Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)



Course Contents (Syllabus) for

Third Year B. Tech. (Information Technology) Sem – V to VI

AY 2020-21

Syllabus for TY IT SEM V

Professional Core (Theory)

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(normally last three modules) covered after MSE.	
Course Contents:	
Module 1	Hrs.
Introduction:	
Database Systems, Types of Database Systems, Data abstraction, Data Models,	_
Architecture of Database Systems.	7
E-R Model: Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables, Specialization, Generalization, Aggregation.	
Module 2	Hrs.
Relational Model: Structure of Relational Databases, database schema, keys,	
Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus	-
Integrity Constraints and Design: Domain Constraints, Referential Integrity,	7
Triggers, Normal forms, Functional Dependencies, Decomposition.	
Module 3	Hrs.
Query Processing: Query processing, Query Cost, measures of query cost, Evaluation	
of expression, Equivalence of Expressions.	6
Structured Query Language (SQL).	
Module 4	Hrs.
File and System Structure: Storage media, RAID, Storage access, File organization,	
Organization of Records into files.	7
Indexing and Hashing: Ordered and secondary Indices, B+ Tree Index Files, Static	,
Hashing, Dynamic hashing, Comparison of Indexing, Grid files, Bitmap indices.	
Module 5	Hrs.
Transactions: Properties and states, Concurrent execution, Serializability.	
Concurrency Control: Lock-Based Protocols, 2 phase locking protocol, Graph based	6
protocols, Time stamp based protocols, Dead lock handling	
Module 6	Hrs.
Crash Recovery: Failure Classification, storage Structure, Log-Based Recovery,	
Shadow Paging, recovery with concurrent transactions, buffer management, backups.	6
Introduction to Database performance tuning.	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Explain ER model of database systems	
Module 2: Design Relational model of database systems	
Module 3:Implement SQL and query processing techniquesModule 4:Describe concepts of File storage and implementation.	
Module 6: Discuss recovery management of database systems.	

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Module 1	Hrs.
Introduction : Notion of operating systems, Computer system organization, Computer	
System architecture, Computer System Structure, Operating System Operations,	
Process Management, Memory Management, Storage Management, protection and	5
security. System Structure: Operating system services, user operating system	5
interface, system calls, types of system calls, system programs, operating system	
design and implementation, operating system structure.	
Module 2	Hrs.
Process	
Process Concept, Process Scheduling, Operation on process, Cooperating process,	
Threads, Inter-process Communication (Algorithms evaluation). Process Scheduling:	8
Basic concept, Scheduling Criteria, Scheduling Algorithms, Multiple processor	
scheduling, Real time scheduling.	
Module 3	Hrs.
Inter-process Synchronization	
Background, Classical problems of synchronization, Critical Region, The critical	6
section problem, Synchronization Hardware, Monitors, Semaphores.	
Module 4	Hrs.
Deadlocks	
System modes, Deadlock characterization, Methods for handling deadlocks Deadlock	6
prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	TT
Module 5	Hrs.
Memory Management	
Background, Logical Versus Physical Address space, Swapping Contiguous Allocation,	
Paging, Segmentation, Segmentation with paging.	8
Virtual Memory: Background, Demand paging, Page replacement, Page replacement algorithms, Allocation of frames, thrashing (Only concept), Demand segmentation.	
Virtualization concept and case studies	
Module 6	Hrs.
File System Management	1115.
File concept, access methods, directory and disk structure, file-system mounting, file	
sharing, protection.	6
Implementing File System : File system structure, file-system implementation,	Ū
directory implementation, allocation methods, free-space management	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Explain the functions of operating systems with system calls.	
Module 2: Identify the difference between process and thread.	
Module 3: Analyze the CPU scheduling concept and Inter-process Communication.	
Module 4: Identify the difference between various deadlock handling mechanisms.	
Module 5: Analyze working of paging, demand paging etc. and to explain the concept	of
virtualization of OS's.	
Module 6: Implement the file system of operating systems with access method.	

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Module 1		Hrs.
	n, Design and Analysis of Algorithm	1110.
Greedy Alg Task schedu Dynamic	gorithms: An activity-selection problem, Knapsack problem, Huffman codes, uling problem. Programming: Matrix-chain multiplication, Elements of dynamics ng, Longest common subsequence.	8
Module 2		Hrs.
Single-Sour	rce Shortest Path (SSSP):	
1	ths and relaxation, Bellman-Ford algorithm, Single-source shortest paths in yclic graphs, Dijkstra's algorithm, Problems, Topological sort	6
Module 3		Hrs.
Shortest pa algorithm fo	nortest Paths (APSP) and Maxflow: aths and matrix multiplication, The Floyd-Warshall algorithm, Johnson's or sparse graphs. orks, Ford Fulkerson method, Maximum Bipartite matching	6
Module 4		Hrs.
Elementary	eoretic Algorithm: number-theoretic notions, Greatest common divisor Modular arithmetic, dular linear equations, The Chinese remainder theorem, DFT/FFT.	6
Module 5		Hrs.
matching w Computatio	ching: The naïve string-matching algorithm, The Rabin-Karp algorithm, String with finite automata, The Knuth-Morris-Pratt algorithm. In Geometry: Line-segment properties, Determining whether any pair of intersects, Finding the convex hull, Finding the closest pair of points.	6
Module 6		Hrs.
NP-Completer reducibility	v class and Approximation Algorithm: eteness: Polynomial time, Polynomial-time verification, NP completeness and , NP-complete problem. tion Algorithms: The vertex-cover problem, The travelling-salesman problem, rering problem, The subset-sum problem	7
Module wise	e Measurable Students Learning Outcomes :	
After the co	mpletion of the course the student should be able to:	
Module 1: Module 2: Module 3: Module 4: Module 5: Module 6:	 Explain and Apply appropriate strategy for solving a given problem. Explain the basic algorithms of finding shortest path. Explain the basic algorithms of maximum flow and APSP. Demonstrate the importance of the DFT/FFT and Number theory. Apply the algorithms in string matching and computational geometry. Identify and relate computationally complex problems and explain practical ap for NP problems. 	pproaches

