

**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	Category
			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	Project
9	BEIT607T	Economics of IT Industries	2	-	-	15	35	50	2	HSMC
10	BEIT608T	Organizational Behavior	2	-	-					Audit
		<b>Total</b>	<b>19</b>	<b>00</b>	<b>10</b>	<b>240</b>	<b>460</b>	<b>700</b>	<b>22</b>	

**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)

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**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. Serializability: 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

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

**BRANCH: INFORMATION TECHNOLOGY**

**Subject Name: Database Management System Lab**

**Subject code: BEIT601P**

<b>Load</b>	<b>Practical</b>	<b>Credits</b>	<b>College Assessment Marks</b>	<b>University Evaluation</b>	<b>Total Marks</b>
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

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

**BRANCH: INFORMATION TECHNOLOGY**

**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

<b>Unit 1</b>	<b>INTRODUCTION TO ARTIFICIAL INTELLIGENCE:</b> History of artificial intelligence, The birth of artificial intelligence, AI Winters, Today's 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
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<b>Unit 2</b>	<b>LOGICAL APPROACH TO AI AND KNOWLEDGE -BASED SYSTEM:</b> 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.
<b>Unit 3</b>	<b>PROBABILISTIC APPROACH TO AI:</b> 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.
<b>Unit 4</b>	<b>EVOLUTIONARY INTELLIGENCE AND NEURAL NETWORKS, NATURAL LANGUAGE UNDERSTANDING:</b> 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.
<b>Unit 5</b>	<b>INTRODUCTION TO MACHINE LEARNING AND LEARNING DETERMINISTIC MODELS:</b> 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

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

**BRANCH: INFORMATION TECHNOLOGY**

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

<b>Load</b>	<b>Practical</b>	<b>Credits</b>	<b>College Assessment Marks</b>	<b>University Evaluation</b>	<b>Total Marks</b>
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

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**SEMESTER: SEVENTH (C.B.C.S)**  
**BRANCH: INFORMATION TECHNOLOGY**

**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.

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

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**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

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**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	<b>Introduction:</b> 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	<b>Fast access technologies:</b> ADSL, Cable Modem, etc.) ATM Networks. ATM layer. ATM Adaptation Layers. <b>Congestion control:</b> Signaling, Routing, QoS support, Neighbor discovery, Auto configuration. Changes to other protocols.
Unit 3	<b>IPv6:</b> Basics of IPv4, Why IPv6, basic protocol, extensions 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	<b>Security</b> : 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	<b>TCP</b> :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.

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**SEMESTER: SIXTH (C.B.C.S)**  
**BRANCH: INFORMATION TECHNOLOGY**

**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

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**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	7 0	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	<b>Fundamentals of IoT</b> : 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	<b>Sensors Networks</b> : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, Raspberry Pi Development Kit, RFID <b>IP Based Protocols for IoT:</b> IPv6, 6LowPAN, RPL, REST, AMQP, CoAP, MQTT. Edge connectivity and protocols

Unit 3	<b>Data Handling &amp; Analytics</b> : 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	<b>Applications of IoT</b> : 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	<b>Cloud Analytics for IoT Application:</b> 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”, Wiley Publications
3. Vijay Madisetti and Arshdeep Bahga, — “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, Wiley 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 st Edition, 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.

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**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	<b>Basic concepts of Testing:</b> 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	<b>Unit Testing:</b> 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	<b>Data Flow and System Integration Testing</b> : Introduction Data flow testing, Data flow graph, Data flow testing criteria, Comparison of Data flow test selection criteria. <b>Fundamentals of System Integration</b> : Types of interfaces and interface errors, System integration testing, Software and Hardware integration, Test plan, Off -the shelf
	component integration and testing
Unit 4	<b>System Test Categories and Test Design</b> : 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	<b>Acceptance Testing and Software Quality</b> : 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 preprocessing 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	<b>Introduction to Data Science</b> 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
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Unit 2	<p><b>Mathematical Foundations for Data Science</b></p> <p>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</p>
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	<p>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.</p>
Unit 3	<p><b>PYTHON FOR DATA HANDLING</b></p> <p>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</p>
Unit 4	<p><b>PYTHON FOR DATA VISUALIZATION</b></p> <p>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</p>
Unit 5	<p><b>Advanced Data Analysis</b></p> <p>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</p>

### 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

**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 3	3D Animation & its Concepts – Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation.
Unit 4	Motion Capture – 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

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

**BRANCH: INFORMATION TECHNOLOGY**

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

**Subject code: BEIT606P**

<b>Load</b>	<b>Practical</b>	<b>Credits</b>	<b>College Assessment Marks</b>	<b>University Evaluation</b>	<b>Total Marks</b>
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.

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

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

**BRANCH: INFORMATION TECHNOLOGY**

**Subject Name: Economics of IT Industries**

**Subject code: BEIT607T**

<b>Load</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Credits</b>	<b>College Assessment Marks</b>	<b>University Evaluation</b>	<b>Total Marks</b>
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**

<b>Load</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Credits</b>	<b>College Assessment Marks</b>	<b>University Evaluation</b>	<b>Total Marks</b>
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 essential aspects 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.