Packages and interface: Packages, access protection, importing packages, interfaces. Exception handling:

	Fundamentals exception types, uncaught exception, try-catch, displaying description of an exception, multiple catch clauses, nested try statements, throw, finally, built in exceptions, creating own exception subclasses
Unit 3	Multithreading: Fundamentals, Thread Life Cycle, Ways of creating threads, Creating multiple threads, isAlive (), join (), Thread Synchronization, Thread priorities, Interthread communication, Methods for suspending, resuming and stopping threads.
Unit 4	String class and its methods. Date, DateTime, Calendar class : Converting Date to String and String to Date using SimpleDateFormat class ,Object Class: Overriding to String, equals & hashcode method
Unit 5	Introduction to collections: Collection hierarchy List, Queue, Set and Map Collections List Collection: Array List, Linked List Vector (Insert, delete,search, sort, iterate, replace operations) Collections class : Comparable and Comparator interfaces Queue collection, Inner class (Regular, Method local, Anonymous & static inner class)

Text/Reference Books
Text Book:
>   1. Core and Advanced Java Black Book / Dreamtech Press

References:

1. Java 8 Programming Black Book / Dreamtech Press
2. Core Java : Volume 1 - Fundamentals by Cay S. Horstmann / Prentice Hall
3. Core Java : Volume 2 - Advanced Features by Cay S. Horstmann / Prentice Hall
4. Programming in Java by Sachin Malhotra, Saurabh Choudhary / Oxford University Press
5. Java The Complete Reference by Herbert Schildt / McGraw Hill
6. Core Java 8 for Beginners by Sharanam Shah, Vaishali Shah / Shroff Publishers
7. Murach's Java Programming by Joel Murach / Mike Murach
8. Object-Oriented Analysis and Design with applications by Grady Booch / Pearson
9. Object-Oriented Analysis and Design Using UML - An Introduction to Unified Process and Design Patterns by Mahesh P. Matha / PHI

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Java Programming Lab   **Subject code: BEIT503P**

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

Aim: To develop Java programs using java programming logic

Prerequisite(s): Basic programming Languages like C, C++ , Java Programming logic

Course Objectives:

1	This course introduces fundamentals of object - oriented programming in Java, including creating, defining classes, invoking methods, using class libraries, collections frameworks
2	It is aimed at building software development skills using java programming for creating real world applications which can be also used as prerequisite to Mobile app development programming.
3	Use a development environment to design, code, test, and debug simple programs, including multi -file source projects using the concepts of pure object oriented programming.

Course Outcome:

At the end of this course students are able to:

CO1	Understand the basic data types and control flow constructs using J2SE.
CO2	Make use of various Object Oriented Concepts like inheritance, data hiding, Exception Handling etc., to implement various programs in Java
CO3	Understand the concepts of Multi threading & Multi-programming
CO4	Implementation of String class, Date class, Time class and Calendar class in various micro projects
CO5	Understand the concepts of Collections Framework.

List of Practicals:-

Minimum 8 Practicals to be conducted based on Syllabus. (Maximum upto 10).

1	Program on function overloading
2	Program on inheritance , using method overriding and also using "this" keyword
3	Program to understand the concepts of Exception Handling
4	Program to create a user defined Exception
5	Demonstrate the life cycle of thread
6	Program on Multi Threading
7	Use of Vector class and ArrayList
8	String class methods
9	Implementation of any two collections class framework

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Theory of Computation   **Subject code:BEIT504T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs (Theory)	2	1	3	30	70	100

Aim: To understand theory of computation for solving complex problems

Prerequisite(s): Basic programming Languages like C, C++, Data Structures

Course Objectives:

1	To understand the language hierarchy
2	To construct automata for any given pattern and find its equivalent regular expressions
3	To design a context free grammar for any given language
4	To understand Turing machines and their capability
5	To understand undecidable problems and NP class problems

Course Outcome:

At the end of this course students are able to:

CO1	Define what a Regular Language is and construct a finite state machine for it.
CO2	Construct equivalent representations among Regular Languages, Regular Expressions, and Regular Grammars.
CO3	Formulate the equations for push down automaton.
CO4	Identify the characteristics of problems for which no computational solution exists.
CO5	Understand the concepts of P vs. NP vs. NP-complete.

Unit 1	**AUTOMATA FUNDAMENTALS:** Introduction to formal proof, Additional forms of Proof, Inductive Proofs, Finite Automata, Deterministic Finite Automata, Non - deterministic Finite Automata, Finite Automata with Epsilon Transitions
Unit 2	**REGULAR EXPRESSIONS AND LANGUAGES:** Regular Expressions, FA and Regular Expressions, Proving Languages not to be regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata.
Unit 3	**CONTEXT FREE GRAMMAR AND LANGUAGES:** CFG, Parse Trees – Ambiguity in Grammars and Languages, Definition of the Pushdown Automata , Languages of a Pushdown Automata, Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.
Unit 4	**PROPERTIES OF CONTEXT FREE LANGUAGES:** Normal Forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.
Unit 5	**UNDECIDABILITY:** Non Recursive Enumerable (RE) Language, Undecidable Problem with RE, Undecidable Problems about TM, Post's Correspondence Problem,

The Class P and NP.

Text/Reference Books

1. Introduction to Languages and the Theory of Computation, 4th by John Martin, Tata Mc Graw Hill
2. Automata Theory, Languages, and Computation By John Hopcroft, Rajeev Motowani, and Jeffrey Ullman
3. Introduction to Automata Theory, Languages and Computation by J. E. Hopcraft,R. Motwani, J. D Ullman, second Edition, Pearson Education, Aisa
4. Theory of Computer Science, Automata, Languages and Computation by K. L. P. Mishra and N. Chandrasekaran, Third Edition, PHI Learning.

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BRANCH: INFORMATION TECHNOLOGY

Subject Name: Gaming Architecture & Programming   Subject code: (BEIT505T.1)

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

Aim: To understand process of Game design and development

Prerequisite(s): Computer Graphics

Course Objectives:

1	Understand the concepts of Game design and development.
2	Learn the processes, mechanics and issues in Game Design.
3	Be exposed to the Core architectures of Game Programming.
4	Know about Game programming platforms, frameworks and engines.
5	Learn to develop games.

Course Outcome:

At the end of this course students are able to:

CO1	Discuss the concepts of Game design and development.
CO2	Design the processes, and use mechanics for game development.
CO3	Explain the Core architectures of Game Programming.
CO4	Use Game programming platforms, frameworks and engines.
CO5	Create interactive Games.

Unit 1	Core Design: What Is a Game? Games Aren't Everything. Games Mean Gameplay. Creating the Game Spec. Example Game Spec, Initial Design: The Beginning . Hardware Abstraction. The Problem Domain. Thinking in Tokens.
Unit 2	Use of Technology: The State of the Art. Blue -Sky Research. Reinventing the Wheel. Use of object Technology, Building Bricks: Reusability in Software, Initial Architecture Design: The Birth of Architecture. The Tier System. Architecture Design.

Unit 3	Development: The Development Process. Code Quality. Coding Priorities. Debugging and Module Completion. The Seven Golden Gambits. The Three Lead Balloons. GAME PROGRAMMING: Technologies: Display, Mixing 2D and 3D, Direct X, User Interface code, Resource caching, the main loop.
Unit 4	Game scripting languages, Building the game and scripts, User interface programming and input devices: Getting the Device State, Working with the Mouse and Joystick, Working with the Keyboard, User Interface Components, More Control Properties. Basic 2D Drawing
	Concepts, Drawing Text, Working with Sprites, Graphics File Formats

Unit 5	Loading and Caching Game Resources: Art and Sound Formats, Resource Files, Data Compression, IPac: A Resource File Builder, the Resource Cache, World Design and Cache Prediction, 3D Graphics and 3D Engines: 3D Graphics Pipeline, Setting Up a Project, Using a Scene Graph, 3D Middleware Review, Rolling Your Own 3D Engine.

Text/Reference Books

1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real- Time Computer Graphics" 2nd Editions, Morgan Kaufmann, 2006.

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: High Performance Computing Architecture   **Subject code: IT505T.2**

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

Aim: To understand process of high performance computing and parallel programming

Prerequisite(s): Computer Architecture and Organization

Course Objectives:

1	To understand computer architecture and its trends.
2	To understand multiprocessing and parallelism.
3	To understand different multiprocessor architectures.
4	To understand Parallel Programming.

Course Outcome:

At the end of this course students are able to:

CO1	Learn the fundamentals of computer architecture, pipelining and multiprocessing environment.
CO2	Understand the different levels of parallelism .
CO3	Learn the design Issues in Parallel Computing environment.
CO4	Understand the importance of parallel programming .
CO5	Learn the impact of High-Performance Computing in recent developments.

Unit 1	Computer Architecture and its Trends: Moore's Law, Performance of Parallel Processors: Speedup and efficiency, Amdahl's law, Gustafson-Barsis's law, Karf-Flatt,metric, Isoefficiency metric. Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards, Processor Pipeline
Unit 2	Multi-Processing: Flynn's Taxonomy of parallel machines, Centralized and distributed memory, Message passing versus Shared Memory. Cache Coherence, Synchronization, Memory Consistency. Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, Dataflow Models etc), Instruction Level Parallelism (IPL): techniques for increasing ILP, Superscalar and VLIW processor architectures, RAW and WAW dependencies.

Unit 3	Multiprocessor architecture: taxonomy of parallel architectures, Architectures: N -wide, multi-core, multi-threaded. Design Issues in Parallel Computing : Synchronization, Scheduling, Job Partitioning, Types of dependencies loop and array dependencies, Loop dependence analysis, Solving diophantine equations, Program transformations, Performance Analysis of Parallel Algorithms.
Unit 4	Parallel Programming with CUDA: Processor Architecture, Interconnect,

	Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: Nvidia Tesla GPU, Intel Larrabee and Intel Nehalem microarchitecture)
Unit 5	Petascale Computing ,Optics in Parallel Computing , Quantum Computers ,Case Study: Recent developments in Nanotechnology and its impact on HPC.

Text/Reference Books

1. David A. Bader (Ed.), Chapman & Hall/CRC, Petascale Computing: Algorithms and Applications,2007.
2. Hawang Kai and Briggs F. A., "Computer Architecture and Parallel Processing", McGraw Hill, 1993.
3. Jorden H. F. and Alaghaband G., "Fundamentals of Parallel Processing", Prentice Hall, 2002.
4. Kai Hwang, "Scalable Parallel Computing", McGraw Hill, 1998.
5. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill, 1993.
6. M. J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw Hill, 2003.
7. Shasikumar M., "Introduction to Parallel Processing", PHI, 2006.

References:

1. D. E. Culler, J. P. Singh, A. Gupta, "Parallel Computer Architecture", Morgan Kaufman, 1998
2. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.
4. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.
5. William James Dally and Brian Towles, Morgan Kauffman , Principles and Practices on Interconnection Networks", 2004.

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Subject Name: HUMAN COMPUTER INTERFACE   **Subject code:BEIT505T.3**

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

Aim: To understand working of human computer interface

Prerequisite: Basic knowledge regarding computer, graphics and screen designs

Course Objectives:

1	Demonstrate an understanding of guidelines, principles, and theories influencing human computer interaction.
2	Recognize how a computer system may be modified to include human diversity.
3	Select an effective style for a specific application.
4	Carry out the steps of experimental design, usability and experimental testing, and evaluation of human computer interaction systems
5	Design mock ups and carry out user and expert evaluation of interfaces
6	Use the information sources available, and be aware of the methodologies and technologies supporting advances in HCI.

Course Outcome:

At the end of this course students are able to:

CO1	Relate the importance of the Graphical user interface and popularity of the graphics
CO2	Interpret the importance of human characteristics in design and how people interact with computers.
CO3	Articulate and apply common design principles for making good decisions in the design of user interfaces.
CO4	Annotate various kinds of windows and their characteristics and have an ability to select the proper device based and screen based controls.
CO5	Apply different components that are available in the screens and various interaction devices which are used to interact with the computer.

