Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY

(Established as State Technical University in the State of Maharashtra)

Under Maharashtra Act No. XXIX of 2014

Po. Lonere, Dist. Raigad, Pin 402 103, Maharashtra.

Telephone and Fax No. 02140 - 275142

www.dbatu.ac.in

Detailed Syllabus

for

Final Year B. Tech in Computer Engineering

with effective from July 2020 - 21

11 August 2020

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - I
Group A

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	**Mandatory**	**Induction Program**	**3 weeks duration in the beginning of the semester**						
2	BTBS101	Engineering Mathematics – I	3	1	-	20	20	60	4
3	BTBS102	Engineering Physics	3	1	-	20	20	60	4
4	BTES103	Engineering Graphics	2	-	-	20	20	60	2
5	BTHM104	Communication Skills	2	-	-	20	20	60	2
6	BTES105	Energy and Environment Engineering	2	-	-	20	20	60	2
7	BTES106	Basic Civil and Mechanical Engineering	2	-	-	50	-	-	Audit
8	BTBS107L	Engineering Physics Lab	-	-	2	60	-	40	1
9	BTBS108L	Engineering Graphics Lab	-	-	4	60	-	40	2
10	BTHM109L	Communication Skills Lab	-	-	2	60	-	40	1
		TOTAL	**14**	**2**	**8**	**330**	**100**	**420**	**18**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - II
Group B

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTBS201	Engineering Mathematics – II	3	1	-	20	20	60	4
2	BTBS202	Engineering Chemistry	3	1	-	20	20	60	4
3	BTES203	Engineering Mechanics	2	1	-	20	20	60	3
4	BTES204	Computer Programming in C	2	-	-	20	20	60	2
5	BTES205	Workshop Practices	-	-	4	60	-	40	2
6	BTES206	Basic Electrical and Electronics Engineering	2	-	-	50	-	-	Audit
7	BTES207L	Computer Programming Lab	-	-	2	60	-	40	1
8	BTBS208L	Engineering Chemistry Lab	-	-	2	60	-	40	1
9	BTES209L	Engineering Mechanics Lab	-	-	2	60	-	40	1
10	BTES210P	Mini Project	-	-	2	60	-	40	1
11	BTES211P	Field Training / Internship / Industrial Training (minimum of 4 weeks which can be completed partially in First Semester and Second Semester or in at one time).	-	-	-	-	-	-	Credit to be evaluated in III Sem
		TOTAL	**12**	**3**	**12**	**430**	**80**	**440**	**19**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - III

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTBSC301	Engineering Mathematics – III	3	1	-	20	20	60	4
2	BTCOC302	Discrete Mathematics	2	1	-	20	20	60	3
3	BTCOC303	Data Structures	2	1	-	20	20	60	3
4	BTCOC304	Computer Architecture & Organization	2	1	-	20	20	60	3
5	BTCOC305	Digital Electronics & Microprocessors	2	1	-	20	20	60	3
6	BTHM3401	Basic Human Rights	2	-	-	50	-	-	Audit
7	BTCOL306	Python Programming	1	-	2	60	-	40	2
8	BTCOL307	HTML and JavaScript	1	-	2	60	-	40	2
9	BTCOL308	Data Structures Lab	-	-	2	60	-	40	1
10	BTCOL309	Digital Electronics & Microprocessor Lab	-	-	2	60	-	40	1
11	BTES211P	Field Training / Internship / Industrial Training Evaluation	-	-	-	-	-	50	1
		TOTAL	**15**	**5**	**8**	**390**	**100**	**510**	**23**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - IV

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTCOC401	Design & Analysis of Algorithms	2	1	-	20	20	60	3
2	BTCOC402	Probability & Statistics	2	1	-	20	20	60	3
3	BTCOC403	Operating Systems	2	1	-	20	20	60	3
4	BTCOE404	**Elective - I** (A) Object Oriented Programming in Java (B) Object Oriented Programming in C++	2	1	-	20	20	60	3
5	BTID405	Product Design Engineering	1	-	2	60	-	40	2
		Elective - II							
6	BTBS405A	Physics of Engineering Materials	2	1	-	20	20	60	3
	BTCOE406B	Numerical Methods							
	BTHM3402	Soft skills and Personality Development							
7	BTCOL407	Design & Analysis of Algorithms Lab	-	-	2	60	-	40	1
8	BTCOL408	Introduction to Data Science with R	1	-	2	60	-	40	2
9	BTCOL409	Object Oriented Programming Lab	-	-	2	60	-	40	1
10	BTCOL410	Operating System Lab	-	-	2	60	-	40	1
11	BTCOF411	Field Training / Internship / Industrial Training Evaluation	-	-	-	-	-	-	Credit to be evaluated in V Sem.
		TOTAL	**12**	**5**	**10**	**400**	**100**	**500**	**22**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - V

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTCOC501	Database Systems	3	1	-	20	20	60	4
2	BTCOC502	Theory of Computations	3	1	-	20	20	60	4
3	BTCOC503	Machine Learning	3	1	-	20	20	60	4
4	BTCOE504	**Elective – III** (A) Introduction to Research (B) Cyber Laws (C) Open Elective offered by other departments	2	-	-	20	20	60	2
5	BTCOE505	**Elective – IV** (A) Economics & Management (B) Business Communication	2	-	-	20	20	60	2
6	BTCOC506	Competitive Programming-I	1	-	2	60	-	40	2
7	BTCOL507	Database System Laboratory	-	-	2	60	-	40	1
8	BTCOL508	Machine Learning Laboratory	-	-	2	60	-	40	1
9	BTCOS509	Seminar	-	-	2	60	-	40	1
10	BTCOF411	Field Training / Internship / Industrial Training Evaluation	-	-	-	60	-	40	1
		TOTAL	**14**	**3**	**8**	**400**	**100**	**500**	**22**

BTCOC501 - Database Systems: Content of this subject is updated. Pl. find below the updated content.