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ESE: Assessment is based on 100% course content with70-80% weightage for course	e conte
(normally last three modules) covered after MSE.	
Course Contents:	
Module 1 – Basics of HTML	Hrs.
HTML introduction, HTML editors, elements, attributes, headings, paragraphs, styles, formatting, lists, tables, layout, forms, graphics, media, HTML v/s XHTML	2
Module 2 – Fundamentals of CSS	Hrs.
CSS Introduction, syntax, selectors, colors, backgrounds, borders, margins, padding, outline, text family, font family, navigation bar, dropdowns, forms, website layout and components	2
Module 3 – Javascript	Hrs.
Introduction to Javascript, syntax, variables, operators, data types, functions, objects, events, date formats, math, control flow statements, forms, objects and its properties, object classes, components, Introduction to server-side and client-side scripting language	3
Module 4 – Introduction to PHP	Hrs.
Basics of PHP, installation of PHP, comments, variables, echo/print, data types, strings, numbers, math, constants, operators, control flow statements, arrays	2
Module 5 – PHP Forms, Data Base Cooncetivity	Hrs.
Form handling, form validation, form required, from URL, form complete, date and time, file handling, open, read, write, upload, cookies, session, MySQL database connectivity, MySQL connect, creating database, inserting data, prepared statements, various queries used in PHP	2
Module 6 – Introduction to Ruby on Rails	Hrs.
Rails Features, Installation, IDE, Directory Structure, Active Record, MVC, Bundler, Session, File Upload, Testing, Layout, validation	2
Module wise Measurable Students Learning Outcomes:	
 After the completion of the course the student should be able to: Module 1: Explain basic fundamentals of HTML and advanced versions Module 2: Explain the basic fundamentals of CSS Module 3: Develop the scripting language Module 4: Deploy, install and create the web pages in PHP Module 5: Create web design forms, storing cookies and maintaining session in PHP and application. Module 6: Create dynamic web applications with Rail. 	web

Professional Core (Lab)

Title of the C	1. J.D. Ullman, "Principles of Database Systems", Galgotia Publications, 2 nd Edition, 1999 2. Wiederhold, "Database Design", McGraw Hill Inc, 2 nd Edition, 1983 3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8th Edition, 2006. Tree Objectives : 1. To demonstrate basic concepts of conceptual database design. 2. To introduce database schemas in DBMS 3. To illustrate between various transaction management protocols. Urgeneration of the course the student should be able to After the completion of the course the student should be able to OI Summarize real world problems into relational databases. 2 OI Study transaction processing techniques. 3 Applying O3 Study transaction processing techniques. 4 Analyzing PO 1 2 3 4 5 6 7 8 9 10 11 12 PSO1 PSO2 CO1 1 2 2 2 1 CO2 2 2 2 3 2 CO3 1 2 2 3 2 1																			
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c	Program to implement	INSERT, DE	ELETE	and UPDATE operation		
	on student database					
5. Advanc	ed operations of relationa					
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6. Indexin	g and hashing		_			
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t b	Program for sparse ind		index			
-	. Program for static hash	-				
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7. Transac	ction processing					
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Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments.

Course Contents: Lab Tutorials/Experiments consists of 10-12 assignments

1. To implement sorting algorithm using array as a data structure and analyze its time complexity for

different values of n. The large number of elements may be generated using Random Number generator or may be stored in a file. (Quick Sort, Merge Sort)

2. To implement different search techniques using array and/or trees and analyze their time complexity. (Linear, Binary, Binary recursive)

3. To implement Fractional Knapsack problem and activity selection problem using Greedy method.

4. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's& Prim's algorithm

and compare.

5. To apply Greedy method to solve problems of

a) Job sequencing with deadlines

b) Optimal storage on tapes

6. Implement the following using Dynamic Programming

a) Matrix-chain multiplication

b) Longest common subsequence

c) Optimal binary search trees

7. To implement Strassen's matrix multiplication algorithm

8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem.

List of Tutorials (Broad Statements)

Module 1: Solve a given greedy problem. Solve Matrix-chain multiplication problems.

Module 2: Solve a given problem based on Single-source shortest paths in directed Acyclic graphs.

Module 3: Solve a given problem based on of maximum flow and APSP.

Module 4: Solve a given problem based on the DFT/FFT and Number theory.

Module 5: Apply the algorithms in string matching and computational geometry.

Module 6: Identify and relate computationally complex problems and solve a given NP problems.

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	ram on applying event han			eb page using JavaScript.	
	ram on applying layout to		ebpage.		
-	ram on PHP controls state				
•	ram on PHP string operation				
9. Prog	ram on PHP form creation	and data	handling.		
10. Prog	ram on session manageme	nt using P	HP.		
11. Prog	ram on Cookies managem	ent using l	PHP.		
12. Prog	ram on PHP to connect M	ySql datab	base for C	URD operations.	
13. Prog	ram on Rails Application u	using Layo	out, Com	ponents.	

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Course Content : Mini-project is to be carried out in a group of maximum 3 to 5 students.

Each group will carry out mini-project on developing any application software based on following areas.

- 1. Front end and Back end connectivity.
- 2. Front end can be JAVA.
- 3. Back end can be MySQL, PgSQL, NoSQL, MongoDB, etc.
- 4. Industry Problem Statement(Sponsored Project)
- 5. Problem statements based on current or previously learned Technology.

Project/Mini-Project group should submit workable project at the end of second semester. Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on online github.

Students should maintain a project log book containing weekly progress of the project.