Unit 1	**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 2	**Design process** – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.
Unit 3	**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 – Technological consideration in interface design
Unit 4	**Windows** – New and Navigation schemes selection of window, selection of devices based and screen based controls.
Unit 5	**Components** – text and messages, Icons and images – Multimedia, colors – uses, problems with choosing colors. Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers

Text/Reference Books
1. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
3. Human – Computer Interaction. ALAN DIX, JANET FINCAY, GREGORY'S, ABOWD, RUSSE

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

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Software Lab (Basics of AR & VR/Web Technology) Subject code:BEIT506 P

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

Aim: To develop basic AR and VR applications and basic web sites

Prerequisite(s): Computer Graphics, Unity , Vuforia, HTML, CSS

Course Objectives:

1	To explore the concepts of Augmented and Virtual reality and develop basic AR and VR applications.
2	To develop basic web applications using HTML and CSS

Course Outcome:

At the end of this course students are able to:

CO1	Create and deploy AR and VR applications.
CO2	Learn the physical principles of VR.
CO3	Create a comfortable, high-performance VR application using Unity.
CO4	Develop dynamic web pages using JavaScript (client side programming).
CO5	Develop web pages using HTML, DHTML and Cascading Styles Sheets.

List of Practicals:-

Minimum 8 Practicals to be conducted based on Syllabus. (Maximum upto 10).

1	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2	Develop a scene in Unity that includes: i. a cube, plane and sphere, apply transformations on the 3 game objects. ii. add a video and audio source.
3	Develop Augmented reality based discovery-based learning applications
4	Develop Whole-Room Environment Augmentations:

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

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Effective Technical Communication   **Subject Code: BTIT507T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs (Theory)	2	-	2	15	35	50

Aim: To develop effective technical communication for real world

Prerequisite(s): None

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 be able to
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 ofInterview.

5	Develop a scene in Unity that includes a sphere and plane . Apply Rigid body component, material and Box collider to the game Objects. Write a C# program to grab and throw the sphere using the vr controller.
6	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.
7	Create a HTML page, which has properly aligned paragraphs with images along with it.
8	Write a program to display a list of items in different styles. 3. Create both client side and server-side image maps.
9	Create your own style sheets and use them in your web page.,
10	Create a form with various fields and appropriate front and validations using any one of the scripting languages.
11	Write a program to store the form fields in a database, use any appropriate Server Side Scripting.

Text Book/References

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
5. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi

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

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Yoga and Meditation   **Subject Code: BTIT508T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs (Theory)	2	-	-	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.

Prerequisite(s): No

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.

Unit III. Formal Correspondence

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

Unit IV. Technical & Scientific Writing:

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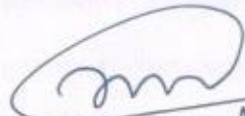
Reference Books:

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

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
(Revised Curriculum as per AICTE Model Curriculum)
SCHEME OF EXAMINATION FOR
FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech.) DEGREE COURSE
SEMESTER: SIXTH (C.B.C.S.)
BRANCH: INFORMATION TECHNOLOGY

S. N.	Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Catege
			L	T	P	CA	UE	Total		
1	BEIT601T	Data Base Management System	3	-	-	30	70	100	3	PCC
2	BEIT601P	Database Management System Lab	-	-	2	25	25	50	1	PCC
3	BEIT602T	Artificial Intelligence and Machine Learning	3	-	-	30	70	100	3	PCC
4	BEIT602P	Artificial Intelligence and Machine Learning Lab	-	-	2	25	25	50	1	PCC
5	BEIT603T	Elective – II	3	-	-	30	70	100	3	PEC
6	BEIT604T	Elective – III	3	-	-	30	70	100	3	PEC
7	BEIT605T	Open Elective- I	3	-	-	30	70	100	3	OEC
8	BEIT606P	Mini Project and Industrial Visit	-	-	6	25	25	50	3	Proje
9	BEIT607T	Economics of IT Industries	2	-	-	15	35	50	2	HSM
10	BEIT608T	Organizational Behavior	2	-	-					Audi
		Total	19	00	10	240	460	700	22	

Dr. M. V. Bramhe

(Dr. A N Thakare)

(Prof. V. P. Thakare)

Dr. S. V. Sonekar
Chairman

S. J Deote

Elective –II (BEIT603 T)

1. Cluster & Grid Computing (BEIT603T.1)

2. Blockchain Technology (BEIT603T.2)

3. Advances in Computer Networks (BEIT603T.3)

Elective –III (BEIT604T)

1. Cloud Computing (BEIT604T.1)

2. Internet of Things(BEIT604 T.2)

3. Software Testing & Quality Assurance (BEIT604T.3)

Open Elective – I (BEIT605 T)

1. Data Science (BEIT605T.1)

2. Computer Animation (BEIT605T.2)

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

Subject Name: Database Management System   **Subject code: BEIT601T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3(Theory)	3	–	3	30	70	100

Aim: To study Database Management System for back end development

Prerequisite(s): File Structure, Object Oriented Concepts

Course Objectives:

1	Learn the fundamental concepts of Database Management Systems
2	Acquire the knowledge of database query languages and transaction processing
3	Understand systematic database design approaches

Course Outcome:

At the end of this course students are able to:

CO1	Analyze and design Database Management System using ER model
CO2	Apply Indexing concepts in database languages
CO3	Implement database queries using database languages
CO4	Create normalized database design using normal forms
CO5	Apply Transaction Management concepts in real -time situations

Unit 1	Introduction: Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models. Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E -R Features, converting ER and EER diagrams into tables.
Unit 2	File organization, Organization of records in files, Data dictionary storage, Basic concepts of indexing, ordered indices, B+ Tree index files, B+ Tree indexing, B+ Tree Extensions, Multiple Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Index Definition in SQL.
Unit 3	SQL and Advanced SQL Introduction to SQL : SQL Data Definition, Basic Structure of SQL Queries, DDL, DML, DCL, TCL, Set Operations, Null values, Aggregate functions, Nested Sub-queries, Modifications of the Databases Intermediate SQL: Join Expressions, Views, Integrity Constraints, SQL Data types and Schemas, Authorization.

Unit 4	Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.
Unit 5	Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. Seria lizability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules. Concurrency Control: Lock-based, Timestamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery Checkpoints. Log-Based Recovery: Deferred Database Modifications and Immediate Database Modifications.

Text/Reference Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
4. S.K.Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
5. Ramez Elmasri and Shamkant Navathe, Database Systems -Models, Languages, Design and Application Programming

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

Subject Name: Database Management System Lab   **Subject code: BEIT601P**

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

Aim: To acquire the knowledge of database queries & apply it in real life example.

Prerequisite: - Discrete Mathematics, Data Structures & Program Design

Course Objectives:

1	To understand the fundamental concepts of Database Management Systems
2	To acquire the knowledge of database query languages and transaction processing
3	To understand systematic database design approaches

Course Outcome:

At the end of this course students are able to:
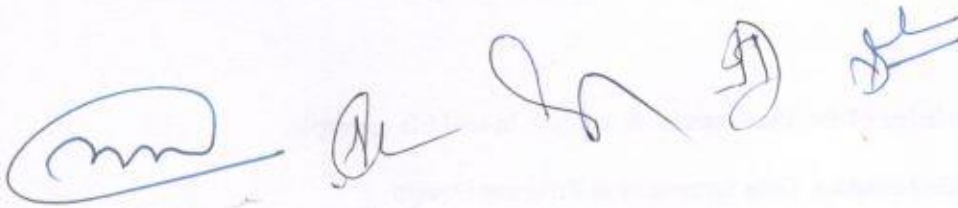
CO1	Analyze and design Database Management System using ER model
CO2	Apply Indexing concepts in database languages
CO3	Implement database queries using database languages
CO4	Create normalized database design using normal forms
CO5	Apply Transaction Management concepts in real -time situations

List of Practicals:-

Minimum 8 Practicals to be conducted based on Syllabus. (Maximum upto 10).

1	ER Modeling and Normalization
2	SQL Queries: DDL
3	SQL Queries: DML
4	SQL Queries: TCL
5	SQL Queries – all types of Join, Sub-Query
6	PL/SQL Stored Procedure and Stored Function
7	Database Trigger
8	Database Connectivity
9	Mini Project

Subject Name: Artificial Intelligence & Machine Learning   **Subject code:BEIT602T**

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

Aim: To understand the basic concepts of Artificial Intelligence and Machine Learning

Prerequisite(s): Basic knowledge of computers and mathematics.

Course Objectives:

1	To Acquire advanced Data Analysis skills
2	To Create AI/ML solutions for various business problems.
3	To understand the basic theory underlying machine learning.
4	To understand a range of machine learning algorithms along with their strengths and weaknesses
5	To apply the algorithms to a real -world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcome:

At the end of this course students are able to:

CO1	Understand the concept of Artificial Intelligence
CO2	Familiarize with Knowledge based AI systems and approaches
CO3	Apply the aspect of Probabilistic approach to AI
CO4	Identify the Neural Networks and NLP in designing AI models
CO5	Recognize the concepts of Machine Learning and its deterministic tools

Unit 1	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE:** History of artificial intelligence, The birth of artificial intelligence, AI Winters, Todays' AI, Historical milestones in the development of AI, Great contributors, People who have influenced AI , Differences between strong AI and weak AI, Artificial Intelligence definitions, Emergence of AI – Technological advances, Machine Learning, Deep Learning AI, Functions of AI, Characteristics of artificial intelligence, Applications of AI

Unit 2	LOGICAL APPROACH TO AI AND KNOWLEDGE -BASED SYSTEM: Introduction to knowledge representation systems, Knowledge representation using logic, Propositional logic, Semantics of propositional logic, Properties of propositional logic statements, Tautologies and logical implication, Resolution, Conjunctive normal form, Resolution is valid, Resolution algorithm, Knowledge base systems, Structure of a knowledge based system, Semantic networks: Types and components, Types of relationships in semantic network.
Unit 3	PROBABILISTIC APPROACH TO AI: Probability, Basic concepts, Probability of an event, Example on Sample Space, counting rules, Event relations, Conditional Probabilities, Defining Independence, Bayes' Rule, Bayesian Networks, Gaussian Bayesian Networks, Linear Gaussian BN to joint Gaussian, Theorem: From Gaussian

	to Bayesian networks, Noisy OR-Gate model, Promedas: A clinical diagnostic decision support system.
Unit 4	EVOLUTIONARY INTELLIGENCE AND NEURAL NETWORKS, NATURAL LANGUAGE UNDERSTANDING: Introduction, Artificial Neural Network, Appropriate problems for neural network learning, Characteristics of the problems, Types of feedforward networks, Multi -layer perceptron, Training MLP: The back -propagation algorithm, Multilayer networks and Backpropagation algorithm, The Backpropagation algorithm, Natural language processing, Classical NLP, Feed - forward networks, Recurrent neural networks and recursive networks, Features for NLP problems.
Unit 5	INTRODUCTION TO MACHINE LEARNING AND LEARNING DETERMINISTIC MODELS: Motivation for Machine Learning, Applications, Machine Learning, Learning associations, Classification, Regression, The Origin of machine learning, Uses and abuses of machine learning, Success cases, How do machines learn, Abstraction and knowledge representation, Classification of machine learning algorithms, General ML architecture, Group of algorithms, Reinforcement learning, Supervised learning, Unsupervised learning, Semi -Supervised learning Algorithms, Ensemble learning, Matching data to an appropriate algorithm, Supervised Learning, Regression.