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BTCOC501: Database Systems

[Unit 1] Introduction [6 Hrs]

Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture **Data modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, Constraints, keys, E-R Diagrams, Mapping Cardinality, Concepts of Super Key, candidate key, primary key, weak entity sets, Codd's rules, Extended ER model, Generalization, Aggregation, , Reduction of an ER diagrams to tables.

[Unit 2] Relational Data Model, Relational Algebra and Calculus [10 Hrs]

Structure of Relational Databases, Database Schema, Keys Relational algebra: Fundamental Operations, Additional Relational Algebra Operations, Extended Relational Algebra Operations. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.

[Unit 3] Introduction to SQL [6 Hrs]

Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operators, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database

Intermediate SQL : Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schema, Authorization, **Advanced SQL :** Assessing SQL from Programming Language, JDBC, ODBC, Embedded SQL, Functions and Procedures, Triggers,

[Unit 4] Relational database design [8 Hrs]

Normalization: Features of good relational designs, Functional dependencies, Normal forms, First, Second, Third normal forms, BCNF, Functional Dependency Theory, Multivalued Dependencies, Fourth Normal Form, Database Design Process

[Unit 5] File Organiztion, Indexing and Hashing [6 Hrs]

File Organization, Ordered Indices, B+tree Index files, B Tree Index File, Static Hashing, Dynamic Hashing, **Query processing:** Overview, Measures of Query Cost, Selection Operation, Evaluation of relational algebra expressions, Query Optimization, Query equivalence Rules, Join strategies.

[Unit 6] Transaction processing [6 Hrs]

Transaction Concept, A simple Transaction Model, Transaction Atomicity and Durablility, Transaction Isolation, ACID Properties, Serializability Concurrency Control Techniques: Lock based Protocols, Deadlock handling, Multiple Granularity, Time stamp-Based Protocols, Recovery System

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.

Reference Books:

1. Joel Murach, *Murach's Oracle SQL and PL/SQL for Developers,* Mike Murach & Associates, 2nd Edition, 2014.
2. Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.
3. Navathe, *Fundamentals of Database System*, Addison-Wesley Publication, 6th Edition, 2012.
4. Mark L. Gillenson, *Fundamentals of Database Management System*, Wiley Publication, 2nd Edition, 2011.
5. **Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Reprint by Addison-Wesley.**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester – VI

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTCOC601	Compiler Design	3	1	-	20	20	60	4
2	BTCOC602	Computer Networks	3	1	-	20	20	60	4
3	BTCOE603	**Elective – V** (A) Human Computer Interaction (B) Artificial Intelligence (C) Object-Oriented Analysis Design	2	1	-	20	20	60	3
4	BTCOE604	**Elective – VI** (A) Geographical Information System (B) Biology (C) Internet of Things	2	-	-	20	20	60	2
5	BTCOE605	**Elective – VII** (A) Development Engineering (B) National Social Service (C) Consumer Behaviour	2	-	-	20	20	60	2
6	BTCOC606	Competitive Programming-II	1	-	2	60	-	40	2
7	BTCOL607	(A) Mobile Application Development **OR** (A) Internet of Things Laboratory	1	-	2	60	-	40	2
8	BTCOL608	Computer Networks Laboratory	-	-	2	60	-	40	1
9	BTCOF609	Field Training / Internship / Industrial Training	-	-	-	-	-	-	Credit to be Evaluated in VII Sem.
		TOTAL	**14**	**3**	**6**	**280**	**100**	**420**	**20**

BTCOE604 (C): Internet of Things: Content of this subject is updated. Pl. find below the updated content.

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

BTCOE604 (B): Internet of Things

[Unit 1] IoT Introduction **[6 Hrs]**

Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

[Unit 2] Smart Objects **[6 Hrs]**

The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

[Unit 3] IP Layer **[6 Hrs]**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

[Unit 4] Data and Analytics for IoT **[7 Hrs]**

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IoT Security, Common Challenges in IoT Security, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

[Unit 5] IoT Physical Devices and Endpoints **[8 Hrs]**

Buildingiot with Arduino: Arduino–Interfaces-Arduino IDE–Programming , RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

REFERENCE BOOKS :

[1].David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education

[2].Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.

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

[4].Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - VII

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTCOC701	Software Engineering	3	-	-	20	20	60	3
2	BTCOE702	**Elective - VIII** (A) Big Data Analytics (B) Distributed System (C) Fundamental of Digital Image Processing	3	-	-	20	20	60	3
3	BTCOE703	**Elective - IX** (A) Cloud Computing (B) Business Intelligence (C) Natural Language Processing	3	-	-	20	20	60	3
4	BTCOE704	**Open Elective - X** (A) Blockchain Technology (B) Computer Graphics (C) Embedded Systems (D) Design Thinking	3	-	-	20	20	60	3
5	BTCOL705	Full Stack Development (LAMP / MEAN)	1	-	2	60	-	40	2
6	BTCOL706	System Administration	1	-	2	60	-	40	2
7	BTCOL707	Elective – VIII Lab	-	-	2	60	-	40	1
8	BTCOL708	Elective – IX Lab	-	-	2	60	-	40	1
9	BTCOP709	Project phase - I	-	-	2	60	-	40	1
10	BTCOF609	Field Training / Internship / Industrial Training	-	-	-	-	-	50	1
		TOTAL	**14**	**-**	**10**	**380**	**80**	**490**	**20**

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester – VIII

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	CA	MSE	ESE	
1	BTCOE801	**Elective – XI** #	3	-	-	20	20	60	3
2	BTCOE802	**Open Elective – XII** #	3	-	-	20	20	60	3
3	BTCOE803	Project phase - II (In-house) $ / Internship and project in the Industry	-	-	24	60	-	40	12
		TOTAL	**6**	**-**	**24**	**100**	**40**	**160**	**18**

These subjects are to be studied on self–study mode using SWAYAM / NPTEL. The list of self-study online courses is given below.