Open Elective (OE) (List OE (MOOC/NPTEL) will be published per semester/year)

Professional Elective-1

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MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content

(normally last three modules) covered after MSE. Course Contents:	
Module 1: Data Center Architecture	Hrs.
Data centre and services, Traditional data centre architecture, Challenges, Modern	4
data centre	4
Module 2: Virtualization	Hrs.
Hosted and Bare-Meta, Server Virtualization, Desktop Virtualization, Application	5
Virtualization, Storage Virtualization	5
Module 3: Cloud Computing Basics	Hrs.
Virtualization and Cloud Computing, Cloud Reference Model: <i>IAAS, PAAS, SAAS,</i> Cloud Deployment Model: <i>Public Cloud, Private Cloud and Hybrid Cloud</i>	5
Module 4: Public Cloud and Network Functions	Hrs.
Public Cloud Networking: Route53, Content Delivery Networks, Resilience	
Infrastructure, Virtual Network Functions: Cloud Firewall, DNS, Load Balancers,	4
Intrusion Detection Systems	
Module 5: Virtual Private Clouds (VPC)	Hrs.
VPC fundamentals, Public and Private Subnets, Security Groups, Network Access	4
Control List, Network Address Translation	
Module 6: Cloud Security	Hrs.
Host Security, Challenges with Cloud data, Challenges with data security, data confidentiality and encryption, Virtual Firewall	4
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Explain fundamentals of cloud computing	
Module 2: Explore various virtualization techniques in data centre applications	
Module 3: Choose the service models in cloud computation	
Module 4: Elaborate the cloud networking for real time applications	
Module 5: Discuss the virtual private cloud to scale the infrastructure	
Module 6: Analyse the security aspects of cloud computing in data centre	
Tutorial Content:	
Tutorial can be conducted as12 Assignments based on module 1 to 6.	

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Introduction to wireless networks, ubiquitous connectivity, types of wireless networks, performance fundamentals of wireless networks, measurement of real world wireless-	4
performance.	
Module 2	Hrs.
Fundamentals of wireless communication technologies, network architectures, IEEE 802.11 standards.	5
Module 3	Hrs.
Wireless internet, mobile IP, TCP in wireless domain	5
Module 4	Hrs.
Ad-hoc wireless networks, MAC protocols for ad-hoc wireless networks, routing protocols for ad-hoc wireless networks.	4
Module 5	Hrs.
Mobile networks, device features and capabilities, radio resource controller, end to end carrier architecture, backhaul capacity and latency, packet flow in a mobile network, heterogeneous networks, real-world 3G, 4G, and WiFi performance.	4
Module 6	Hrs.
Optimization in mobile networks, preserve battery power, eliminate periodic and inefficient data transfers, anticipate network latency overhead, design for variable network interface availability, offload to WiFi networks.	4
Module wise Measurable Students Learning Outcomes :	I
After the completion of the course the student should be able to:	
Module 1: Understand wireless network concept.	
Module 2: Comprehend network technologies and architecture.	
Module 3: Differentiate different network layers.	
Module 4: Examine performance of mac and routing protocol performance.	
Module 5: Compare mobile, adhoc and heterogeneous network.	
Module 6: Evaluate performance of mobile WiFi networks.	
Tutorial Content:	
Tutorial can be conducted as12 Assignments based on module 1 to 6.	

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Module 1	Hrs.
Introduction to Computer Graphics Graphics i/p & o/p devices, Display adapters, Vector & Raster Scan displays Scan conversion Techniques- Real Time, RLE, Frame buffers Visualization of basic mathematical objects- Point, Line, Circle – DDA & Bresenham's Techniques.	4
Module 2	Hrs.
Geometric Transformations Object representations & Transformations- 2D & 3D Affine transformations- Translation, scaling, rotation, reflection, shearing; multiple transformations Plane Geometric Projections- Parallel and Perspective Viewing	4
Module 3	Hrs.
Polygon FillingPolygon listing & filling criteria- ordered edge list representationsPolygon filling algorithms- Edge fill, fence fill, edge flag and seed fill algorithmsAntialising- polygon interiors, simple area antialisingHalftoning- patterning, thresholding & error distribution, ordered dither	5
Module 4	Hrs.
Clipping and Hidden line Elimination Window & Viewport Transformation, Window Clipping –Line subdivision, Midpoint subdivision Visibility & Hidden surface removal -Z Buffer algorithm, Warnock Algorithm	5
Module 5:	Hrs.
Plane & Space CurvesCurve Representation & Visualization- Non-parametric and parametric curves,Interpolation, Cubic Spline, Parabolic Blended curves, Bezier curves and B-spline curves	4
Module 6	Hrs.
Multimedia Elements Multimedia components, Types of Media files, Compression techniques, Media editing & recording software, Portable storage devices Principles an techniques of animation, Introduction to animation software	4
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:Module 1:Explain the basics of computer graphicsModule 2:Practice geometric transformation on graphical objectsModule 3:Analyze polygon filling algorithms with error minimizationModule 4:Identify various algorithms for object visibilityModule 5:Describe curve drawing methodologiesModule 6:Choose appropriate media techniques and storage devicesTutorial Content:	
Tutorial can be conducted as12 Assignments based on module 1 to 6.	

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Module 2:	Hrs.
Advance Tree Structures: Binary Trees, Binary search trees, Threaded Binary trees, Height balanced AVL trees, Splay trees: A self-Adjusting-Data Structure.	4
Module 3:	Hrs.
Heaps: Balanced Search Trees as Heaps, Array-Based Heaps, Heap-Ordered Trees and Half- Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Double-Ended Heap Structures and Multidimensional Heaps	5
Module 4:	Hrs.
Tree Data Structure Applications: Multiway Trees, Lexicographical Search Trees: Tries, External Searching: B & B+ Trees, Redblack trees, Tree Structured Programs: Look –Ahead in Games.	5
Module 5:	Hrs.
Hashing: Basic Hash Tables and Collision Resolution, Universal Families of Hash Functions, Perfect Hash Functions, Hash Trees, Extendible Hashing, Membership Testers and Bloom Filters.	4
Module 6:	Hrs.
Selected Problems: Graph Problems – Network flows: Max flow – mincut theorem, Probabilistic methods – Markov's inequality, Dynamic Graph Problems.	4
 Module wise Measurable Students Learning Outcomes: Module 1: Answer data structure questions with respect to time complexity. Module 2: Explain balanced search trees to solve the real world problems. Module 3: Relate heaps, binomial heaps, multidimensional heaps etc. Module 4: Associate tree data structure in real application. Module 5: Estimate various static as well as dynamic hashing techniques. Module 6: Assess selected graph problems widely used for real world problem solvin Tutorial Content: Tutorial can be conducted as12 Assignments based on module 1 to 6. 	g.