Text/Reference Books

1. Artificial Intelligence (Third Edition) McGraw -Hill Elaine Rich, Kevin Knight.
2. Marco Gori , Machine Learning: A Constraint -Based Approach, Morgan Kaufmann. 2017
3. Ethem Alpaydin, Machine Learning: The New AI, MIT Press -2016

Subject Name: Artificial Intelligence and Machine Learning Lab   Subject code: BEIT602P

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

Aim: To apply AI and ML algorithms for real life problems

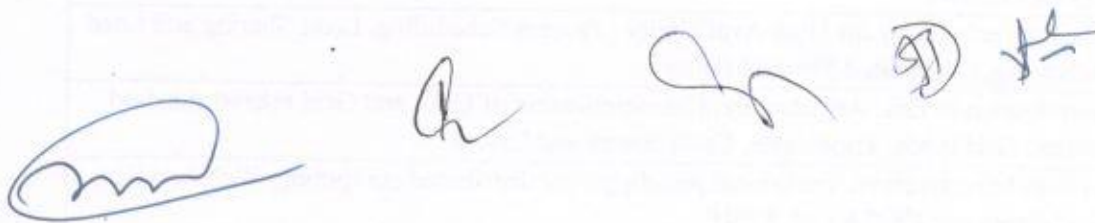**Prerequisite:** - Basic knowledge of computers, mathematics and programming languages

Course Objectives:

1	To understand the fundamental concepts of AI and ML
2	To develop programs based on AI and ML algorithms
3	To understand applications of AI and ML in real life

Course Outcome:

At the end of this course students are able to:

CO1	Understand the concept of Artificial Intelligence
CO2	Familiarize with Knowledge based AI systems and approaches
CO3	Apply the aspect of Probabilistic approach to AI
CO4	Identify and apply Neural Networks and NLP in designing AI models
CO5	Recognize the concepts of Machine Learning and its deterministic tools

Practical :- Minimum 8 practicals based on the syllabus of AI and ML

Subject Name: Cluster and Grid Computing   **Subject code: BEIT603T.1**

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

Aim: To study working of Cluster and Grid Computing

Prerequisite: - Basic knowledge of computers, networking, operating system

Course Objectives:

1	To understand the cluster and grid computers.
2	To understand task scheduling and resource allocation in cluster and grid environments.
3	To understand middleware architecture in Cluster and Grid Environment .

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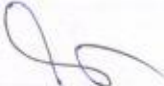
At the end of this course students are able to:

CO1	Learn the fundamentals of the cluster computing environment.
CO2	Understand the different features of clustering systems.
CO3	Learn the fundamentals of the grid computing environment.
CO4	Understand different features of grid systems.
CO5	Adopt basic services like resource management, process scheduling, etc.

Unit 1	Introduction to Cluster Computing, Cluster Middleware: An Introduction, Early Cluster Architecture and High Throughput Computing Clusters, Networking, Protocols and I/O for Clusters
Unit 2	Cluster Technology for High Availability , Process Scheduling, Load Sharing and Load Balancing, Distributed Shared Memory
Unit 3	Introduction to Grid Architecture, Characterization of Grid, and Grid related standard bodies, Grid types, Topologies, Components and Layers
Unit 4	System Infrastructure, Traditional paradigms for distributed computing, Web Services, Grid standards: OGSA and WSRF
Unit 5	Basic Services: Grid Security, Grid Monitoring, GMA, Grid Scheduling and Resource Management: Scheduling Paradigms, working of Scheduling Paradigms

Text/Reference Books

1. Grid and Cluster Computing, Prabhu C.S.R, PHI Learning Private Limited
2. The Grid (Chapter 1, 2, 3, 4, 5) Core Technologies by Maozhen Li, Mark Baker (John Wiley and Sons)
3. A networking Approach to Grid Computing by Daniel Minoli (Chapter 1) (John Wiley and Sons, INC Publication)
4. High Performance Cluster Computing: Architectures and Systems, Vol. 1, Prentice Hall
5. Distributed Systems: Principles and Paradigms, Second Edition, Andrew S. Tanenbaum, Maarten Van Steen, Person Education.

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

Subject Name: Blockchain Technology   **Subject code: BEIT603T.2**

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

Aim: To study working of Blockchain Technology

Prerequisite: - Basic knowledge of computers, mathematics and Cryptography

Course Objectives:

1	To explore various aspects of Blockchain technology like application in various domains.
2	To design, build, and deploy smart contracts and distributed applications
3	To integrate ideas from blockchain technology into their own projects.

Course Outcome:

At the end of this course students are able to:

CO1	Understand and explore the working of Blockchain technology
CO2	Understand how blockchain systems (mainly Bitcoin and Ethereum) work
CO3	Analyze the working of Smart Contracts
CO4	Understand and analyze the working of Hyperledger
CO5	Apply the learning of solidity and de -centralized apps on Ethereum and understand the application of blockchain Technology

Unit 1	Introduction of Cryptography and Blockchain: What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.
Unit 2	BitCoin and Cryptocurrency: What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double -Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency?

Unit 3	Introduction to Ethereum: What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts.

Unit 4	Introduction to Hyperledger: What is Hyperledger? Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer
Unit 5	Solidity Programming: Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File Blockchain Applications: Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

Text Books
1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:
1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei , Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

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

Subject Name: Advances in Computer Networks   **Subject code : BEIT603T.3**

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

Aim: To understand the advancement in computer networking field

Prerequisite: - Computer Networks

Course Objectives:

1	To become familiar with the basics of Advances in Computer Networks.
2	To understand the protocols and their functionalities
3	To understand the requirements for the future Internet and its impact on the computer network architecture.

Course Outcome:

At the end of this course students are able to:

CO1	Develop an understanding of advances in computer networking.
CO2	Learn various Fast access technologies
CO3	Comprehend the features of IPv6.
CO4	Demonstrate various security protocols.
CO5	Interpret advances in computer network authentication.

Unit 1	**Introduction:** Overview of computer networks, seven layer architecture, TCP/IP suite of protocols, etc. MAC protocols for high speed LANs, MANs, and wireless LANs. (for example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)
Unit 2	**Fast access technologies:** ADSL, Cable Modem, etc.) ATM Networks. ATM layer. ATM Adaptation Layers. **Congestion control:** Signaling, Routing, QoS support, Neighbor discovery, Auto configuration. Changes to other protocols.
Unit 3	**IPv6:** Basics of IPv4, Why IPv6, basic protcol, exte nsions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, routing. Changes to other protocols. Application Programming Interface for IPv6. 6Bone. Mobility in networks.

	Mobile IP.
Unit 4	**Security :** Security related issues. IP Multicasting. Multicast routing protocols, address assignments, session discovery, etc. TCP extensions for high speed networks,

	transaction oriented applications. Other new options in TCP. Network security at various layers.
Unit 5	**TCP :**TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP. Network security at various layers. Secure -HTTP, SSL, ESP, Authentication header, Key distribution protocols. Digital signatures, digital certificates.

Text/Reference Books

1. W. Stallings.*Cryptography and Network Security: Principles and Practice,* 2nd Edition, Prentice Hall, 1998.
2. R. Handel, M. N. Huber, and S. Schroeder.*ATM Networks: Concepts, Protocols, Applications,*Addison Wesley, 1998.
3. W. R. Stevens.*TCP/IP Illustrated, Volume 1,2 : The protocols,* Addison Wesley, 1994.
4.W. R. Stevens.*TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, and the Unix Domain Protocols,* Addison Wesley, 1996.
5. C. E. Perkins, B. Woolf, and S. R. Alpert. *Mobile IP: Design Principles and Practices,* Addison Wesley, 1997.
6. Peter Loshin.*IPv6 Clearly Explained,* Morgan Kauffman, 1999.

Subject Name: Cloud Computing **Subject code: BEIT604T.1**

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

Aim: To study the working and applications of Cloud Computing

Prerequisite: - Basic knowledge of computers, networking and database storage

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 Outcome:

At the end of this course students are 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

Unit 1	Introduction: Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven -step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models.
Unit 2	Introduction to Virtualization : Definition of Virtualization, Adopting Virtualization, Types of Virtualization, 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 Trends 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 and Implementation", Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN-13:978-1-25-902995-0
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach" McGraw Hill
4. Tim Mather, Subra K, Shahid L.,"Cloud Security and Privacy", Oreilly, ISBN-13 978- 81- 8404-815-5
5. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", Wiley Publications, ISBN: 978 -0-470-97389-9

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

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

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Internet of Things **Subject code: BEIT604T.2**

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

Aim: To study working of Internet of Things

Prerequisite: - Basic knowledge of hardware, Micro controller, computer networks

Course Objectives:

1	To study fundamental concepts of IoT
2	To summarize different protocols used for IoT design
3	To study the role of big data, cloud computing and data analytics in a typical IoT system.

Course Outcome:

At the end of this course students are able to:

CO1	Summarize the various concepts, terminologies and architecture of IoT systems.
CO2	Identify and apply sensors & protocols for design of IoT systems
CO3	Analyze various techniques of data storage and analytics in IoT
CO4	Illustrate various applications of IoT
CO5	Correlate Real world IoT Design constraint.

Unit 1	**Fundamentals of IoT** : Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks.
Unit 2	**Sensors Networks** : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberry Pi Development Kit, RFID **IP Based Protocols for IoT:** IPv6, 6LowPAN, RPL, REST, AMQP, CoAP, MQTT. Edge connectivity and protocols

Unit 3	**Data Handling & Analytics** : Introduction, Big Data, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud Analytics and applications
Unit 4	**Applications of IoT** : Home Automation, Smart Cities, Energy, Retail Management,
	Logistics,Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.
Unit 5	**Cloud Analytics for IoT Application:** Introduction to cloud computing, Difference between Cloud Computing and Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT, Connecting IoT to cloud, Cloud Storage for IoT Challenge in integration of IoT with Cloud.

Text Books:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications

2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications

3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014.

4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution" , O'Reilly Media, 2016.

Reference Books:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 stEdition, Apress Publications, 2013.

4. Cassimally, Hakim, "Designing the Internet of Things", Wiley Publications.

5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

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

Subject Name:Software Testing & Quality Assurance   **Subject code: BEIT604T.3**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
3Hrs(Theory)	3	-	3	30	7 0	100

Aim: To understand the need and working of software testing for quality of software

Prerequisite: - Software Engineering

Course Objectives:

1	To understand basic idea of software testing
2	To learn system test categories and design methods
3	To develop skills required to improve software quality

Course Outcome:

At the end of this course students are able to:

CO1	Understand need of testing and issues in testing
CO2	Know unit testing and debugging including tools for Unit Testing
CO3	Analyze data flow testing and system integration
CO4	Analyze various system test categories and design methods
CO5	Apply Acceptance testing to improve software quality with effecting testing

Unit 1	**Basic concepts of Testing:** Need of Testing, Basic concepts- errors, faults, defects,failures, objective of testing, central issue in testing, Testing activities, V - Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.
Unit 2	**Unit Testing:** Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Unit Testing in Extreme Programming, Tools for Unit Testing.