The list of self-study online courses

BTCOE801: **Elective – XI** #	BTCOE802: **Open Elective – XII** #
(A) Deep Learning	(A) Introduction to Industry 4.0 and Industrial Internet of Things
(B) Social Networks	(B) Cryptography and Network Security ##
(C) Randomized Algorithms ##	(C) Model Checking

***** Six months of Internship and Project in the industry.

$ This is for those students who are not doing Internship and project in the Industry, they can do project in the department.

Digital contents should be developed by University for the subjects:
1. Randomized Algorithm
2. Cryptography and Network Security

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

BTCOC701: Software Engineering

[Unit 1] Introduction **[6 Hrs]**

Professional software development, Software engineering ethics, Case studies.

Software processes: Software process models, Process activities, Coping with change, The rational unified process.

[Unit 2] Agile software development **[6 Hrs]**

Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods.

Requirements engineering: Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

[Unit 3] System modeling **[6 Hrs]**

Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering. **Architectural design:** Architectural design decisions, Architectural views, Architectural patterns, Application architectures.

[Unit 4] Design and implementation **[6 Hrs]**

Object-oriented design using UML, Design patterns Implementation issues, Open source development.

[Unit 5] Testing **[6 Hrs]**

Software testing, Development testing, Test-driven development, Release testing, User testing.

[Unit 6] **[6 Hrs]**

Dependability properties, Availability and reliability, Safety Security.

Text Books:

1. Ian Sommerville, *Software Engineering*; 9th Edition, Addison-Wesley Publishing Company, USA.

Reference Books:

1. Software Engineering, S. A. Kelkar, Prentice Hall of India, 2007
2. Software Engineering, Pressman, Tata McGraw Hill, 2006
3. Software Engineering, Pankaj Jalote, Narosa Publishers, 2006.

NPTEL Course:

1Software Engineering, Prof. Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur.

Elective - VIII
BTCOE702 (A): Big Data Analytics

[Unit 1] Introduction to Big Data [6 Hrs]
Why Big Data and Where did it come from?, Characteristics of Big, Challenges and applications of Big Data, Enabling Technologies for Big Data, Big Data Stack, Big Data distribution packages.

[Unit 2] Big Data Platforms [7 Hrs]
Overview of Apache Spark, HDFS, YARN, MapReduce, MapReduce Programming Model with Spark, MapReduce Example: Word Count, Page Rank etc, CAP Theorem, Eventual Consistency, Consistency Trade-O-s, ACID and BASE, Zookeeper and Paxos, Cassandra, Cassandra Internals, HBase, HBase Internals.

[Unit 3] Big Data Streaming Platforms [6 Hrs]
Big Data Streaming Platforms for Fast Data, Streaming Systems, Big Data Pipelines for Real-Time computing, Spark Streaming, Kafka, Streaming Ecosystem.

[Unit 4] Big Data Applications [6 Hrs]
Overview of Big Data Machine Learning, Mahout, Big Data Machine learning Algorithms in Mahout- kmeans, Naïve Bayes etc. Machine learning with Spark, Machine Learning Algorithms in Spark, Spark MLlib, Deep Learning for Big Data, Graph Processing: Pregel, Giraph, Spark GraphX

[Unit 5] Database for the Modern Web [7 Hrs]
Introduction to mongoDB key features, Core server tools, MongoDB through the JavaScript' sshell, Creating and querying through Indexes, Document-oriented, principles of schema design, Constructing queries on databases, collections and documents, MongoDBquery language.

Text Books:

3. "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Bart Baesens, Wiley and SAS Business Series.
4. "Big Data Principals and Paradiagram", Rajkumar Buyya, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, Morgan Kaufmann, Elsevier, ISBN: 978-0-12-805394-2
5. "MongoDB in Action", Kyle Banker, Peter Bakkum and Shaun Verch, 2nd Edition Dream tech Press, ISBN: 978-9351199359.
6. "Mining of Massive Datasets", Anand Rajaraman, Jeffrey D. Ullman, 3rd edition, Cambridge University Press

Reference Books:

1. "BIG Data and Analytics", Sima Acharya, Subhashini Chhellappan,Wiley publication, ISBN: 978-8126554782.

NPTEL COURSE:

1. Big Data Computing by PROF. RAJIV MISRA, Dept. of Computer Science and Engineering, IIT Patna.

Elective - VIII
BTCOE702 (B): Distributed Systems

[Unit 1] Introduction [7 Hrs]
Introduction to Distributed Computing System, Evolution of Distributed Computing System, Distributed Computing System models, Distributed Computing System Gaining Popularity, Distributed Operating System, Introduction to Distributed Computing Environment (DCE), Desirable Features of a Good Message-Passing System, Issues in IPC by Message-Passing, Synchronization, Buffering, Multidatagram message, Encoding and Decoding of message data, Process addressing, Failure Handling, Group Communication, Case Study: BSD UNIX IPC Mechanism.

[Unit 2] Remote Procedure Calls [7 Hrs]
Introduction, the RPC model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC messages, Marshaling arguments and Results, Server Management, Parameter Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client- Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case studies: Sun RPC, DCE, RPC.