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Problem, Problem Spaces and Search, Application, Characteristics of AI, Heuristic, A*,AO*.	4
Module 2: Knowledge Representation & Logic	Hrs.
Predicate calculas, Predicates and arguments, ISA hierarchy, Frames, Unification	5
Module 3: : Logic Programming	Hrs.
Logic programming in Prolog, writing a Prolog program, Structure of Prolog program, Searching and backtracking in prolog, Lists	5
Module 4: Planning	Hrs.
Introduction, Planning as problem solving, STRIPS, Forward and Backward planning,	4
Non linear planning. Module 5: : Neural Networks	Hrs.
History and Introduction to Neural network, Working of neurons, Basic components of ANN, ANN Architecture, Feedforward network, Applications of Neural Network.	4
Module 6: Expert systems & Natural Language Processing.	Hrs.
Introduction, Functionality /components of Expert systems, Architecture of ES, Bulding an Expert system, NLP and Understanding.	4
Module wise Measurable Students Learning Outcomes :	
Module 1: Understanding AI by examining the nature of the difficult problems that Al	seeks to
solve.	
Module 2: Exploring variety of methods for encoding knowledge in computer systems)
Module 3: Learn how to use the logic programming for problem solution	

Module 4: Providing intelligent problem solution

Module 5: Knowing difficulties in understanding and providing solution using constraint satisfaction.

Module 6: Design the expert system by using AI facts and Understanding and evaluating processes for natural language processing

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Syllabus for TY IT SEM VI

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Course Contents: Module 1: Parallel and Distributed Databases	Hrs.
Architectures for parallel database, Parallel query Evaluation, Parallelizing individual	
operation, Parallel Query Optimization, Distributed DBMS, Architecture, Storing data	-
in distributed DBMS, Distributed Catalog Management, Distributed query processing,	7
Updating distributed data, Distributed concurrence control, Distributed recovery.	
Module 2: Data Warehousing and Data Mining	Hrs.
Introduction to decision support, OLAP, Implementation Techniques for OLAP, Data	
Warehousing, Views and decision support, view materialization.	0
Data Mining: Introduction, Counting Co-occurrences, Mining for rules, Tree structured	8
rules, Clustering, Similarity search over sequences.	
Module 3: Object Database Systems	Hrs.
Structured data types, Operations, inheritance, Objects, OID and Reference types,	4
design for ORDBMS, Comparing RDBMS with OODBMS and ORDBMS.	4
Module 4: Information Retrieval and Web Databases	Hrs.
Database, information retrieval. Indexing for text search. Web search engines, web	
search architecture, Inverted indexes the IR way, Inverted indexes for web search	7
engines, web crawling, web search statistics. Data model for XML. XML Quires.	
Module 5: Spatial Database	Hrs.
Types of Spatial Data, Spatial Queries, Application, spatial Indexes, space filling	(
Curves, Grid files, R trees.	6
Module 6: Deductive Database and Introduction to Advance Topics	Hrs.
Recursive Queries, least model semantics, fixpoint operator, datalog programs,	
Recursive Queries with Negation, stratification, evaluation of Recursive Queries.	7
Advance transaction processing, Mobile database, Geographic Information systems.	/
Temporal and Sequence database.	
Aodule wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: study parallel and distributed database systems	
Module 2: discuss data warehousing concepts and extend to data mining techniques	
Module 3: summarize object oriented database systems along with OOP concepts.	
Module 4: identify information retrieval and construct web databases.	
Module 5: design spatial database systems	
Module 6: design deductive database systems and discuss new concepts in database s	ystems.
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Partial list of tutorials consisting assignments (design and study) and computer prog	grammi
o demonstrate results.	
1. Design the database according to given rules.	
2. Implement user interfaces for entering/updating data in database tables (distributed	1
systems).	
3. Construct OLAP and execute queries over it.	
4. Show execution of commit protocols.	
5. Execute parallel and distributed operations on database.	
6. Implement data mining algorithm on database.	
7. Demonstrate different operations on web, spatial and deductive database.	
8. Develop a web or desktop or mobile application in any programming language and	l/or
platform to show use of application database.	

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Module 2Image Enhancement in Spatial Domain	7 Hrs.
Basic intensity transformation: image negation, Log transformation, power law	
transformation, Piecewise linear transformation functions, arithmetic and Logic	
operation, Histogram processing (equalization and matching)	
Module 3 Image Enhancement in Frequency Domain	6 Hrs.
Need of image transformation, Two dimensional Fourier Transform, properties	
of frequency domain, correspondence between filtering in spatial and frequency	
domain, Smoothing and Sharpening frequency domain filters. Convolution	
Theorem	
Module 4Image Segmentation	7 Hrs.
Detection of Discontinuities (point, line edge), Edge Linking and Boundary	
Detection, Threshold, Basic global Threshold, Adaptive Threshold, Region-Based	
Segmentation, region growing, splitting and merging	
Module 5Image Morphology	6 Hrs.
Basic morphological concepts, four morphological principles, binary dilation,	
erosion, Hit or miss transformation, opening and closing; thinning and skeleton	
algorithms	
Module 6.Image Compression	6 Hrs.
Fundamentals of Image Compression, Image compression models, concepts of	
Information Theory, Fundamental coding theorems, Estimation of entropy,	
Variable length coding, Huffman coding, Near optimal variable length coding,	
Near optimal variable length coding, Arithmetic coding, constant area coding, run	
length coding, image compression standards (JPEG, JPEG2000).	
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(normally last three modules) covered after MSE.	
Course Contents: (Arrange contents logically/process-wise/conceptually/theory	followed
pplication)	
Iodule wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Analyze general terminology of digital image processing.	
Module 2: Examine various types of images, intensity transformations and spatial	filtering
techniques.	
Module 3: Develop Fourier transform for image processing in frequency domain.	
Module 4: Identify the methodologies for image segmentation.	
Module 5: Generalize feature extraction techniques using image morphology techn	iques.
Module 6: Relate image compression techniques.	