Unit 3	**Data Flow and System Integration Testing** : Introduction Data flow testing, Data flow graph, Data flow testing criteria, Comparison of Data flow test selection criteria. **Fundamentals of System Integration** : Types of interfaces and interface errors, System integration testing, Software and Hardware integration, Test plan, Off -the

	shelf
	component integration and testing
Unit 4	**System Test Categories and Test Design** : Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test. Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification based test case design, Use case bases, Application based test case design,Level of test execution.
Unit 5	**Acceptance Testing and Software Quality:** Types of acceptance testing, Acceptance criteria, Acceptance test plan and execution, fire view of software quality, ISO -9126 quality characteristics, ISO -9000:2000 software quality standard, ISO - 9000:2000 fundamentals

Text Books-
1. Software Testing and Quality Assurance by Kshirsager Naik and
Priyadarshini Tripathi (Wiley)
2. Software Testing Concepts and Tools by Nageswara Rao Pusuluri
(Dream Tech Press)
3. Software Testing Principles, Techniques and tools, 1st Edition, by M. G.
Lim aye McGraw Hills

Reference Books:

1. "Foundations of Software Testing" 2E by Aditya P. Mathur , Pearson Education

2. Effective Methods for Software Testing - William E Perry, (Wiley). 2.

Software Testing Tools by Dr. K. V. K. K. Prasad (Dream Tech)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

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

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

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Data Science   **Subject code: BEIT605T.1**

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

Aim: To study Data Science and Data Engineering

Prerequisite: - Mathematics, Statistic, Artificial Intelligence, Database Systems

Course Objectives:

1	To acquire skills in data preparatory and prepossessing steps
2	To learn the tools and packages in Python for data science
3	To acquire knowledge in data interpretation and visualization techniques

Course Outcome:

At the end of this course students are able to:

CO1	Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data science tools
CO2	Apply principles of Data Science to the analysis of business problems.
CO3	Apply ethical practices in everyday business activities and make well -reasoned ethical business and data management decisions
CO4	Demonstrate knowledge of statistical data analysis techniques utilized in business decision making
CO5	Apply algorithms to build machine intelligence

Unit 1	**Introduction to Data Science**
	Need for data science benefits and uses facets of data data science process setting the research goal retrieving data cleansing integrating and transforming data exploratory data analysis build the models presenting and building applications

| Unit 3 | **Data Flow and System Integration Testing** : Introduction Data flow testing, Data flow graph, Data flow testing criteria, Comparison of Data flow test selection criteria. **Fundamentals of System Integration** : Types of interfaces and interface errors, System integration testing, Software and Hardware integration, Test plan, Off -the |

	shelf
	component integration and testing
Unit 4	**System Test Categories and Test Design** : Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test. Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification based test case design, Use case bases, Application based test case design, Level of test execution.
Unit 5	**Acceptance Testing and Software Quality:** Types of acceptance testing, Acceptance criteria, Acceptance test plan and execution, fire view of software quality, ISO -9126 quality characteristics, ISO -9000:2000 software quality standard, ISO - 9000:2000 fundamentals

Text Books-

1. Software Testing and Quality Assurance by Kshirsager Naik and
Priyadarshini Tripathi (Wiley)
2. Software Testing Concepts and Tools by Nageswara Rao Pusuluri
(Dream Tech Press)
3. Software Testing Principles, Techniques and tools, 1st Edition, by M. G.
Lim aye McGraw Hills

Reference Books:

1. "Foundations of Software Testing" 2E by Aditya P. Mathur , Pearson Education

2. Effective Methods for Software Testing - William E Perry, (Wiley). 2.

Software Testing Tools by Dr. K. V. K. K. Prasad (Dream Tech)

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY,

NAGPUR FOUR YEAR BACHELOR OF TECHNOLOGY (B.

Tech.)DEGREE COURSE SEMESTER: SIXTH (C.B.C.S)

BRANCH: INFORMATION TECHNOLOGY

Subject Name: Computer Animation   **Subject code: BEIT605T.2**

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

Aim: To study computer animation for real life problems

Prerequisite: - Computer Graphics

Course Objectives:

1	To use basic 3D modeling techniques
2	To use basic shading, rendering, texturing, and lighting techniques
3	To apply animation concepts learned in fundamentals of animation to a 3D environment
4	To create a short 3D animation

Course Outcome:

At the end of this course students are able to:

CO1	Understand, identify and design art relating to that particular artwork in the given time frame
CO2	Apply the concepts of animation using Maya
CO3	Understand and apply 3D animation concepts
CO4	Summarize various formats and effects of motion capture
CO5	Relate and apply the features of animation and VFX for animated application
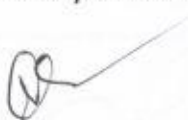
Unit 1	What is mean by Animation – Why we need Animation – History of Animation – Uses of Animation – Types of Animation – Principles of Animation – Some Techniques of Animation – Animation on the WEB – 3D Animation – Special Effects -Creating Animation.
Unit 2	Introduction to Maya: Keyframe animation, application of Maya in the film, television and game industries. Introduction to the interface of Maya. Hotkeys. Using the spacebar.Manipulating a view. Creating objects. Simple primitives. Light s, cameras, selecting objects, types of selection- single selection, adding and subtracting selection, edit menu selection options. Marquee selection, Lasso selection, selection mask.

Unit 2	**Mathematical Foundations for Data Science**
	Basics of Data Science: Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; structured thinking for solving data science problems. Linear Algebra: Matrices and their properties (determinants, traces, rank, nullity, etc.); Eigenvalues and eigenvectors; Matrix factorizations; Inner

	products; Distance measures; Projections; Notion of hyperplanes; half -planes. Probability, Statistics and Random Processes: Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White-noise process.Optimization: Unconstrained optimization; Necessary and sufficient conditions for optima; Gradient descent methods; Constrained optimization, KKT conditions; Introduction to non -gradient techniques; Introduction to least squares optimization; Optimization view of machine learning.Introduction to Data Science Methods: Linear regression as an exemplar function approximation problem; Linear classification problems.
Unit 3	**PYTHON FOR DATA HANDLING**
	Basics of Numpy arrays aggregations computations on arrays comparisons masks boolean logic fancy indexing structured arrays Data manipulation with Pandas data indexing and selection operating on data missing data hierarchical indexing combining datasets – aggregation and grouping – pivot tables
Unit 4	**PYTHON FOR DATA VISUALIZATION**
	Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statsmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh
Unit 5	**Advanced Data Analysis**
	Decision Trees: What Is a Decision Tree? Entropy, The Entropy of a Partition, Creating a Decision Tree, Random Forests Neural Networks : Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Defeating a CAPTCHA MapReduce : Why MapReduce? Examples like word count and matrix multiplication

Text/Reference Books

1. Data Science from Scratch : Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427
2. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016
4. Practical Data Science Andreas François Vermeulen APress

Unit 3	3D Animation & its Concepts – Types of 3D Animation – Skeleton & Kinetic3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.
Unit 4	Motion Caption – Formats – Methods – Usages – Expression – Motion Capture Software – Script Animation Usage – Different Language of Script Animation Among the Software.
	Visual Effects - Description- Types- Particles – Analysis- Size- Sand Effects – Smoke Effects- Fire Effects – Cloud Effects – Snow Effects
Unit 5	Animation & VFX Around the World , Concept Development –Story Developing – Audio & Video – Color Model –Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

Text/Reference Books
1. Compositing Visual Effects: Steve Wright
2. Digital Compositing for Film and Video: Focal Press

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY,

Subject Name: Mini Project & Industrial Visit   **Subject code: BEIT606P**

Load	Practical	Credits	College Assessment Marks	University Evaluation	Total Marks
6Hrs (Practical)	6	3	25	25	50

Aim: To develop software projects and have industrial exposure

Prerequisite: - Software Engineering , Programming skills, Database systems

Course Objective:

1	To develop software development and research skills in students
2	To develop project management skills in students
3	To develop professionalism in students through industry exposure

Course Outcome:

At the end of this course students are able to:

CO1	Summarize past research in the field through literature review
CO2	Analyze user requirements and design the system as per requirements
CO3	Develop, test and deploy the system in user environment

Project Development and Industrial Visit Procedure :

1. Students shall work in group of 4-5 each and work on small application or research based / Industry Oriented real time problems.

2. College Mentor and Industry mentor shall work in coordination.

3. Industry visit should be planned to explore students about real time problems.

4. Students shall use Agile framework for project development

5. Project report should be based on Agile Framework .

6. Evaluation should be done based on feedback of College and Industry Mentor.

Text / 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.

Subject Name: Economics of IT Industries   **Subject code: BEIT607T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs (Theory)	2	–	2	15	35	50

Aim: To study economy of IT industries

Prerequisite: - None

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

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

1. Distinguish between Micro and Macro economics
2. Relate economics concept with IT industry
3. Identify key trends in IT industry
4. 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

Text / 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.

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

Subject Name: Organizational Behaviour   **Subject code: BEIT608T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs (Theory)	2	–	-	Grade	-	Grade

Aim: To study working and interpersonal behaviour in organization

Prerequisite: - None

Course Objective: The objective of the course is to create awareness among learners about the various essentialaspects of organizational processes and structure and motivation in organization.

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

1. Understand the concept and importance of organizational behaviour.
2. Acquire the knowledge of interpersonal behaviour and transaction analysis
3. Know different traits and theories of personality
4. Analyze the importance of motivation in organization and types of leadership

Syllabus:

Unit 1. Introduction to organizational behaviour.

Concept of organization behaviour, Importance of organization behaviour, Key elements of organization behaviour, scope of organizational behaviour.

Unit 2: Introduction to interpersonal behaviour.

Nature and meaning of interpersonal behaviour, concept of transaction analysis, benefits and uses of transaction analysis, Johari window model.

Unit 3: Introduction to personality

Definition and meaning of personality, importance of personality, theories of personality, personality traits.

Unit 4: Introduction to Motivation and leadership.

Concept and importance of motivation, Maslow's two factor theory of motivation. Significance of motivation in organization. Types of leadership styles.

List of books

1. Organizational behaviour by MN Mishra, published by S.Chand.

2. The human side of organization by Michale Drafke, published by Pearson education.

3. Management and Organizational behaviour by Laurie.J. Mullins, published by Pearson education.

4. Organizational behaviour by K. Aaswathappa, Published by Himalaya publications.

R.T.M. Nagpur University, Nagpur
Four Year B.Tech. Course
(Revised curriculum as per AICTE Model Curriculum)
B.Tech. V Semester (Computer Technology) Scheme

Subject code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
BTCT501T	Design and Analysis of Algorithms (TH)	3	0	0	30	70	100	3	PCC
BTCT501P	Design and Analysis of Algorithms Lab (PR)	0	0	2	25	25	50	1	PCC
BTCT502T	Database Management System(TH)	3	0	0	30	70	100	3	PCC
BTCT502P	Database Management System(PR)	0	0	2	25	25	50	1	PCC
BTCT503T	Software Engineering and Project Management (TH)	3	0	0	30	70	100	3	PCC
BTCT504T	Effective Technical Communication (TH)	2	0	0	15	35	50	2	HSMC
BTCT505P	Artificial Intelligence (TH)	3	0	0	30	70	100	3	PCC
BTCT506T	Elective - I	3	0	0	30	70	100	3	PEC
BTCT507T	Professional Ethics (Audit Course)	2	0	0	0	0	0	0	Audit
	Total	19	0	4	215	435	650	19	

Elective - I BTCT506T
BTCT506T-1 TCP/IP
BTCT506T-2 Computer Graphics
BTCT506T-3 System Software and Device Driver

PCC-CS Professional Core Courses **ESC** – Engineering Science Courses **LC** – Laboratory Course
OEC-CS Open Elective Courses   **MC** – Mandatory Course   **PROJ-CS** Project (Min. one month internship is derirable)   **BSC** – Basic Science Courses   **PEC-CS** Professional Elective Courses
HSMC- Humanities and Social Sciences including Management Courses

(Dr AN Thakare)

Dr. S.V. Soneli Chairman

(Mrs) N. M. Thakare

(Dr. M.V. Bramhe)

Dr. (Avg) sonelet s.Golet

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B. Tech. Fifth Semester CT
Design and Analysis of Algorithms

Total Credits: 3	Subject Code: BTCT501T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam: 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. Analyze the time complexity of recursive function
2. Analyze the asymptotic performance of algorithms.
3. Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes:(Please follow Bloom's Taxonomy words in Course outcome)

After completing the course, students will be able to

CO1. Argue the correctness of algorithms using inductive proofs and Analyze worst-case running times of algorithms using asymptotic analysis

CO2. Explain and apply Divide-and-Conquer and Greedy algorithmic design paradigms

CO3. Explain and apply Dynamic-Programming algorithmic design paradigms

CO4. Explain and apply Backtracking Database Management System(PR)algorithmic design paradigms

CO5. Describe the classes P, NP, and NP Complete and prove NP-Completeness of certain problem.

Unit I (8 Hrs)

Algorithm, Properties of Algorithm, Summation of arithmetic and geometric series, Recurrence relations, Solutions of recurrence relations using following techniques: Characteristic equation, Recursion tree method and Master method. Asymptotic notations of analysis of algorithms, Time complexity of program segments, Best case and worst case analysis of Insertion sort.

Unit II (8 Hrs)

Divide and Conquer strategy: Binary search, Merge sort, Quick sort, Strassen's matrix multiplication.

Greedy Approach: Fractional Knapsack Problem, Huffman coding algorithm, Traveling Salesman Problem, Activity Selection Problem, Job sequencing with deadlines problem, Minimum cost spanning trees, Single source shortest path.