[Unit 3] Distributed Shared Memory [6 Hrs]
Introduction, general Architecture of DSM Systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other Approaches to DSM, Heterogeneous DSM, Advantages of Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms.

[Unit 4] Resource Management [6 Hrs]
Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task assignment Approach, Load-Balancing Approach, load Sharing Approach, Process Migration, Threads.

[Unit 5] Distributed File System [6 Hrs]
Introduction, Desirable Features of a Good Distributed File System, File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions, Design Principles, Case Study: DCE Distributed File Service.

Text Books:

1. P. K. Sinha, *Distributed Operating System*, PHI Publication.
2. Colorouis, *Distributed Systems*, Addison Wesley Publication.
3. M. L. Liu, *Distributed Computing: Principles and Applications*, Addison-Wesley, 2004.

NPTEL Course:

1. Distributed Systems, Prof. Rajiv Mishra, IIT Patna.

Elective - VIII

BTCOE702 (C): Fundamental of Digital Image Processing

[Unit 1] Digital Image Fundamentals and Image Transform [6 Hrs]

What is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Digital image representation, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception, Image sampling and quantization, Basic relationship between pixels, Discrete Fourier transform, Properties of 2D DFT.

[Unit 2] Image Enhancement Techniques [6 Hrs]

Spatial Domain Techniques, Point processing, Neighborhood processing, Spatial domain filtering, Image smoothing and Image sharpening using spatial domain filters, Enhancement based on histogram modeling, Frequency domain filtering, Image smoothing and Image sharpening using frequency domain filters.

[Unit 3] Image Compression [6 Hrs]

Fundamentals, Types of redundancies, Lossy and Lossless compression, Dictionary based coding, Run-length coding, LZW coding, Huffman coding, Arithmetic coding, Image compression model.

[Unit 4] Image Segmentation [6 Hrs]

Detection of Discontinuities - Point, Line and Edge detection, finding gradients using masks, Thresholding based image segmentation, global and local thresholding, Region based segmentation.

[Unit 5] Applications in different domains [6 Hrs]

Applications of image processing in satellite, sonar, radar and medical areas.

Text Books:

1. R. C. Gonzalez and Richard E Woods, “Digital Image Processing”, 3’rd Edition, Pearson Education, ISBN 978-81-317-1934-3, 2008.
2. R.C. Gonzalez and R.E. Woods, “Digital Image Processing Using Matlab”, Pearson Education, ISBN: 978-8177588989.
3. Anil K Jain, “Fundamentals of Digital Image Processing”, Prentice Hall, ISBN: 0133361659, 9780133361650

Elective - IX
BTCOE703 (A): Cloud Computing

[Unit 1] Introduction to Cloud **[6 Hrs]**

Cloud Computing at a Glance, the Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments. **Virtualization:** Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V.

Before the Move into the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications.

[Unit 2] Cloud Computing Architecture **[6 Hrs]**

Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance.

Ready for the Cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management, Data Security, Network Security, Host Security, Compromise Response.

[Unit 3] Defining the Clouds for Enterprise **[6 Hrs]**

Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service; Scaling a cloud infrastructure - Capacity Planning, Cloud Scale. **Disaster Recovery:** Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

[Unit 4] Aneka: Cloud Application Platform **[6 Hrs]**

Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.

[Unit 5] Cloud Applications **[6 Hrs]**

Scientific Applications – Health care, Geo-science and Biology; Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.

Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model.Microsoft Azure- Azure Core Concepts, SQL Azure.

Text Books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi from TMH2013.
2. George Reese Cloud Application Architectures, First Edition, O"Reilly Media 2009.
3. Cloud Computing and SOA Convergence in Your Enterprise *A Step-by-Step Guide* by David S. Linthicum from Pearson 2010.
4. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India2012.
5. Cloud Computing – web based Applications that change the way you work and ollaborate Online – Micheal Miller, Pearson Education.

NPTEL Course:

1. Cloud Computing, Prof. Soumya Kanti Ghosh, Department of Computer Science and Engineering, IIT Kharagpur.

Elective - IX
BTCOE703 (B): Business Intelligence

[Unit 1] Introduction to Business Intelligence [6 Hrs]
Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP).

[Unit 2] Basics of BI [6 Hrs]
BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

[Unit 3] Data Integration [6 Hrs]
Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data –types and sources.

[Unit 4] Data Processing [6 Hrs]
Introduction to data quality, data profiling concepts and applications, Introduction to ETL (Extract-Transform-Loading) using Open Source Software

[Unit 5] Data and Dimension Modeling [6 Hrs]
Introduction, ER Modeling, multidimensional data modeling, concepts of dimensional, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPLs, creating OLAP using Application Software.

Basic of Enterprise Reporting: A typical enterprise, Malcolm Baldrige – quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using software tools, best practices in the design of enterprise dashboards.

Text Books:

1. R. N. Prasad and Seema Acharya, “Fundamentals of Business Analytics”, Wiley Publication.

Reference Books

1. Raiph Kimball, Ross, “The Data Warehouse Lifecycle Toolkit” Wiley Publication, 2nd edition.
2. Anahory& Murray, “Data Warehousing in the Real World” Pearson Edt Ponniah, “Data Warehousing Fundamentals”, Wiley Publication

Elective - IX

BTCOE703 (C): Natural Language Processing

[Unit 1] Introduction **[6 Hrs]**

Biology of Speech Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

[Unit 2] Word level Analysis **[7 Hrs]**

Morphology fundamentals; Morphological Diversity o f Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

[Unit 3] Syntax Analysis **[6 Hrs]**

Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

[Unit 4] Semantic Analysis **[7 Hrs]**

Lexical Knowledge Networks, Wordnet Theory; Indian Language Wordnets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors; Coreferences.