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General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware.	7
Introduction to the KERNEL: Architecture of UNIX OS, Introduction to system	
concepts, Kernel Data Structure, System Administration.	
Module 2	Hrs.
The Buffer Cache	
Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading	4
and writing disk blocks, advantages and disadvantages of cache.	
Module 3	Hrs.
Internal Representation of Files	
Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types.	6
Module 4	Hrs.
System calls for the file System	
Open, Read, write, File and Record Locking, Adjusting the position of FILE I/O-	
LSEEK, Close, File Creation, Creation of Special File, Change Directory and Change	8
Root, Change Owner and Change Mode, Stat and Fstat, Pipes, Dup, Mounting and	0
Unmounting file systems, Link, Unlink, File System Abstractions, File system	
maintenance.	
Module 5	
	Hrs.
Structure of Process	Hrs.
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Module 1 Introduction	Hrs.
Motivation for parallel programming ,Need-Concurrency in computing, Basics of processes, multitasking and threads, cache, cache mappings ,caches and programs, virtual memory , Instruction level parallelism, hardware multi-threading, Parallel Hardware-SIMD, MIMD, Interconnection networks, cache coherence, Issues in shared memory model and distributed memory model.	3
Module 2 Parallel algorithm design	Hrs.
Parallel Software- Caveats- coordinating processes/ threads- hybrid model – shared memory model and distributed memory model - I/O – performance of parallel programs-– parallel program design, Finding the maximum, n-body problem	2
Module 3 Shared Memory paradigm using Open MP	Hrs.
Basics Open MP – Trapezoidal Rule-scope of variables – reduction clause – parallel for directive – loops in OpenMP , scheduling loops	2
Module 4: Distributed memory programming with MPI	Hrs.
Basic MPI programming, MPI_Init and MPI_Finalize, MPI communicators, SPMD,programs– MPI_Send and MPI_Recv, message matching,MPI- I/O,parallel I/O,collective communication – Tree-structured communication -MPI_Reduce , MPI_Allreduce, broadcast, scatter, gather, allgather – MPI derived types – dynamic process management – performance evaluation of MPI programs- A Parallel Sorting Algorithm	2
Module 5 :Graphical Processing paradigms: Introduction to CUDA.	Hrs.
GPGPU architecture of NVidia, Intel ,CUDA model, programming in CUDA	2
Module 6: Application scalability	Hrs.
HPC Application development	2
 Module wise Measurable Students Learning Outcomes : Module 1: Classify the parallel architecture and identify network infrastructure. Module 2: Profile sequential algorithm and identify scope of parallelism Module 3: Able to map the logic using Open MP constructs. 	

Module 4: Able to map the logic using MPI constructs Module 5: Able to identify kernels and configure it using GPGPU. Module 6: Profile of parallel algorithm and to compute speedup.

Professional Core (Lab)

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related documentation	Faculty	submission at the end of week 18	
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Lab activities shall include performing ex	cperiments, mi	ni-project, presentations, drawing, program	nming and
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The experimental lab shall have typically	8-10 experim	ients	
Course Contents:			
Content			Hours
1. Processing Environment			
a. fork, vfork, wait, wait pid	(),exec (all va	riations exec), and exit	10
b. IPC: Interrupts and Signals	s: signal(any f	ives type of signal), alarm, kill,	10
signal, signation, pause			
2. File system Internals			
a. Stat, fstat, ustat.			
b. Threading concept: clone	, threads of j	ava.	6
c. IPC: Semaphores: semap			
3. IPC: Message Queues: msgge	v		4
4. IPC: Shared memory and s			
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A1 A2	attenda Lab attenda Lab attenda Lab	ince, ince, perfo	jour jour jour	activ nal activ nal nce	vities, and	Fa B	acul y acul	ty (ty		se	subn Duri subn Duri	nissio ng w nissio ng w	n at t veek n at t veek	$\frac{10 \text{ to}}{10 \text{ to}}$	of w we of w we	veek 8 eek 14 veek 14 eek 1	4 25 4 8 25
A1 A2 A3 ab ESE	attenda Lab attenda Lab attenda Lab p related	nce, nce, perfo docu	jour jour jour rma	activ nal activ nal nce ntati	vities, and on	Fa B Fa B Fa	acul y acul y acul	ty (ty (Cour	se	subn Duri subn Duri	nissio ng w nissio ng w	n at t veek n at t veek	he end 10 to he end	of w we of w we	veek 8 eek 14 veek 14 eek 1	4 25 4 8 25
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The experimental lab shall have typically 8-10 experiments

Course Contents:

- 1. Program based on multithreading.
- Program based on OPEN MPI.
 Program based on MPI.
- 4. Program based on CUDA.
- 5. Program based on arithmetic operation in parallel mode.
- 6. Program based on sorting algorithms.

Title of the Course: Mini-Project III 4IT342	L	Т	Р	Cr
	0	0	2	1

Pre-Requisite Courses: -

Textbooks: -

References: -

Course Objectives :

- 1. To provide guidance to select & build the ideas.
- 2. To help students to address real-world challenges.
- 3. To get students acquainted with team spirit.

Course Learning Outcomes:

CO	After the completion of the course the student should be	Bloom	's Cognitive
	able to	level	Descriptor
CO1	Demonstrate the database design & Use tools like WAMP,	3	Applying
	LAMP and XAMP		
CO2	Identify the real world challenges & try to address it.	4	Analyzing
CO3	Write & explain a detailed project report for submission and	4	Analyzing
	evaluation.		