Unit III (9 Hrs)

Dynamic Programming strategy: Longest Common Subsequence, Single source shortest paths, Traveling salesman problem, All pairs shortest path, Matrix Chain Multiplication, Multistage graphs, Optimal binary search trees, 0/1 Knapsack problem.

Unit IV (6 Hrs)

Backtracking strategy: n-Queen's problem, Sum of subsets, Graph coloring, Hamiltonian cycles.

Unit V (5 Hrs)

NP-hard and NP-complete problems: Non-deterministic algorithms, NP-hard and NP-complete, decision and optimization problems, Clique, Polynomial Reduction, Cook's theorem, graph based problems on NP Principle.

Text Books:

1. Introduction to Algorithms By Thomas H. Cormen et.al. Prentice Hall of India.

Reference Books:

1. Design & Analysis of Algorithms By Parag Himanshu Dave, HimanshuBhalchandra Dave, second Edition, Pearson Publication.

2. Computer Algorithms- Inroduction to Design and Analysis By Sara Baase, Allen Van Gelder, Third Edition, Pearson Publication.

3. The Design and Analysis of Algorithms By Alfred V. Aho, John E. Hopcraft, Jeffrey D. Ullman, Pearson Publication.

4. Ellis Horowitz, Sartaj Sahni, 'Fundamentals of Computer Algorithms', Galgotia Pubs.

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B. Tech. Fifth Semester CT
Design and Analysis of Algorithms (PR)

Total Credits: 1	Subject Code: BTCT501P
Teaching Scheme : Lectures: 0 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam: College Assessment : 25 Marks University Assessment: 25 Marks

Minimum ten experiments should be conducted based on the Theory Syllabus

Total Credits: 3	Subject Code: BTCT502T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To present an introduction to database management systems,.
2. To emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.
3. To Implement relational databases using a RDBMS

Course Outcomes:(Please follow Bloom's Taxonomy words in Course outcome)

After completing the course, students will be able to

CO1. Explain the basic concepts of Database management system and database architecture and illustrate the concepts of Relational algebra.

CO2. functional dependencies , apply concepts of normalization and construct ER Diagrams.

CO3. Compare various indexing techniques and to illustrate the concepts of PL/SQL programming.

CO4. Select Query Optimization techniques and to evaluate the performance of Query and transaction Processing.

CO5. Define and illustrate the concepts of advanced database techniques.

Unit I (8 Hrs)

Introduction: Database system architecture, Database applications, Data Abstraction, Data Independence, Data Definition and models, Relational query languages: Relational algebra, tuple and domain relational calculus, SQL and QBE.

Unit II (7 Hrs)

SQL: Data definition, basic SQL query structure, set operations, nested subqueries, aggregation, null values, database modification, join expressions, views. Concepts of PL/SQL,Triggers and Assertions.

Unit III (7 Hrs)

Database Design: E-R model, E-R diagram, reduction to relational schema, E-R design issues, database integrity, specifying integrity constraints in SQL, triggers.Functional Dependency theory, decomposition using functional dependency and normal forms.

Unit IV (8 Hrs)

Query processing and optimization Evaluation of relational algebra expressions, query equivalence, join strategies, query optimization algorithms. Storage strategies Indices, B-trees, hashing. Transaction processing Recovery and concurrency control, locking and timestamp based schedulers, multiversion and optimistic Concurrency Control schemes.

Unit V (6 Hrs)

Advanced topics Object-oriented and object relational databases, logical databases, web databases, distributed databases, data warehousing and data mining (6 Hrs)

Text Books:

1. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book,2nd Ed., Prentice-Hall, 2008.

2. A Silberschatz, H Korth and S Sudarshan, Database System Concepts, 6th Ed., McGraw-Hill, 2010.

Reference Books:

1. R Elmasri, S Navathe, Fundamentals of Database Systems, 6th edition, Addison-Wesley, 2010.

2. R Ramakrishnan, J Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill,   2002.

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B. Tech. Fifth Semester CT
Database Management System (PR)

Total Credits: 1	Subject Code: BTCT502P
Teaching Scheme : Lectures: 0 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme : Duration of University Exam : . College Assessment : 25 Marks University Assessment: 25 Marks

Minimum ten experiments should be conducted based on the Theory Syllabus

Total Credits: 03	Subject Code: BTCT503T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam: 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To provide an understanding of the working knowledge of the techniques for analysis, design, testing, estimating and quality management of large software development projects.

2. To develop an understanding of the working methods and procedures for software development that can scale up for large systems and that can be used consistently to produce high quality software at low cost with a small cycle time.

Course Outcomes: (Please follow Bloom's Taxonomy words in Course outcome)

After completing the course, students will be able to

1. Explain evolution and impact of Software Engineering and to demonstrate and compare different software development process models.

2. Explain Agile process model, System Engineering and to list and explain different steps in Requirement Engineering Process.

3. Understand, analyze and apply different analysis and design models in software development process.

4. To explain and compare different software testing strategies, types and their significance and to understand and apply the concept of Software Quality Assurance and estimation.

5. To estimate the quality metrics for process and product and to list and analyze different software risk management strategies, software quality management process and to understand Software Configuration Management.

Unit I (06 Hrs)

Introduction: Software Characteristics, Software Engineering,A Layered Technology, Software Process Framework, Software Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, , The Unified Process Model

Unit II (06 Hrs)

Agile Process Models, System engineering and modeling Requirements Engineering: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

Unit III (08 Hrs)

Software Analysis & Design : Modeling Approaches, Data Modeling, Object, Oriented Modeling, Scenario Based Modeling, Flow Oriented Modeling, Class based Modeling, Behavioral Model. Design Engineering Concepts, Design Model, Pattern Based Software design, Design Concepts: Abstraction Architecture, pattern modularity, information hiding, design classes, refactoring.

Unit IV (08 Hrs)

Software Testing : Testing Fundamentals , Black Box Testing, White Box Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging.

Product metrics: Software quality, Quality Concepts, Software Quality Assurance , Metrics for Analysis & Design Models, Metrics for Source Code, Metrics for Testing & Maintenance.

Unit V (08 Hrs)

Metrics for process & Product: – Software measurement, Metrics for software quality, Project scheduling.

Risk management – Risk strategies, Software risks, Risk identification, Risk refinement, RMMM Quality Management, Software Reliability, Change Management, and Software Configuration Management

Text Books:

1.Software Engineering: A Practitioner's Approach (Sixth Edition),Roger Pressman (TMH)

2.Software Engineering (Ninth Edition), Ian Summerville (Pearson Education)

3. Software Engineering : Theory and Practice (Fourth Edition) – Pfleeger (Pearson Education)

Reference Books:

1. Software Engineering Schaum's Series (TMH)
2. Software Engineering for Students –(Fourth Edition) – Bell (Pearson Education)
3. The Unified modeling language

CREDITS: 02

Teaching Scheme: 2 Hours/Week (Theory) + 1 Hour/Week (Tutorial)

Examination Scheme: University Assessment: 35 Marks College Assessment: 15 Marks

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

Course Outcomes: After completing the course, students will

1. Acquire knowledge of structure of language.

2. 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 I. 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 Resume Writing, 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 UniversityPress, 201,

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, PearsonEducation Asia, 2000

6. Developing Communication skills by Krishna Mohan & Meera Banerjee

Total Credits: 3	Subject Code: BTCT505T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 3 hrs. College Assessment : 30Marks University Assessment: 70Marks

Course Objectives:

To make students
1. To understand necessary depth of the fundamental techniques of Artificial Intelligence.
2. To capable of using heuristic search techniques.
3. To aware of knowledge based systems.
4. To learn various applications domains AI.
5. To able to use fuzzy logic and neural networks and Genetic algorithm.

Course Outcomes:

After completion of the course, students will be able to -

1. Explain the basics of the theory of AI and different informed and uninformed search algorithms.
2. Formulate and solve given problem using Propositional and First order logic.
3. Describe various knowledge representation techniques and to apply reasoning for non-monotonic AI problems.
4. Describe various application domain of AI such as Expert system, Game Playing, Natural Language Processing.
5. Apply neural network learning and evolutionary algorithms such as Genetic Algorithms for solving AI problems.

UNIT I (8 Hrs)

Introduction to AI: Definition of AI, Early work in AI, Importance of AI and related fields, Task domains of AI systems, Intelligent agents, Generic architecture of intelligent agent.
Basics of problem solving: Defining the problem on a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs.

UNIT II (8 Hrs)

Heuristic search techniques: Generate and test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Means-ends analysis.

Knowledge Representation: Representation and mapping, Approaches and Issues. Introduction to proposition logic, Knowledge representation using predicate logic, Unification and resolution. Representing knowledge using rules, procedural Vs declarative knowledge, logic programming, forward Vs backward reasoning, matching.

UNIT III (8 Hrs)
Knowledge representation: Network representation schemes - Semantic networks, conceptual graphs, Conceptual dependency, Structured representation schemes – Frames, Scripts.
Statistical reasoning: Symbolic Vs Statistical reasoning, Nonmonontonic and monotonic reasoning, Probability and Bayes' theorem, Certainty factors and rule based systems, Baysian networks, Introduction to fuzzy logic.

UNIT IV (6 Hrs)
Expert systems: Characteristic features of expert system, Architecture of expert system, Expert system shell.
Game playing: Minimax search procedure, adding alpha-beta cutoffs.
Natural Language Processing: Overview of linguistics, Grammar and languages, basic parsing techniques, semantic analysis and representation structures.

UNIT V (6 Hrs)
Artificial Neural Network: Introduction, Neural Network representation, neural learning, Knowledge representation in ANN, application of neural networks.
Genetic Algorithm: Motivation, GA cycle, genetic operators, GA based Machine Learning, illustrative example.

TEXT BOOK:
1. E. Rich & K. Knight, S. B. Nair "Aritificial Intellegence", Tata McGraw Hill Publications, 2008.
2. D. W. Patterson, "Introduction to Artificial Intelligence and Expert System", PHI Pub., 1997.
3. K. Uma Rao, "Aritificial Intelligence and Neural Networks" Pearson Education, 2011.
4. David E. Goldberg, "Genetic Algorithms in search, optimization and machine learning",Pearson Education, 2002.

Total Credits: 3	Subject Code: BTCT506T
Teaching Scheme : Lectures: 3Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 3 hrs. College Assessment : 30Marks University Assessment: 70Marks

Course Objectives:

1. Define fundamental concepts of TCP/IP architecture and protocols
2. Basic Concept on the network layer, transport layer, and application layer of the suite
3. Basic Concept of Network management and internet Security.

Course Outcomes:(Please follow Bloom's Taxonomy words in Course outcome)

After completing the course, students will be able to

1. Identify protocols and standards in the Internet.
2. Concept of basic addressing and setup, connectivity and communications, name resolution, and fundamental network services.
3. Learn real-time IP-based protocols and services including Voice over IP (VoIP) and Instant Messaging (IM) applications,
4. Basic concept of Network configuration with other services like mail services.

5. Basic Concept of Network Management Protocols and internet security.

Unit I (6 Hrs)
Introduction and Overview: Comparison of OSI Model and TCP/IP model. Networking Technologies: LANS, WANS, Connecting Devices. Internetworking concept and Architectural model. Internet Backbones, NAP, ISP's, RFC's, Internet Standards.

Unit II (8 Hrs)
Internet Addresses: IP address classes, subnet mask, CIDR, ARP,RARP, Internet Protocol, Routing IP Datagrams, ICMP and IGMP, Introduction to IPv6 and ICMPv6

Unit III (8 Hrs)
UDP, TCP, Sockets and socket Programming, Routing in Internet, Routing protocols- RIP, OSPF and BGP. Introduction to Multicasting and Multicast routing.

Unit IV (6 Hrs)
Host Configuration: BOOTP, DHCP; Services: Domain Name System, FTP, TFTP and **Electronic Mail**: SMTP, MIME, IMAP, POP.