[Unit 5] Applications **[6 Hrs]**

Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

Text Books:

1. Allen, James, *Natural Language Understanding*, 2nd Edition, Benjamin / Cumming, 1995.
2. Charniack, Eugene, *Statistical Language Learning*, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, *Speech and Language Processing*, Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, *Foundations of Statistical Natural Language Processing*, MIT Press, 1999.

NPTEL Course:

1. Natural Language Processing, Prof. Pushpak Bhattacharyya, Department of Computer Science and Engineering, IIT Bombay.

Elective - X

BTCOE704 (A): Blockchain Technology

[Unit 1] Introduction [6 Hrs]

Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs. Private Blockchain, Understanding Cryptocurrency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain. **Basic Crypto Primitives:** Hash functions, Properties of a hash function, Hash pointer and Merkle tree, Public key cryptography, Digital signatures, Zero-knowledge systems

[Unit 2] Bitcoin and Blockchain [6 Hrs]

Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. **Working with Consensus in Bitcoin:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake,Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

[Unit 3] Permissioned Blockchain [6 Hrs]

Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain-Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

[Unit 4] Blockchain Application Development [5 Hrs]

Enterprise application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade –Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

[Unit 5] Blockchain Application Development [5 Hrs]

Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.

Text Books:

1. Melanie Swan, *"Blockchain: Blueprint for a New Economy"*, O' Reilly, 2015.

2. Josh Thompsons, *"Blockchain: The Blockchain for Beginners-Guide to Blockchain Technology and Leveraging Blockchain Programming"*

3. Daniel Drescher, *"Blockchain Basics"*, Apress; 1st Edition, 2017.

4. Anshul Kaushik, *"Blockchain and Crypto Currencies"*, Khanna Publishing House, Delhi.

5. Imran Bashir, *"Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained"*, Packt Publishing.

6. Ritesh Modi, *"Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain"*, Packt Publishing.

7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O' Dowd, Venkatraman Ramakrishna, "*Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer"*, Import, 2018.

Elective - X
BTCOE704 (B): Computer Graphics

[Unit 1] Basic Concepts **[6 Hrs]**
Introduction to computer graphics, lines, line segments, pixels and frame buffers, anti-aliasing techniques and character generation methods. Graphics Display devices (monochrome, color) interactive devices, Scanners and digitizers, touch panels, tablets, mouse, joysticks, trackball, light pen.

[Unit 2] 2D Transformation **[7 Hrs]**
Line and circle plotting using Breshemham's and other algorithms, transformation matrices, scaling, rotation, translation, picture transformation, mirror image.
Window and Clipping: Introduction, viewing transforms, 2-D clipping, Sutherland Cohen approach, Cyrus Beck Method, Midpoint subdivision algorithm, Liang-Barsky line clipping algorithm, polygon clipping, text clipping, generalized clipping.

[Unit 3] 3D Graphics **[7 Hrs]**
Introduction, 3-D geometry, Coordination system, 3D transformation, rotation about an arbitrary axis, orthogonal projections, multiple views, isometric projection, perspective projections, 3-D clipping.
Hidden Surfaces and Lines: Introduction, Back face removal algorithm, Z-buffers, Scan line and Painter's algorithm hidden surface removal, curved surface generation, generation of solids, sweep method, interpolation.

[Unit 4] Graphical User Interface **[6 Hrs]**
X-Windows, use of graphics tools like OPENGL, DirectX, Windows and Motif, Graphic Standards.

[Unit 5] Animation **[6 Hrs]**
Introduction, devices for producing animation, computer assisted animation, real time animation, method for controlling animation (fully explicit control, procedural).

Text Books:

1. Peter Shirley, Michael Ashikhmin, Steve Marschner, *Fundamental of Computer Graphics*, 4th Edition, CRC Press.
2. Newman, Sprouall, *Interactive Computer Graphics*, McGraw-Hill Publication.
3. Hearn, Baker, *Computer Graphics*, PHI Publication.
4. Krishnamurthy, *Introduction to Computer Graphics*, McGraw-Hill Publication.
5. ISRD Group, *Computer Graphics*, McGraw-Hill Publication.

NPTEL Course:

1. Computer Graphics, Prof. Sukhendu Das, Department of Computer Science and Engineering, IIT Madras.

Elective - X
BTCOE704 (C): Embedded Systems

[Unit 1] Introduction **[6 Hrs]**

Embedded system overview, Design challenge, Processor technology, IC technology, Design technology, Custom single processor technology, Hardware-combinational logic, Sequential logic, Custom single purpose processor design, RT-level custom single purpose processor design, Optimizing custom single purpose processors.

[Unit 2] General purpose processor Software **[6 Hrs]**

Basic architecture, Operation, Programmers view, Development environment, Application specific instruction set processor, Selecting a microprocessor, General purpose processor design. Introduction, ARM7TDMI-S processor, Block diagram, Memory mapping, Memory accelerator module.

[Unit 3] System control **[7 Hrs]**

Pin description, Register description, Crystal oscillator, External interrupt inputs, Other system controls, Memory mapping control, Phase locked loop, Power control, Reset, APB divider, Wakeup timer. GPIO: GPIO register map, Timer-TIMER / COUNTER0 and TIMER / COUNTER1 register map, Example timer operation, Architecture.

[Unit 4] UART **[6 Hrs]**

UART0/1 - UART0/1 register map, UART0/1 baud rate, UART0/1 auto-baud, UART0/1 block diagram. Serial peripheral interface: SPI data transfers, SPI pin description, SPI register map, SPI block diagram; I2C-bus interface: I2C bus configuration, I2C operating modes, I2C Bus serial interface block diagram, Summary of I2C registers.