CO-PO Mapping :

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1		1			2						3		2	
CO2										2				
CO3							3					1		

Lab Assessment

Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE

IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, Report	By Course Faculty/Guide	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, Report	By Course Faculty/Guide	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, Report	By Course Faculty/Guide	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation/ Report	By Course Faculty/Guide	During week 15 to week 18 submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, Project/mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

Mini-project is to be carried out in a group of maximum 3 to 5 students.

Each group will carry out mini-project on developing any application software based on following areas.

- 1. Web based application development with PHP/NodeJS/Angular etc and back end for data management.
- 2. Mobile application development with Android/Flutter/Swift etc.
- 3. Industry Problem Statement(Sponsored Project)
- 4. Problem statements based on current or previously learned Technology.

Project/Mini-Project group should submit workable project at the end of second semester.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on online github.

Students should maintain a project log book containing weekly progress of the project.

Open Elective (OE) (List OE (MOOC/NPTEL) will be published per semester/year)

Profe	ssic	onal	Elect	ive	2					
Title of the Course: Professional Ele	ctiv	e 2:	Machi	ne l	Learı	ning	L	Т	Р	Cr
4IT321							2	1	0	3
Pre-Requisite Courses:		N .		-			.1			
Computer Programming, Da	ita S	struc	tures, (Comp	outer	Algori	thms.			
Textbooks: 1. Aurelien Geron, "Hands-On N	100	hina	Loorni	naw	ith S	oileit I	oorn k	orag	and Tan	sor
Flow: Concepts, Tools and Tec				-			,			1
Edition, 2019	11110	ques	to Dui	iu iii	uenig	ciii by:		, 01	ciiry, 2	
References:										
1. Richard Duda, Peter Hart and I	Dav	id St	ork, "P	atter	n Cla	ssifica	tion", 2	2 nd Ec	lition,20	07
2. Tom Mitchell, "Machine Learn	ing	", M	cGraw	-Hill,	, 2 nd I	Edition	, 1997		-	
Course Objectives:										
1. To explain the concept supervision			1		d ma	chine l	earnin	g tech	iniques	
2. To introduce various machine l		-	-				1 • 1		. 1	
3. To discuss problem solving app	oroa	iches	using	appr	opria	ite ma	chine I	earnii	ng techn	iques
Course Learning Outcomes: CO After the completion of the co		so th	o stud	lont	shou	ld ha	Place	m'a (ognitiv	0
able to	Jui	se u	ie sluu	lent	SIIUU	iu de	DIUUI		oginuv	e
							level	De	escripto	r
CO1 Distinguish various machine lear	ning	g alg	orithm	s			2	Ur	nderstan	d
CO2 Apply appropriate learning method							3		oply	
CO3 Verify Machine Learning al					erforn	nance	5		aluate	
parameters	-			-						
CO- Mapping:							T			
PO 1 2 3 4 5 6	7	8	9 10	11	12	PSO1	l PSC	02		
CO1 1 2						1	_			
CO2 1 2					2		2			
CO3 3					3					
Assessments:										
Teacher Assessment:										
Two components of in Semester Evaluation	n (I	SE),	One M	lid S	emes	ter Exa	minat	ion (N	ASE) an	d one
End Semester Examination (ESE) having 2	0%	, 30%	6 and 5	0% v	weigh			ly.		
Assessment						N	/larks			
ISE 1							10			
MSE							30			
ISE 2							10			
ESE	daal	larad	tost/a	uiz/aa	mino	r ata	50			
ISE 1 and ISE 2 are based on assignment/ MSE: Assessment is based on 50% of cou			-				- modi	ilec)		
ESE: Assessment is based on 100% cou			· · ·					/	urse co	ntent
(normally last three modules) covered after			// 16		, 0 / 0					
Course Contents:										
Module 1:									Hı	·s.
Introduction to Machine Learning:									4	

Applications of Machine Learning, Supervised vs Unsupervised Learning, Python	
libraries suitable for Machine Learning	
Module 2:	Hrs.
Regression Techniques in Machine Learning::	111.5.
Linear Regression, Non-linear Regression, Model evaluation methods: Bias/Variance	5
trade off. Error Analysis Ensemble methods. Precision/Recall trade off	5
Module 3:	Hrs.
Classification Techniques in Machine Learning:	
K-Nearest Neighbour, Decision Trees, Logistic regression: Classification, Hypothesis	
representation, Decision Boundary, Cost Function, Simplified Cost Function and	_
Gradient Descent, Optimization, One vs All.	5
Support Vector Machines: Optimization Objective, Mathematics behind Large	
Margin classification, Kernels, Using an SVM.	
Module 4:	Hrs.
Unsupervised Learning Techniques in Machine Learning::	
K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Principal	4
Component Analysis, Outlier Detection	
Module 5:	Hrs.
Practical Examples:	
Content-based recommender systems, Collaborative Filtering, Large Scale Machine	4
learning	
Module 6:	Hrs.
Neural Networks:	
Regularization: The problem of Over fitting, Regularized Linear Regression and	
Logistic Regression.	4
Neural Networks: Non Linear Hypothesis, Representation, Multiclass Classification,	
One vs all.	
Module wise Measurable Students Learning Outcomes:	
Module 1: Extricate the concepts of Machine Learning.	
Module 2: Decide Machine Learning algorithms for Regression.	
Module 3: Relate Machine Learning techniques for classification.	
Module 4: Communicate various Machine Learning algorithms for Unsupervised Lea	rning.
Module 5: Prove Machine earning techniques in practical scenarios.	
Module 6: Substantiate Neural Network technique for solving Machine Learning prob	olems.
Tutorial Content:	
Tutorial can be conducted as12 Assignments based on module 1 to 6.	

