Detailed Syllabus

for

*Final Year B. Tech in Computer Engineering*

with effective from July 2020 - 21

11 August 2020
### Semester - I
**Group A**

<table>
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### Semester - III

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

[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 Organization, 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]
Text Books:


Reference Books:


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

[Unit 2] Smart Objects [6 Hrs]

[Unit 3] IP Layer [6 Hrs]

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

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

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<td>9</td>
<td>BTCOP709</td>
<td>Project phase - I</td>
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<td>10</td>
<td>BTCOF609</td>
<td>Field Training / Internship / Industrial Training</td>
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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Semester - VII
Semester – VIII

<table>
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<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Weekly Teaching hrs</th>
<th>Evaluation Scheme</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1</td>
<td>BTCOE801</td>
<td>Elective – XI *</td>
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<td>BTCOE802</td>
<td>Open Elective – XII *</td>
<td>3 - -</td>
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<td>3</td>
<td>BTCOE803</td>
<td>Project phase - II (In-house) $ / Internship and project in the Industry</td>
<td>- - 24</td>
<td>60 - 40</td>
<td>12</td>
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| 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**

<table>
<thead>
<tr>
<th>BTCOE801: Elective – XI *</th>
<th>BTCOE802: Open Elective – XII *</th>
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<tbody>
<tr>
<td>(A) Deep Learning</td>
<td>(A) Introduction to Industry 4.0 and Industrial Internet of Things</td>
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<tr>
<td>(B) Social Networks</td>
<td>(B) Cryptography and Network Security ##</td>
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<tr>
<td>(C) Randomized Algorithms ##</td>
<td>(C) Model Checking</td>
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</table>

* 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
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:**

**Reference Books:**

**NPTEL Course:**
1. Software Engineering, Prof. Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur.
[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]

[Unit 4] Big Data Applications  [6 Hrs]

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

Text Books:


Reference Books:


NPTEL COURSE:

Elective - VIII
BTCOE702 (B): Distributed Systems

[Unit 1] Introduction [7 Hrs]

[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]

[Unit 4] Resource Management [6 Hrs]

[Unit 5] Distributed File System [6 Hrs]

Text Books:

NPTEL Course:
1. Distributed Systems, Prof. Rajiv Mishra, IIT Patna.
[Unit 1] Digital Image Fundamentals and Image Transform [6 Hrs]

[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]

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

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]


[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]

[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.

Text Books:
5. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller, Pearson Education.

NPTEL Course:
[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]

[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.


Text Books:

Reference Books
[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 of 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:

NPTEL Course:
1. Natural Language Processing, Prof. Pushpak Bhattacharyya, Department of Computer Science and Engineering, IIT Bombay.
[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]

[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]

Text Books:


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.


[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.


[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:

NPTEL Course:
[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:

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.)
[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:

Reference Books:
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.
[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]
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:
2. [https://www.w3schools.com/whatis/whatis_fullstack.asp](https://www.w3schools.com/whatis/whatis_fullstack.asp).
4. Callum Macrae, Learning from jQuery, O'Reilly Media.
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).

Reference Books:
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 HbaseDDI and DML commands
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 items frequently 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.
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.
11. To study Implementation of Mutual Exclusion algorithms.
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
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.
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.
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.
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%).
Guidelines for Field Training / Internship / 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 fail, they can also complete online certification courses which are available at free of cost on various MOOC platforms.
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, Semantic 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
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/ndl_noc19_cs66/preview
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

Link: https://swayam.gov.in/nd1_noc20_cs39/preview
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, Artificial 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 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 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
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 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 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
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.
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###