Unit V (6 Hrs)
Network Management: SNMP, WWW: HTTP, Mobile IP. **Multimedia** : RTP, RTCP. **Middle wares** : RPC, RMI.
Internet Security:IPSec, PGP, Firewalls, SSL

Text Books:

1. Internetworking and TCP/IP: Principles, Protocols and Architectures, Douglas Comer, Pearson Education.
2. TCP/IP Protocol suite, Behrouz A. Forouzan, Third Edition, TMH.
3. Computer Networking – A Top-Down Approach Featuring the Internet, James F. Kurose, Keith W. Ross, Pearson Education, Asia.
4. Computer Networks: A systems approach by Larry L. Peterson and Bruce S. Davie, 3rd Edition, Morgan Kaufmann Publishers

Reference Books:

1. Stevens W. R. TCP/IP Illustrated, volume 1,2,3, Pearson education.
2. "Hands-On Networking with Internet Technologies"• by Douglas E. Comer, Pearson Education, Asia, 2002.

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B.Tech. Fifth/Sixth Semester CT
Elective – I : Computer Graphics (Th)

Total Credits: 3	Subject Code: 8 BTCT506T
Teaching Scheme : Lectures: 3Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 3 hrs College Assessment : 30Marks University Assessment: 70Marks

Course Objectives:
On successful completion of the course, students will be able to:
1.Understand the core concepts of computer graphics, Graphics devices.
2.Understand and implement various Scan conversion techniques.
3.Understand and apply the windowing, clipping and various transformations principles.

Course Outcomes:(Please follow Bloom's Taxonomy words in Course outcome)
After completing the course, students will be able to
1. Explain the basic concepts of computer graphics, identify the importance of computer graphics and its wide spread applications.
2. Categorize and apply basic raster graphics algorithms for drawing 2D primitives and various polygon filling algorithms.
3. Categorize and apply 2D Clipping algorithms for regular and irregular windows ; Compare various types of curves.
4. Compare, contrast and apply various 2D Transformations.
5. Explain 3D System Basics, compare and contrast various 3D Transformations and various hidden surface removal algorithms.

Unit I : (6 Hrs)
Introduction to Graphics : Introduction to Computer Graphics & its application, Origin of Computer Graphics, Graphics Areas, Graphics Pipeline, Graphics APIs, Hardcopy Technologies, Display Technologies – Raster scan Display System, Video Controller – Vector scan display system, Random Scan Display Processor, Input Devices for Operator Interaction.

Unit II : (9 Hrs)
Line generation Algorithms: DDA, Bresenham's Algorithm, Bresenham's Circle Generation algorithm,Polygon filling methods: Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence fill and Edge Flag Algorithm. ,Seed fill Algorithms: Simple and Scan Line Seed Fill Algorithm.

Unit III : (7 Hrs)
Windowing & Clipping: The viewing transformations. Line Clipping: Sutherland-Cohen algo, Midpoint Subdivision algo, Cyrus Beck algo. Polygon Clipping: Sutherland-Hodgman algo.Curves: Bezier & B-spline Curves.

Unit IV : (6 Hrs)

Transformation 2-Dimension Transformation: Basic Transformation: Scaling, Rotation, Translation, Matrix representation, Homogeneous Coordinates & Composite transformations, rotation about an arbitrary point, other transformation: Reflection Shear.

Unit V : (8 Hrs)

3-Dimension Transformation – 3D geometry, 3D primitives, Scaling, Translating, Rotation about an arbitrary axis,Parallel and Perspective projections, Hidden line/surface Removal Algorithms. painter's algorithm, Z -buffers, Warnock's algorithm.

Text Books:

1. Rogers; Procedural Elements of Computer Graphics; 3rd Edition; McGraw Hill, 2001.
2. Newman and Sproull; Principles of Interactive Computer Graphics; McGraw Hill, 1989.
3. Ivan Harringhton; Computer Graphics - A Programming Approach; McGraw Hill Publications, 1987

Reference Books:

1 Hearn and Baker; Computer Graphics; 2nd Edition; PHI, India, 1994
2. James D. Foley, Andries Van Dam, Feiner Steven K. and Hughes John F. – Computer Graphics: Principles & Practise, Adddison Wesley Publishing House

Total Credits: 3	Subject Code: 8 BTCT506T
Teaching Scheme : Lectures: 3Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam: 3 hrs. College Assessment : 30Marks University Assessment: 70Marks

Course Objectives:
1. Learn basic concepts of operating systems and system software's.
2. Design of operating systems and system software's.

Course Outcomes:(Please follow Bloom's Taxonomy words in Course outcome)
After completing the course, students will be able to

1. Explain the basics concept of system programs like editors, compiler, assembler, linker, loader, interpreter and debugger.
2. Design and describe the various concepts of assemblers, the various phases of compiler and compare its working with assembler.
3. Explain and describe the various concepts of macro -processors.
4. Explain the basic concepts of linker and loader, create an executable program from an object Unit created by assembler and compiler.
5. Explain various Device drivers, its types and installation.

Unit I   Introduction to System Software and IBM 360 Machine: (8 Hrs.)
Evolution of components of programming system, Operating System, Overview, Functions and Facilities o, Goals of System software, Views of System Software, Virtual machine. General machine structure IBM 360/370, Machine Language Assembly language.

Unit II   Assembler: (8 Hrs.)
Design of Pass-I and Pass-II Assemblers, Table Processing, Searching and Sorting, Problems based on symbol table, Base table and Literal table generation, Machine code generation and Searching and sorting. Phases of Compiler, Compiler writing tools, Lex and YACC.

Unit III Macro Language and Macro Processor: (7 Hrs.)
Macro instruction, Features of Macro facility, Implementation of 1-Pass, 2-Pass Macro processor, Macro calls within macro, macro definition within macros.

Unit IV : (8 Hrs)
Different Loading Schemes, Binders, Overlays, Linking loaders, Design of absolute loaders, Design of Direct Linking loaders.

Unit V UNIX Device Drivers: (5 Hrs.)

   Introduction to Device drivers, Types of Device Drivers, Design issues in Device Drivers, Driver installation with example, character driver-A/D Converter, Block Driver-RAM Disk driver, Terminal Driver-The COM1 port driver .

Text Books:

1. J. J. Donovan; System Programming; TMH, 2012

2. D.M. Dhamdhere; System Programming; THM; 2011

3. George Pajari; Eritting Unix Device Drivers; Pearson Education; 2011

Reference Books:

1.   Leland Beck, D. Manjula; System Software; An Introduction to Programming; Pearson Education; 2013
2.   Alfred Aho, J. Ullman; Principles of Compiler Design; Narosa Pub. 2010

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B.Tech. Fifth/Sixth Semester CT
Subject: Professional Ethics (Theory)
Audit Course

Teaching Scheme
Lectures:2 Hours/Week

Course Objective: The objective of this course is to inculcate the sense of professional and social responsibilities along with moral and ethical values among learners and to make them realize the significance of ethics and Intellectual Property Rights in professional environment so as to make them a global citizen

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

CO1: Realize their roles of applying ethical principles and morals at professional levels
CO2: understand their constructive roles in understanding corporate culture and maintaining work-life balance.
CO3: become responsible and contributing members of society

CO4: acquire knowledge of Intellectual property rights.

Unit I (6hrs)
Engineering Ethics, Senses of 'Engineering Ethics', Codes of Ethics, moral issues, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory

Unit II (6hrs)
Meaning of corporate governance, gender equality at work place, concept of whistle blower, respect for environment, work-life balance.

Unit III (6hrs)
Corporate social responsibility(CSR)- need and importance, corporate environment responsibility(CER) need and importance, real life examples of CSR projects in India.

UNIT IV(6hrs)
Introduction and the need of intellectual property rights (IPR), kinds of intellectual property rights - Patents, Copy rights, Trade Mark, Plagiarism, types of plagiarism – Global plagiarism, verbatim plagiarism, paraphrasing plagiarism, patch work plagiarism, Plagiarism checking software .

Reference Books:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S. Chand Publications
3. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
4. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
5. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013
6. Dr. Vaibhav Ramesh Bhalerao , Dr. Mayur Subhash Punde, Dr. Shrikant Waghulkar, Thakur Publications, 2021
7. Corporate Social Responsibility in India, Sanjay K Agrawal, Sage Publications Pvt. Ltd; 2008
8. Fundamentals of Intellectual Property for Engineers, Kompal Bansal, BS publications, 2014

Dr. S. V. Sonelcar
Chairman

R.T.M. Nagpur University, Nagpur
Four Year B.Tech Course
(Revised curriculum as per AICTE Model Curriculum)
B.Tech. VI Semester (Computer Technology) Scheme

Subject Code	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1 BTCT601T	Compiler Design(TH)	3	0	0	30	70	100	3	PCC
2 BTCT601P	Compiler Design (PR)	0	0	2	25	25	50	1	PCC
3 BTCT602T	Data Warehousing and Mining(TH)	3	0	0	30	70	100	3	PCC
4 BTCT602P	Data Warehousing and Mining(PR)	0	0	2	25	25	50	1	PCC
5 BTCT603T	Elective II	3	0	0	30	70	100	3	PEC
6 BTCT604T	Elective III	3	0	0	30	70	100	3	PEC
7 BTCT605T	Open Elective – I	3	0	0	30	70	100	3	OEC
8 BTCT606T	Economics of IT industry	2	0	0	15	35	50	2	HSMC
9 BTCT607P	Mini Project	0	0	4	25	25	50	2	Project
10 BTCT608T	Organizational Behaviour (Audit Course)	2	0	0	0	0	0	0	Audit
	Total	19	00	08	240	460	700	21	

Elective -II BTCT603T	Elective -III BTCT604T	Open Elective -I BTCT605T
BTCT603T-1 High Performance Computer Architecture	BTCT604T-1 Embedded System	BTCT605T-1 Digital Image Processing
BTCT603T-2 Software Testing and Quality Assurance	BTCT604T-2 Mobile Application and Development	BTCT605T-2 Advanced Web Technologies
BTCT603T-3 Advance Microprocessor	BTCT604T-3 Cloud Computing	BTCT605T-3 Multimedia and

Mrs. Rubana Khan

(Dr AM Thakare)

Dr. (Mrs). Snehal salwk

N·M·Thakare

and Interfacing		Animation

PCC-CS Professional Core Courses **ESC** – Engineering Science Courses **LC** – Laboratory Course
OEC-CS Open Elective Courses   **MC** – Mandatory Course   **PROJ-CS** Project (Min. one month
internship is derirable)   **BSC** – Basic Science Courses   **PEC-CS** Professional Elective Courses
HSMC- Humanities and Social Sciences including Management Courses

Total Credits: 03	Subject Code: BTCT601T
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. To make students to understand basics of Compilation Process.
2. To make students to understand thoroughly the concepts of various phases of Lexical Analysis, Syntax Analysis, Syntax Directed Translation Scheme.
3. To make students to understand Code generation and code Optimization techniques

Course Outcomes:
After completing the course, students will be able to
1. Explain basic fundamentals of the translators and role of the lexical analysis.
2. Describe principles of Parsing and will be able design various Top-Down and Bottom-Up Parsers
3. Explain various forms of intermediate code and will be able to demonstrate use of SDTS to translate elementary programming constructs.
4. Describe various optimization techniques and will be able to develop simple code generators.
5. Explain storage allocation methods, error recovery techniques and will be able to apply various error recovery techniques in parsers.

Unit I   (06 Hrs)

Translators, Compilers, Interpreters, Just in Time Compilers, Cross Compilers, Bootstrapping, Structure of a typical compiler, overview of lexical analysis, syntax analysis, code optimization and code generation, design of lexical analyzer.

Unit II   (08 Hrs)

Parsers, Shift-Reduce Parser, Top-down parser, Predictive Parsers, Bottom up parsing technique, LR parsing algorithm, Design of SLR, LALR, LR parsers.