1. Jame Proc References: Author/s, "N 1. Sear	es E. Smith an cesses", Elsevi	nd Ra	vi Na	-	ns.									L 2	T 1	P 0	Cr 3
Textbooks: 1. Jame Proc References: Author/s, "P 1. Sear	es E. Smith an cesses", Elsevi :	nd Ra	vi Na	-	ns.										1		
Textbooks: 1. Jame Proc References: Author/s, "P 1. Sear	es E. Smith an cesses", Elsevi :	nd Ra	vi Na	-	ns.												
extbooks: 1. Jame Proc References: Author/s, "N 1. Sear	es E. Smith an cesses", Elsevi :	nd Ra	vi Na	-													
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	Compare virti computing	ualiza	ation	tech	nniqu	ies	to	imj	oler	ner	nt cl	oud	I	II	Арр	olying	_
C O3 A	Analyze differ	ent v	irtua	lizati	ion te	echr	niqu	ues.					Γ	V	Ana	alyzing	
O-PO Ma	apping : (Use 1	, 2, 3	as co	rrela	tion	stre	ngt	ths)									
	РО	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2		
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Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction to Virtualization	6 Hrs.
Virtualization overview, Benefits of Virtualization, Need of Virtualization,	
Limitations, Traditional v/s Contemporary Virtualization, Hypervisors, Types of	
Provisioning, Impact of Virtualization, Introduction to Cloud Computing, Cloud	
Services and Types.	
Module 2 :Emulation	6 Hrs.
Basic interpretation, Threaded interpretation, Pre-decoding and direct threaded	
interpretation, Interpreting a complex instruction set, Binary translation, Code discovery and	
dynamic translation, control transform optimizations.	
Module 3 : Mechanism	7 Hrs.
Implementation levels of virtualization, virtualization providers, virtualization at the	
OS level, Virtualization structures: <i>Hosted and Bare-Meta</i> , Virtualization mechanisms,	
Virtualization of CPU, Memory and I/O devices.	
Module 4 : Virtualization Techniques	7 Hrs.
Server Virtualization, Terminal Services, Desktop Virtualization, Application	
Virtualization, Storage Virtualization, Managing heterogeneous virtualization	
environment, advanced virtualization.	
Module 5 : Process Virtualization	7 Hrs.
Emulation, virtual machine implementation, compatibility, state mapping, memory	
architecture emulation, operating system emulation, code cache management.	
Module 6 : System Virtualization	6 Hrs.
Applications of system virtualization, key concepts, Resource virtualization:	
Applications of system virtualization, key concepts, Resource virtualization.	1

After the completion of the course the student should be able to:

- Module 1: Explain the basic concepts of Virtualization.
- Module 2: Implement interface and functionality between system and sub-system.
- Module 3: Analyze the structure and levels of virtualization.
- Module 4: Apply various Virtualization Techniques.
- Module 5: Explain concepts and implementation of Process Virtualization

Module 6: Explain concepts and implementation of System Virtualization.

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Applications 4IT333		101	Зу	stem	is and		Т	Р	Cr
						2	1	0	3
Pre-Requisite Courses: Basic Electronics, Co	mpute	er Net	work	S					
Textbooks:	- 1 - 7		0 751		T 11	· _	1 1		
1. Pethuru Raj and Anupama C. Raman "T					s: Enabli	ing Tec	hnolo	gies,	
Platforms, and Use Cases", CRC Press,					II		1- 11		
 Arshdeep Bahga and Vijay Madisetti "In Universities Press, 1st Edition, 2015 	aterne	1 01 1	nings	5. A	Hands-0	on Appi	oacn	,	
References:									
1. Waltenegus Dargie, Christian Poellabaue	er "Fi	ındam	nental	ls of	Wireles	s Senso	or Net	works	
Theory and Practice", 1 st Edition, Willey			lentu	15 01	vi neles	5 Sense		WOIK5.	•
2. Jan Holler, VlasiosTsiatsis, Catherine M			efan A	Aves	and. Sta	matis F	Karno	uskos.	
David Boyle, "From Machine-to-Machin									ew
Age of Intelligence", 1 st Edition, Acade					C				
Course Objectives :									
1. To infer the concept of Internet of Thing		/							
2. To apply basic WSN protocols for IoT s	•								
3. To create IoT based applications in diffe	erent p	aradi	gms.						
Course Learning Outcomes:									_
CO After the completion of the cour	se the	e stud	dent	shou	uld be	Bloon			
able to					-	Cogni	1	• 4	
CO1 Apply IoT concent in real time seen	orio					level		cripto	r
CO1Apply IoT concept in real time scenaCO2Analyze use of WSN protocols in Io		licati	200			3 4		<u>lying</u> lyzing	
CO3 Develop IoT enabled services.	, i app	ncati	5115.			6		ating	
CO-PO Mapping :						0	Citt	ung	
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CO2 2 2	-		3	1		1			
CO3 2 3 3			3	3	1	-			
			5	0	-				
Assessments :									
Teacher Assessment:									
Two components of In Semester Evaluation (IS	//							E) and	d on
End Semester Examination (ESE) having 20%,	30% a	and 5	0% w	reigh		2			
Assessment						urks			
ISE 1						0			
MSE						0			
ISE 2						$\frac{0}{0}$			
	1		tagt (5	0)		

for ISE 2] MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 70-80% weightage for course content

(normally last three modules) covered after MSE.	
Course Contents:	
Module 1	Hrs.
Introduction to IoT, Sensing, Actuation, Basics of Networking.	5
Module 2	Hrs.
Communication Protocols, Sensor Networks, Machine-to-Machine Communications.	5
Module 3	Hrs.
Introduction to SDN, SDN for IoT, Data Handling and Analytics, Cloud Computing, Fog/Edge Computing.	4
Module 4	Hrs.
Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.	5
Module 5	Hrs.
Introduction to Python programming, Introduction to Raspberry, Implementation of IoT with Raspberry-Pi.	4
Module 6	Hrs.
Case study: Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Agriculture, Healthcare, Activity Monitoring.	4
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Describe basics of Internet of Things.	
Module 2: Apply sensor network protocols in IoT systems.	
Module 3: Categorize SDN, Cloud and Fog based IoT enabled services.	
Module 4: Demonstrate arduino programming and arduino based IoT based systems.	
Module 5: Demonstrate python programming and Raspberry-Pi based IoT based syste	ms.
Module 6: Test IoT based services.	
Tutorial Content:	
Tutorial can be conducted as12 Assignments based on module 1 to 6.	