[Unit 5] Process scheduling **[7 Hrs]**

Examples of RTOS, Microprocessor and microcontroller based system design, typical design examples, system design and simulation using simulation software such as Proteus VSM. Digital Camera Example Introduction, Introduction to a Simple Digital Camera; User's Perspective, Designer's perspective requirements specification non functional requirements, Informal functional specification, Refined functional specification, Design

Text Books:

1. "Embedded System Design- A Unified system Hardwar/Software Introduction", Frank Vahid (3rd Edition, John Wiley India) ISBN 978-81-265-0837-2.
2. LPC 214x User manual (UM10139) www.nxp.com.
3. "ARM System Developer's Guide – Designing and Optimizing System Software", Andrew N. Sloss, Dominic Symes and Chris Wright (ELSEVIER) ISBN: 1-55860-874-5.

Reference Books:

1. LPC 17xx User manual (UM10360) :- www.nxp.com
2. ARM architecture reference manual : - www.arm.com
3. "An Engineer's Introduction to the LPC2100 series" Trevor Martin (Hitex (UK) Ltd.)
4. "ARM System-on-Chip Architecture" Steve Furber (2nd Edition, Addison-Wesley Professional)ISBN-13: 9780201403527

Elective - X
BTCOE704 (D): Design Thinking

[Unit 1] Overview of Design Thinking Process **[7 Hrs]**

Design Thinking Process: Business context of innovation for applying design thinking, two models of design thinking, phases of design thinking, correlation with other philosophies. Introduction to design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs. Design thinking, Problem solving, Understanding design thinking and its process model, Design thinking tools. Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate or Empathize, Analyze, Solve and Test.

[Unit 2] Empathize **[6 Hrs]**

Design thinking phases, How to emphasize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, creation of user persons, customer journey mapping, How might we questions.

[Unit 3] Analyze or Define **[6 Hrs]**

Root cause analysis, conflict of interest, perspective analysis, big picture thinking through system operator, big picture thinking through function modeling Silent brainstorming, metaphors for ideation, CREATE and What-If tool for ideation, introduction to TRIZ, Inventive principles and their applications.

[Unit 4] Test (Prototyping And Validation) **[5 Hrs]**

Prototyping, Assumptions during the design thinking process, Validation in the market, best practices of presentation.

[Unit 5] Design Innovation **[5 Hrs]**

Benefits of iteration in the design thinking process, taking the idea to the market, introduction to innovation management in a company.

Text Books:

1. Bala Ramadurai, “Karmic Design Thinking”, First Edition, 2020.

Reference Books:

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kuma.
2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO.
3. This is Service Design Thinking: Basics, Tools, Cases by Marc Stickdorn and Jakob Schneider.
4. Ulrich, Karl T. Design: Creation of artifacts in society, 2011.

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BTCOL705: Full Stack Development (LAMP / MEAN)

[Unit 1] Basic HTML, Advanced HTML [4 Hrs]

HTML5: HTML5 Doctype, Some New HTML5 Elements, HTML5 Header And Footer, Allow spell check and editable areas, Adding audio, Drag & drop, User location: geolocation, Saving information - localStorage, Saving information - sessionStorage.

[Unit 2] CSS [6 Hrs]

What Is CSS?, How to write CSS: syntax, Using style sheets, Using external style sheets, Identities and classes, Style entire elements, CSS Comments, Change background colors, Setting background images, Change text color, Text formatting using CSS, Font Properties, Text Properties, Styling hyperlinks using CSS, Styling lists using CSS, Setting element width and height, Adding borders, Spacing: margin & padding, Change the mouse type: cursor, Hide, show and display elements, What to do with overflowing content.

CSS Advanced: Grouping & Nesting, Maximum & Minimum Dimensions, Move an element from its default position, Relative location & layering, Floating, Clear, Pseudos, Alignment Sprites: the most efficient way to load images, Make elements translucent: opacity, Different media types, Style elements based on their attributes, Browser prefixes.

[Unit 3] Javascript Basics [6 Hrs]

JavaScript Essentials, What is JavaScript?, JavaScript: Internal vs. External, JavaScript comments, document.write(); Display info from the browser: alert & confirm, Prompting the user for information, Programming fundamentals: Variables, Add two sentences together: concatenation, Basic math in JavaScript, Redirecting users and opening new windows, Creating empty hyperlinks, String Manipulation, Comparing variables and values, Programming fundamentals: If...Else Statements, Else...If Statements, Switch Statements, Functions; JavaScript Events, Selecting HTML elements using getElementById(), Escaping content, Programming fundamentals: Arrays, For Loops, While Loops, Breaking Out Of Loops, Skipping A Loop Cycle.

Javascripts Advanced: Getting parts of a value: split & substr, Programming fundamentals: Try...Catch And Throw, Getting the users date and time, Some more complex math (no homework), Programming fundamentals: Regular Expressions, Get the users browser (navigator), Add timing: setInterval & setTimeout.

[Unit 4] Ajax, jQuery, PHP, PHP Advanced. **[4 Hrs]**

Text Books:

1. Colin Ihrig, Full Stack JavaScript Development With MEAN: MongoDB, Express, AngularJS, and Node.JS, SitePoint; 1st Edition.
2. https://www.w3schools.com/whatis/whatis_fullstack.asp**.**
3. Robin Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites, O'Reilly Media; 3rd edition,
4. Callum Macrae, Learning from jQuery, O'Reilly Media.