Unit III   (08 Hrs)

Syntax directed schemes, intermediate code, Prase trees, Syntax trees, three address code, Quadruples, Triples, Indirect Triple, using syntax directed translation schemes to translate assignment statements, Boolean expressions, if then else structures

Unit IV   (08 Hrs)

Sources of Optimization, Loop Optimization, DAG representation of basic blocks, Global data flow analysis, Dominators, Loop invariant computations, Induction variable elimination, Loop unrolling, Loop jamming., simple code generator, Register allocation and assignment

Unit V (06 Hrs)

Storage allocation and run time storage administration, symbol table management, types of Errors, Lexical phase Errors, Syntactic phase Errors, error recovery in LR parsing, error recovery in LL parsing,

Text Books:
1. Alfred V.Aho, Jeffrey Ullman :Principals of Compiler Design, ,Narosa Publications.
2. O.G. Kakde : Compiler Design , Laxmi Publication , 4th Edition.

Reference Books:
1. Fischer and LeBlanc: Crafting a compiler:, Addison Wesley

Compiler Design (Practical)

Total Credits: 01	Subject Code: BTCT601P
Teaching Scheme:	Examination Scheme:
Lectures: 00 Hours/Week	College Assessment: 25 Marks
Tutorials: 00 Hours/Week	University Assessment:25 Marks
Practical: 02 Hours/Week	

Minimum ten experiments should be conducted based on the theory syllabus.

Total Credits: 03	Subject Code: BTCT602T
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

To make students
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:

After completion of the course, students will be able to -

1. Understand the data warehousing components and design a data warehouse for any organization.
2. Learn data mining concepts and working.
3. Explore functionality of the various data mining techniques.
4. Discuss the data-mining tasks like classification, clustering, association mining and extract knowledge using data mining techniques.
5. Apply data mining techniques in trending domain such as web mining and Solve real-world problems in business and scientific information using data mining.

UNIT I   (09 Hrs)

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   (06 Hrs)

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   (09 Hrs)

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   **(06 Hrs)**

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   **(06 Hrs)**

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 BOOK:

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.

Data Warehousing and Mining (Practical)

Total Credits: 01	Subject Code: BTCT602P
Teaching Scheme:	Examination Scheme:
Lectures: 00 Hours/Week	College Assessment: 25 Marks
Tutorials: 00 Hours/Week	University Assessment:25 Marks
Practical: 02 Hours/Week	

Minimum ten experiments should be conducted based on the theory syllabus.

Total Credits: 03	Subject Code: BTCT603T-1
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. To make students familiar with fundamental of computer organization and performance laws
2. To discuss the concept and issues in instruction level Parallelism
3. To discuss multiprocessor architecture and synchronization issue in multiprocessor

Course Outcomes: After completing the course, students will be able to
1. Compare Multi vector and SIMD Computers, PRAM and VLSI Models
2. Explain Basic concepts, instruction and arithmetic pipelines, and hazards in a pipeline:
3. Illustrate Concepts and Challenges, Basic Compiler Techniques for Exposing ILP
4. Explain Virtual memory organization, mapping and management
5. Compare Parallel and Scalable Architecture, Multiprocessors and Multicomputer:

Unit I   (08 Hrs)

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputers, Multi vector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks, Principles of Scalable Performance: Performance Metrics and Measures, Speedup and Performance Laws.

Unit II   (08 Hrs)

Pipelining, Basic concepts, instruction and arithmetic pipelines, and hazards in a pipeline: structural, data and control hazards, overview of hazard resolution technique, Dynamic instruction scheduling, branch prediction techniques, Exception handling, Pipeline optimization techniques, Compiler techniques for improving performance.

Unit III   (08 Hrs)

Instruction Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Prediction , Overcoming Data Hazards with Dynamic Scheduling ,Dynamic Scheduling: Algorithm, Data level and Thread Level Parallelism.

Unit IV   (06 Hrs)

Memory Hierarchies: Basic concept of hierarchical memory organization, Hierarchical memory technology, main memory, Inclusion, Coherence and locality properties, Cache memory design and implementation, Techniques for reducing cache misses, Virtual memory organization, mapping and management techniques, memory replacement policies, RAID.

Unit V (06 Hrs)

Parallel and Scalable Architecture: Multiprocessors and Multicomputer: Multiprocessor System Interconnect, Cache Coherence and Synchronization Mechanism, Multi vector and SIMD Computers: Vector Processing Principles, Multi vector-Multiprocessor, Compound Vector Processing.

Text Books:

1. John. Hennessy & David A . Patterson, "Computer Architecture A quantitative approach", 5 th Edition, Morgan Kaufmann Publications.
2. Kai Hwang and A. Briggs , "Computer Architecture and parallel Processing ", International Edition McGraw-Hill.

Reference Book

1. Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability and Programmability" 2 nd Edition, TMH Publications
2. David A. Kular and Jasvinder Pal Singh," Parallel Computer Architecture", Morgan Kaufmann Publications.

Total Credits: 03	Subject Code: BTCT603T-2
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	**Examination Scheme :** Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. To learn the criteria for test cases.
2. To learn the design of test cases.
3. To understand test management and test automation techniques.
4. To apply test metrics and measurements.

Course Outcomes: After completing the course, students will be able to
1. Design test cases suitable for a software development for different domains.
2. Identify suitable tests to be carried out.
3. Prepare test planning based on the document, develop and validate a test plan
4. Document test plans and test cases designed.
5. Use automatic testing tools.

Unit I   (08 Hrs)

Overview of software evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference between Verification and Validation, Test Cases, Testing Suite, Test Oracles, Impracticality of Testing All data; Impracticality of testing AllPaths
Introduction: Purpose – Productivity and Quality in Software – Testing Vs Debugging – Model for Testing – Bugs – Types of Bugs – Testing and Design Style.
Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design.

Unit II   (07 Hrs)

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing -Compatibility testing – user documentation testing – domain testing – Random Testing -Requirements based testing
Using White Box Approach to Test design – Test Adequacy Criteria
– static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs
– Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches-Evaluating Test Adequacy Criteria.

Unit III   (07 Hrs)

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing -Compatibility testing – Testing the documentation -Website testing.

Unit IV   (07 Hrs)

Software Testing Activities: Levels of Testing, Debugging, Testing techniques and theirApplicability, Exploratory TestingAutomated Test Data Generation:Test Data, Approaches to test data generation, test data generation using genetic algorithm, Test Data Generation Tools, Software Testing Tools, and Software test Plan.

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

Unit V   (07 Hrs)

Object oriented Testing: Definition, Issues, Class Testing, Object Oriented Integration and System Testing. Testing Web Applications: What is Web testing?, User interface Testing, Usability Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing.

Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing – Formats – Test Cases .

Logic Based Testing – Decision Tables – Transition Testing – States, State Graph, State Testing.

Text Books:
1. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing – Principles and Practices, Pearson Education, 2006.
2. Ron Patton, Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007.
3. Ilene Burnstein, Practical Software Testing, Springer International Edition, 2003.

Reference Books:
1. Edward Kit, Software Testing in the Real World – Improving the Process, Pearson Education, 1995.
2. Boris Beizer, Software Testing Techniques – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
3. Aditya P. Mathur, Foundations of Software Testing _ Fundamental Algorithms and Techniques, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

Total Credits: 03	Subject Code: BTCT603T-3
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	**Examination Scheme :** Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To study architecture of microprocessor & to understand the concept of memory organization.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To create an exposure to basic peripherals, its programming and interfacing techniques
4. To understand the concept of Interrupts and interfacing details of 8086.
5. To impart the basic concepts of serial communication in 8086.

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

1. Describe internal organization of 8086/8088 microprocessors. Demonstrate the concept of interrupts and its use
2. Understand assembly language programming using concepts like assembler directives, procedures, macros, software interrupts. Describe the concept of addressing modes
3. Demonstrate Interfacing of 8086 with Keyboard/ Display, ADC/DAC,8255 PPI,Programmable Keyboard/Display controller 8279.
4. Demonstrate Interfacing of 8086 with Programmable interval timer/counter 8254, 8259 PIC.Demonstrate the concept of Serial data communication using USART 8251
5. Describe 8087 Numeric coprocessor & its use in practical application.Describe the concept of DMA & Pentium.

Unit I   (08 Hrs)

8086 /8088 architecture: 8086 /8088 architecture- functional diagram, pin diagram,features and operating modes, minimum mode and maximum mode, memory segmentation, programming model, Memory addresses, physical memory organization & interfacing, Interrupts of 8086.

Unit II   (06 Hrs)

Clock generator 8284,Instruction set and assembly language programming of 8086: Instruction formats. Addressing modes, instruction set, assembler directives. Simple programs involving logical, branch and call instructions.Sorting, evaluating arithmetic expressions, string manipulations instructions.

Unit III   (08 Hrs)

8086 & Peripheral Interfacing I: Assembly language programming of 8086,Interrupt structure, I/O interfacing, Interfacing of peripherals like 8255 PPI, multiplexed 7-seg display & matrix keyboard interface using 8255. Programmable Keyboard/Display controller 8279, Organization, Working modes, command words & interfacing.

Unit IV (08 Hrs)

8086 & Peripheral Interfacing II : Programmable interval timer/counter 8254; Architecture, working modes, interfacing 8259 PIC, Organization, control words, interfacing, cascading of 8259's. Serial communication, Classification & transmission formats. USART 8251, Pins & block diagram, interfacing with 8086 & programming.

Unit V (06 Hrs)

Numeric Co-processor & DMA Controller: 8086 maximum mode pin diagram, Closely coupled & loosely coupled multiprocessor system, 8087 Numeric coprocessor, architecture, interfacing with 8086, instruction set. DMAC 8237, Architecture, interfacing & programming, Introduction to Pentium.

Text Books:
1. D.V.Hall, Microprocessors and Interfacing. TMGH
2.Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH

Reference Books:
1.Intel Reference Manuals, Microprocessors : Intel
2.8086 MICROPROCESSOR AND APPLICATIONS 3ED (PB 2022) by A.Nagoorkani

Total Credits: 03	Subject Code: BTCT604T-1
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To make students to conceptualize the basics of embedded systems
2. To make students to conceptualize the basics of organizational and architectural issues of a microcontroller.
3. To make students to learn programming techniques used in microcontroller.
4. To make students to understand fundamentals of real time operating system
5. To make to design embedded system

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

1. Define and explain the basic fundamental, problems and challenges and application areas in embedded system.
2. Illustrate the fundamental of 8051 Microcontroller ,
4. Illustrate the communication with 8051 Microcontroller and analyze through programming.
4. Illustrate the basic concepts with working environment of Real Time Operating System
5. Design embedded system and apply in case study .

Unit I   (06 Hrs)

Introduction to Embedded Systems: Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC.

Unit II

(06 Hrs)

The Microcontroller Architecture: Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.

Unit III   (10 Hrs)

Assembly Language Programming of 8051: Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and ISR.

Unit IV   (10 Hrs)

Embedded / Real Time Operating System: Architecture of kernel, Task and Task scheduler, Interrupt service routines, Semaphores, Mutex, Mailboxes, Message queues, Event registers, Pipes, Signals, Timers, Memory management, Priority inversion problem. Off-the-Shelf Operating Systems, Embedded Operating Systems, Real Time Operating System (RTOS) and Handheld Operating Systems.

Embedded System - Design case studies: Digital clock, Battery operated smart card reader, Automated meter reading system, Digital camera.

Text Books:
1. The 8051 microcontroller & Embedded systems, M. A. Mazidi, J. G. Mazidi, R. D. McKinlay, Pearson
2. The 8051 microcontroller & Embedded systems, Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning
3. Embedded / real – time systems: concepts, design & programming, Black Book, Dr. K. V. K. K. Prasad, Dreamtech press
4. Introduction to embedded systems, Shibu K. V., McGraw Hill

Reference Books:
1. Embedded systems an integrated approach, Laya B. Das, Pearson.
2. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiely
3. Raj Kamal, Embedded Systems Architecture, Programming and design, Tata MCgraw-Hill Publication.

Total Credits: 03	Subject Code: BTCT604T-2
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

To make students
1. To understand android SDK.
2. To aware basic understanding of Android application development.
3. To inculcate working knowledge of Android Studio development tool.

Course Outcomes:

At the end of this course, students will be able to:
1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.
5. Deploy applications to the Android marketplace for distribution.

UNIT - I   **(08 Hrs)**

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT - II   **(08 Hrs)**

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT - III   **(08 Hrs)**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT - IV   **(06 Hrs)**

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT - V   **(06 Hrs)**

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TEXT BOOKS:
1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education.

2. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd.

3. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd.

4. Android Application Development All in one for Dummies by Barry Burd.

Total Credits: 03	Subject Code: BTCT604T-3
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	**Examination Scheme :** Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. To make students familiar with the concepts, characteristics, delivery models and benefits of cloud computing.
2. To make the student aware of the key security and compliance challenges of cloud computing
3. To make students understand about key technical and organizational challenges and the different characteristics of public, private and hybrid cloud deployment models.

Course Outcomes : After completing the course, students will be able to
1. The concepts, characteristics, delivery models and benefits of cloud computing.
2. Illustrate and explain in detail the cloud computing architecture and classify various types of clouds.
3. Explain big data analysis, Hadoop and MapReduce and introduction to tools.
4. Illustrate various security concepts in cloud computing and need of security measures.
5. Discuss and implement Cloud based Application using C# and windows azure

Unit I   (08 Hrs)

Introduction to Cloud Computing, Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Pros and Cons of Cloud Computing, Benefits of CloudComputing, Cloud computing vs. Cluster computing vs. Grid computing. Legal issues when using cloud models, challenges in cloud computing.

Unit II   (08 Hrs)
Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

Unit III   (06 Hrs)
Big Data Analysis, Hadoop and Map Reduce: Introduction, Clustering Big Data, Classification of Big Data, Hadoop MapReduce Job Execution, Hadoop scheduling, Hadoop cluster setup, configuration of Hadoop, starting and stopping Hadoop cluster.

Unit IV   (06 Hrs)
Security in Cloud: Cloud Security Challenges, Infrastructure Security, Network level security, Host level security, Application level security, data privacy, data security, application security, virtual machine security, Identity Access Management, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Unit V   (08 Hrs)
Application Development using C#: Understand object oriented concepts in C#.NET, Creation of UI and event handling, web page creation using ASP.NET, ADO.NET architecture, implementation of data seta, using ADO.NET in console application, using ADO.NET in web application.

Creating Cloud Application using Azure: Creating simple cloud application, Azure fabrics, Azure service, and storage types and deployment of application to the production environment.

Text Books:

1. Mcohen K. Hurley, "Google Compute Engine", O'Reilly Edition, 2014 .
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wile, 2011.
3. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing, A Hands-on Approach", Universities Press, 2013.
4. R. J. Dudley, N. A. Duchene, "Microsoft Azure: Enterprise Application Development", Packt Publication, 2010.

Reference Books:

1. B. M. Harwani, "Cloud Computing using Windows Azure ", Arizona Business Alliance Publication, 2014.
2. J. W. Rittinghouse, J. F. Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press, 2009.

Total Credits: 03	Subject Code: BTCT605T-1
Teaching Scheme : **Lectures: 03 Hours/Week** **Tutorials: 00 Hours/Week** **Practical: 00 Hours/Week**	**Examination Scheme :** **Duration of University Exam : 03 Hrs.** **College Assessment : 30 Marks** **University Assessment:70 Marks**

Course Objectives:
1. To understand the basic fundamentals of image.
2. To understand and describe various techniques for image enhancement and restoration.
3. To understand and describe various techniques for image segmentation and compression.

Course Outcomes: After completing the course, students will be able to
1. Explain the basic fundamentals of Image and compare different 2 D transforms.
2. Design and implement various image enhancement techniques.
3. Design and implement various image restoration techniques.
4. Design and implement various image segmentation techniques.
5. Design and implement various image compression techniques.

UNIT I: (06 Hrs)

Digital image fundamentals: Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms -DFT, DCT, KLT, SVD.

UNIT II: (09 Hrs)

Image enhancement: Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image fundamentals -RGB, HSI models, Color image enhancement.

UNIT III: (07 Hrs)

Image restoration: Image Restoration -degradation model, unconstrained restoration -Lagrange multiplier and constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV: (06 Hrs)

Image segmentation: Edge detection, Edge linking via Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and merging, Segmentation by morphological watersheds, basic concepts, Dam construction, and Watershed segmentation algorithm.

UNIT V: (08 Hrs)

Image compression: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

Text Books:
1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, PearsonEducation, Third Edition, 2008.

2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson 2002.

Reference Books:
1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
3. D. E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing' , John Wiley, New York, 2002
5. Milan Sonka etaI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999,

Total Credits: 03	Subject Code: BTCT605T-2
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	**Examination Scheme :** Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:
1. To introduce PHP language for server-side scripting
2. To introduce XML and processing of XML Data with Java
3. To introduce Server-side programming with Java Servlets and JSP
4. To introduce Client-side scripting with Javascript and AJAX.

Course Outcomes: After completing the course, students will be able to
1. Gain knowledge of client-side scripting, validation of forms and AJAX programming
2. Understand server-side scripting with PHP language
3. Understand what is XML and how to parse and use XML Data with Java
4. Introduce Server-side programming with Java Servlets and JSP
5. Introduce Scripting Language PHP

Unit I   (07 Hrs)

HTML Common tags- List, Tables, images, forms, Frames; **Cascading Style sheets**; **XML:** Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

Unit II   (07 Hrs)

Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

Unit III   (07 Hrs)

Introduction to Servlets: Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

Unit IV   (07 Hrs)

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP

Unit V   (08 Hrs)

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

Text Books:
1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill

Reference Books:
1. Web Programming, building internet applications, Chris Bates 2" edition, Wiley Dreamtech
2. Java Server Pages —Hans Bergsten, SPD O'Reilly,
3. Java Script, D.Flanagan
4. Beginning Web Programming-Jon Duckett WROX. R18 B.TECH CSE III YEAR
5. Programming world wide web, R.W.Sebesta, Fourth Edition, Pearson.
6. Internet and World Wide Web — How to program. Dietel and Nieto, Pearson.

Total Credits: 03	Subject Code: BTCT605T-3
Teaching Scheme : Lectures: 03 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assessment:70 Marks

Course Objectives:

1. To introduce the principles and current technologies of multimedia systems.

2. Issues in effectively representing, processing, and retrieving multimedia data such as sound and music, graphics, image and video will be addressed.

3.The students will gain hands-on experience in those areas by implementing some components of a multimedia streaming system as their term project.

4.Latest Web technologies and some advanced topics in current multimedia research will also be discussed.

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

1.To acquire fundamentals principles of multimedia, including digitization and data compression for non-textual information

2. To understand issues in representing, processing, and transmitting multimedia data

3. To understand core multimedia technologies and standards

4. To gain hands-on experience in image, sound and video editing and in some aspects of multimedia authoring (incorporating images, sound, video, and animation)

5.To design, capture, store and integrate sound, images and video to deliver multimodal information.

Unit I   (08 Hrs)

Limitations of Traditional Input Device, Multimedia Elements. Multimedia Application. Multimedia System Architecture, Evolving Tech. for Multimedia, Defining Objects for Multimedia Systems, Multimedia Data Interface Standard. Magnetic Media Technology, Hard disk Technology, RAID, Criteria for Selection of RAID, Use of Magnetic Storage in Multimedia, Optical Media, Magneto Optical.

Unit II   (07 Hrs)

Evaluating the Compression System, How much, Compression, How Good is Picture, How fast Does it Compress or Decompress, What H/W & S/W Does it take, Redundancy & Usability. Types of compression, Need of Data Compression ,Color Gray Scale and Still Video Image , Color Characteristics, Color Model,Simple Compression Technique, Interpolative, Predictive, Transfer Coding, Discrete Transfer, Statistical (Huffman, arithmetic)JPEG Compression, Requirement Addressing JPEG, Definition of JPEG Standard, Overview of JPEG Components, JPEG methodology, The discrete cosine Transfer , Quantization, Zigzag Sequence.

Unit III   (07 Hrs)

Introduction to Standardization of Algorithm •File Formats •History of RIF, TIFF TIFF Specification , TIFF structure , TIFF tag ,TIFF Implementation issues , TIFF classes RIFF Chunks with two sub chunks , List chunk , RIFF waveform Audio File format , RIFF MIDI file Format, RIFF DIB's,•Introduction to RIFF, AVI RIFF AVI File format, Index Chunk and Boundary condition handling for AVI files., AVI Indeo File Format. JPEG-objectives, Architecture, JPEG-DCT encoding Quantization. •JPEG-stastical coding, predictive lossless coding, JPEG performance •MPEG-objectives, Architecture, BIT stream syntax performance •MPEG2 & MPEG4.

Unit IV (07 Hrs)

Multi Media Authoring System and its type. Hypermedia Application Design consideration. User Interface Design. Information Access. Object Display / Playback Issues. Components of Distributed Multimedia Systems 5.2 Distributed Client Server Operation 5.3 Multimedia Object Server 5.4 Multi Server Network topologies 5.5. Distributed Multimedia Databases.

Unit V (07 Hrs)

Introduction to Multimedia tool – Flash. Creating & Modifying elements 6.3 Line tool, fill/attributes, different shapes, text tools & pen tool. Selecting lines fill with arrow tool, selecting shapes, using lasso tool performing basic editing tools, selecting & deselecting elements, modifying created objects.

Text Books:
1.Prabhat k. Andheigh, Kiran Thakrar, John F, Multimedia Systems Design, Prentice Hall of India
2.Koegel Buford , Multimedia Systems Design, Pearson Education
3. Katherine Ulrich ,Micromedia Flash for Windows and Macintosh, Pearson Education

Reference Books:
1.Free Halshal, Multimedia Communication , Pearson Education
2. . R. Steimnetz, K. Nahrstedt, Multimedia Computing, Communication and Application , Pearson Education
3. .D. Gibson, Multimedia Communication Directions and Innovations,Academic Press, Hardcourt India
4.J.F. Kurose, K. W. Rose, Computer Networking, Pearson Education

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur
Syllabus for B.Tech. Sixth Semester CT
Economics of IT industry(Theory)

Total Credits: 02	Subject Code: BTCT606T
Teaching Scheme : Lectures: 02 Hours/Week Tutorials: 00 Hours/Week Practical: 00 Hours/Week	**Examination Scheme :** **Duration of University Exam : 02 Hrs.** **College Assessment : 15 Marks** **University Assessment:35 Marks**

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

1. Distinguish between Micro and Macro economics
2. Relate economics concept with IT industry
3. Identify key trends in IT industry
4. Understand the key economic drivers of IT industry.

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.

Total Credits: 02	Subject Code: BTCT607P
Teaching Scheme : Lectures: 00 Hours/Week Tutorials: 00 Hours/Week Practical: 04 Hours/Week	Examination Scheme : College Assessment : 25 Marks University Assessment:25 Marks

Total Credits: 00
Teaching Scheme : **Lectures:** 02 Hours/Week **Tutorials:** 00 Hours/Week **Practical:** 00 Hours/Week

Objective: The objective of the course is to create awareness among learners about the various essential aspects of organizational processes and structure and motivation in organization.

Course outcomes: By the end of the course, students will be able to

1. understand the concept and importance of organizational behaviour.
2. acquire the knowledge of interpersonal behaviour and transaction analysis
3. know different traits and theories of personality
4. analyze the importance of motivation in organization and types of leadership

Unit 1. Introduction to organizational behaviour.
Concept of organization behaviour, Importance of organization behaviour, Key elements of organization behaviour, scope of organizational behaviour.

Unit 2: Introduction to interpersonal behaviour.
Nature and meaning of interpersonal behaviour, concept of transaction analysis, benefits and uses of transaction analysis, Johari window model.

Unit 3: Introduction to personality
Definition and meaning of personality, importance of personality, theories of personality, personality traits.

Unit 4: Introduction to Motivation and leadership.
Concept and importance of motivation, Maslow's two factor theory of motivation. Significance of motivation in organization. Types of leadership styles.

List of books

1. Organizational behaviour by MN Mishra, published by S.Chand.

2. The human side of organization by Michale Drafke, published by Pearson education.

3. Management and Organizational behaviour by Laurie.J. Mullins, published by Pearson education.

4. Organizational behaviour by K. Aaswathappa, Published by Himalaya publications.