BTCOL706: System Administration

1. Installations of various Linux flavors (Optionally using Virtualbox): Centos (with LVM, without LVM), Ubuntu (with LVM, without LVM), Debian (with LVM, without LVM).
2. SSH Server (CentOS and Ubuntu): enable/disable root login.
3. Telnet server (CentOS and Ubuntu).
4. FTP Server (CentOS and Ubuntu).
5. Using command upload/download files from FTP Server.
6. Samba Server (CentOS and Ubuntu).
7. HTTP Server (CentOS and Ubuntu).
8. Configuration of Proxy Server.

Reference Books:

1. Tom Adelstein, Bill Lubanovic, *Linux System Administration: Solve Real-life Linux Problems Quickly*, O'Reilly Media.
2. Æleen Frisch, *Essential System Administration*, Third Edition, O'Reilly Media.
3. Terry Collings, Kurt Wall, *Red Hat Linux Networking and System Administration*, 3rd Edition, Wiley Publication.

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Elective - VIII Laboratory
BTCOL707 (A): Big Data Analytics Laboratory

List of Experiments:

1. Perform setting up and Installing Hadoop in its two operating modes:
    a) Pseudo distributed,
    b) Fully distributed.
2. Implement the following file management tasks in Hadoop:
    a) Adding files and directories
    b) Retrieving files
    c) Deleting files
3. To understand the overall programming architecture using Map Reduce API
4. Store the basic information about students such as roll no, name, date of birth and address Of student using various collection types such as List, Set and Map
5. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
    a) Find the number of occurrence of each word appearing in the input file(s)
    b) Performing a MapReduce Job for word search count (look for specific keywords in a file)
6. Install and Run Hbase then use HbaseDDl and DML commands
7. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications usingScala.
8. Basic CRUD operations in MongoDB
9. Retrieve various types of documents from students collection
10. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of itemsfrequently reviewed together.
    a) Write a single Spark application that:
        i. Transposes the original Amazon food dataset, obtaining a PairRDD of the type:<user_id> → <list of the product_ids reviewed by user_id>
        ii. Counts the frequencies of all the pairs of products reviewed together;
        iii. Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

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Elective - VIII Laboratory
BTCOL707 (B): Distributed Systems Laboratory

List of Experiments:

1. Implement the concept of RPC.
2. Implement the concept of RMI.
3. Design a Distributed Application using Message passing Interface for remote computation.
4. Implementation of Clock Synchronization (logical/physical).
5. To write Program multi-threaded client/server processes.
6. Implement concurrent echo client-server application
7. Implement concurrent day-time client-server application.
8. Configure following options on server socket and tests them:
   SO_KEEPALIVE,SO_LINGER, SO_SNDBUF, SO_RCVBUF, TCP_NODELAY .
9. Incrementing a counter in shared memory.
10. To Study Implementation of Election algorithm.
11. To study Implementation of Mutual Exclusion algorithms.
12. Implement Network File System (NFS).

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Elective - VIII Laboratory
BTCOL707 (C): Fundamental of Digital Image Processing Laboratory

List of Experiments:

1. Study of Matlab environment and implementation of matlab commands, functions and programming constructs.
2. Point processing in spatial domain
    a. Negation of an image
    b. Thresholding of an image
    c. Contrast Stretching of an image
3. Program to implement Bit Plane Slicing
4. Program for plotting a Histogram of an image
5. Program to implement Histogram Equalization
6. To write a Program for Histogram Specification
7. Zooming an image by interpolation and replication
8. Filtering in spatial domain
    a. Low Pass Filtering
    b. High Pass Filtering
    c. Median filtering
9. Edge Detection using derivative filter mask
    a. Prewitt
    b. Sobel
    c. Laplacian
10. Data compression using Huffman coding
11. Filtering in frequency domain
    a. Low pass filter
    b. High pass filter

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Elective - IX Laboratory
BTCOL708 (A): Cloud Computing Laboratory

List of Experiments:

(Pl. Note: List of Experiments should be as per theory covered in the class based on Cloud Environments. Following list can be used as a reference.)

1. Sketch out and analyze architecture of Moodle cloud portal and moodle cloud site and create different entities dynamically.
2. Create a scenario in wordpress for Social Marketing, Search engine and Sharing Tools.
3. Working in Cloud9 to demonstrate different language.
4. Working in Codenvy to demonstrate Provisioning and Scaling of a website.
5. Implement and configure Google App Engine to deploy Python Program application.
6. Installation and configuration of virtual machine with guest OS.
7. Demonstrate the use of map and reduce tasks.
8. Implementation of SOAP Web services in C#/JAVA Applications.
9. Categorize Amazon Web Service (AWS) and implement its various cloud entities using its Cloud Toolbox support.
10. Implement and use sample cloud services with the help of Microsoft Azure.
11. Design and analyze architecture of Aneka / Eucalyptus / KVM identify different entities to understand the structure of it.
12. Make and perform scenario to pause and resume the simulation in Aneka / Eucalyptus entity, and create simulation entities dynamically.
13. Organize a case in Aneka / Eucalyptus for simulation entities in run-time using a its toolkit support and manage virtual cloud.

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Elective - IX Laboratory
BTCOL708 (B): Business Intelligence Laboratory

List of Experiments:

1. Installation of SQL server and Power BI.
2. Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system.
3. Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver / Power BI.
4. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
5. Create the ETL map and setup the schedule for execution.
6. Execute the MDX queries to extract the data from the data warehouse.
7. Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
8. Implementation of Classification algorithm in R Programming.
9. Practical Implementation of Decision Tree using R Tool.
10. Prediction Using Linear Regression.
11. Data Analysis using Time Series Analysis.

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Elective - IX Laboratory
BTCOL708 (C): Natural Language Processing Laboratory

List of Experiments:

Practical may be implemented using programming Python / Java. Concern faculty member may add more experiments in the list make it minimum 10 to 12.

1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming)
2. Morphological Analysis
3. N-gram model
4. POS tagging
5. Chunking
6. Named Entity Recognition
7. Case Study/ Mini Project based on Application mentioned in Module.

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BTCOP709: Project Phase – I

Guidelines for the project phase – I:

The project should enable the students to combine the theoretical and practical concepts studied in his / her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work:

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity:

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase - I:

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

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BTCOF609: Field Training / Internship / Industrial Training

Guidelines for Field Training / Internship / Industrial Training Industrial Training:

1. To apply for a suitable Industrial Training, submit an application form to respective organization concerned one semester before the Industrial Training Programme commences.
2. Student can also apply through online platforms such as Internshala for industrial training.
3. Submit one copy of the offer letter for the Industrial Training to the Head of the department or Faculty coordinator (Industrial Training).
4. To complete the Industrial Training process within the specified time based on the Industrial Training Programme schedule.
5. Assessment within the Industrial Training context aims to evaluate the student's work quality and appropriateness to the field of study with reference to the learning outcomes of the Industrial Training Programme.
6. Evaluation of the students' performance should be done in the next upcoming semester.
7. Those students who fails, they can also complete online certification courses which are available at free of cost on various MOOC platforms.

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Elective - XI

BTCOE801 (A): Deep Learning

Week 1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces

Week 2: Linear Classifiers, Linear Machines with Hinge Loss

Week 3: Optimization Techniques, Gradient Descent, Batch Optimization

Week 4: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning

Week 5: Unsupervised Learning with Deep Network, Autoencoders

Week 6: Convolutional Neural Network, Building blocks of CNN, Transfer Learning

Week 7: Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Week 8: Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

Week 9: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc.

Week 10: Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.

Week 11: LSTM Networks

Week 12: Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Link: https://swayam.gov.in/nd1_noc20_cs62/preview

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Elective - XI

BTCOE801 (B): Social Networks

Week 1: Introduction
Week 2: Handling Real-world Network Datasets
Week 3: Strength of Weak Ties
Week 4: Strong and Weak Relationships (Continued) & Homophily
Week 5: Homophily Continued and +Ve / -Ve Relationships
Week 6: Link Analysis
Week 7: Cascading Behaviour in Networks
Week 8: Link Analysis (Continued)
Week 9: Power Laws and Rich-Get-Richer Phenomena
Week 10: Power law (contd..) and Epidemics
Week 11: Small World Phenomenon
Week 12: Pseudocore (How to go viral on web)

Link: https://swayam.gov.in/nd1_noc19_cs66/preview

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Elective - XI
BTCOE801 (C): Randomized Algorithms

Week 1: Introduction to Randomized Algorithms
Week 2: Probability Review
Week 3: Moments and Deviation
Week 4: The Probabilistic Method
Week 5: Markov Chains - I
Week 6: Markov Chain - II
Week 7: Number Theoretic Algorithms
Week 8: Graph Algorithms
Week 9: Approximate Counting
Week 10: Data Structures
Week 11: Computational Complexity
Week 12: Review of the course

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Open Elective - XII

BTCOE802 (A): Introduction to Industry 4.0 and Industrial Internet of Things

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security inIIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

- **Case study - I :** Milk Processing and Packaging Industries
- **Case study - II:** Manufacturing Industries - Part I
- **Case study - III :** Manufacturing Industries - Part II
- **Case study - IV :** Student Projects - Part I
- **Case study - V :** Student Projects - Part II
- **Case study - VI :** Virtual Reality Lab
- **Case study - VII :** Steel Technology Lab

Link: https://swayam.gov.in/nd1_noc20_cs24/preview

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Open Elective - XII

BTCOE802 (B): Cryptography & Network Security

Week 1: Introduction to cryptography, Classical Cryptosystem, Block Cipher.

Week 2: Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.

Week 3: LFSR based Stream Cipher, Mathematical background, Abstract algebra, Number Theory.

Week 4: Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem.

Week 5: Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem.

Week 6: Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime.

Week 7: Generalized ElGamal Public Key Cryptosystem, Rabin Cryptosystem.

Week 8 : Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.

Week 9 : Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS).

Week 10: Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis.

Week 11: Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Shamir's secret sharing and BE, Identity-based Encryption (IBE), Attribute-based Encryption (ABE).

Week 12: Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP), Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.

Link: https://swayam.gov.in/nd1_noc20_cs21/preview

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Open Elective - XII

BTCOE802 (C): Model Checking

Week 1: Modeling systems as Finite-state machines

Week 2: Using the model-checker NuSMV

Week 3: Linear-time properties for verification

Week 4: Regular properties – automata over finite words

Week 5: Omega-regular properties – automata over infinite words

Week 6: Model checking omega-regular properties

Week 7: Linear Temporal Logic (LTL)

Week 8: Algorithms for LTL

Week 9: Computation Tree Logic (CTL)

Week 10: Algorithms for CTL

Week 11: Binary Decision Diagrams (BDDs)

Week 12: Models with timing constraints – timed automata Regular properties – automata over finite words

Link: https://swayam.gov.in/nd1_noc20_cs38/preview

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BTCOP803: Project phase – II $ / Internship and project in the Industry *

$ This is for those students who are not doing Internship and Project in the Industry, they can do project in the department.

* Six months of Internship and Project in the industry.

This is continuous work to the project phase - I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a power point presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase phase - II

1. Coding / Implementation.
2. Use cases.
3. Testing / Trouble shooting.
4. Data dictionary / Documentation.
5. Finalization of project in all respects.

* (For guide, Personal copy, Departmental library)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.

###End of the syllabus###