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Manage	ment 4	IT334														2	1	0	3
Pre-Req	uisite	Course	es:	Cor	npu	iter	netv	wor	ks							•			•
Fextboo	ks:																		
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Ν	/lanage	ment",	EM	1C]	Edu	cati	on	Ser	vice	es (V	Wile	ey In	dia),	$2^{nd} E$	Edition, 2	2012.			
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CO-PO																<u> </u>			
		PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	2		
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Module 1: Introduction to information storage and Data centre	4Hrs.
Information Storage, Evolution of Storage Architecture, Data Centre Infrastructure,	
Virtualization and Cloud Computing , Application, Database Management System	
(DBMS), Host, Connectivity, Storage, Disk Drive Components Disk Drive	
Performance, Host Access to Data, Direct-Attached Storage	
Module 2: Data Protection and Intelligence Storage System	Hrs.
RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID	
Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares,	_
Components of an Intelligent Storage System, Storage Provisioning, Types of	5
Intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX	
Module 3: Fibre Channel Storage Area Networks	Hrs.
Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC	
Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services,	5
Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN,	3
Concepts in Practice: EMC Connectrix and EMC VPLEX	
Module 4: IP SAN and FCoE and Network-Attached Storage, Object-Based and	Hrs.
Unified Storage iSCSI, FCIP, FCoE, General-Purpose Servers versus NAS Devices, Benefi ts of NAS,	
File Systems and Network File Sharing, Components of NAS, NAS I/O Operation,	
NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS	
Performance, File-Level Virtualization, Object-Based Storage Devices, Content-	4
Addressed Storage, CAS Use Cases, Unified Storage, Concepts in Practice: EMC	
Atmos, EMC VNX, and EMC Centre	
Module 5: Business Continuity Backup and Recovery	Hrs.
Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis,	
Business Impact Analysis, BC Technology Solutions, Concept in Practice: EMC Power	
Path, Backup Purpose, Backup Considerations, Backup Granularity, Recovery	
Considerations, Backup Methods, Backup Architecture, Backup and Restore	4
Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data	
Doduntization for Boolann Boolann in Virtualized Environments Data Archive	
Deduplication for Backup, Backup in Virtualized Environments, Data Archive,	
Archiving Solution Architecture.	
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage	Hrs.
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure	Hrs.
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local	Hrs.
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and	Hrs.
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local	Hrs.
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized	
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment, Modes of Remote Replication, Remote Replication Technologies, Three-	
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment, Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication, Data Migration Solutions, Remote Replication and Migration in a	
Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment, Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication, Data Migration Solutions, Remote Replication and Migration in a Virtualized Environment, Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking,	
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Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment, Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication, Data Migration Solutions, Remote Replication and Migration in a Virtualized Environment, Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: Module 1: Explain basic components of storage architecture	
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Archiving Solution Architecture. Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in a Virtualized Environment, Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication, Data Migration Solutions, Remote Replication and Migration in a Virtualized Environment, Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: Module 1: Explain basic components of storage architecture	

Module 5: Analyse different backup and recovery techniques **Module 6:** Analyse various storage infrastructures

Tutorial Content:

Tutorial can be conducted as12 Assignments based on module 1 to 6.

Title of the Course: Professional Elective 2:Intellectual Property	L	Т	Р	Cr
Right(IPR) 4IT335	2	1	0	3
Pre-Requisite Courses:NA		1		
Textbooks:				
 Howard B. Rockman, "Intellectual Property Law for Engine first edition, May 2004. JeffreyG. Sheldon, How to Write a Patent Application, Thir Institute, 2016. 				-
References:				
 Indian Patents Act, 1970 Ove Granstrand, The Economic and management of Intel Narayanan, V. K., Managing technology and inne advantage, first edition, Pearson education, New Delhi, 2 Idris, K., Intellectual property: a power tool for economi WIPO publication no. 888,Switzerland, 2003 Additional Reading - WIPO - http://www.wipo.int/pate 	ovation 006 c grov	n for vth, sec	comp	etitive
Course Objectives :				
 To disseminate fundamental aspects of Intellectual prope To provide awareness of IPR and government policies ab Course Learning Outcomes: CO After the completion of the course the student should 	out IP	-		rocess
he able to				
	level]	Descri	ptor
CO1 Identify and apply IPR for intellectualwork.	3		Apply	ing
CO2 Analyze the intellectual work for economical, moral,	4	1	Analy	zing
ethical issues and social importance with respect to IPR				
CO-PO Mapping :				
PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10	PO11	PO12	PSO1	PSO2
CO1 3 2			1	
CO2		2		
Assessments :				
Teacher Assessment:				

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Fundamentals of IPR	Hrs.
Introduction to IPR: Definition, Types of IPR, IPR Acts, Nature of Intellectual	
Property right(IPR) protection of IP, IPR and Economic Development,	3
Instruments relating to the protection of IP:Berne Convention, Paris Convention,	5
TRIPS	
Module 2: Patent and patentability	Hrs.
Introduction to patent: Definition, concepts, Patentability Criteria:How to	5
Identify whether my invention is patentable?, Criteria for obtaining	
patents:Novelty, Inventive step, Utility, Non patentable inventions, Patentability	
check - various tools. Understanding the Patents Act, 1970, Prioir art and patent.	
Module 3: Patents procedures and filing	Hrs.
Procedure for registration/filing (forms), Term of patent, Rights of patentee,	
Basic concept of Compulsory license and Government use of patent,	5
Infringement of patents and remedies. Important sections of form2. Drafting	5
patent and claim.	
Module 4: Copyright, Trademark, Designs and Geographical Indication(GI)	Hrs.
Copy right :Ownership of copyright, Term of copyright, Rights of	
owner:Economic Rights, Moral Rights, Assignment and license of rights,	6
Performers rights and Broadcasters rights, Infringement of copyright, Fail use	O
and Fair Dealing concepts, Categories of Trademark: Certification Mark,	

NT (*		
	nal Marks, Concept of distinctiveness, Doctrine honest user,	
registration and	protection.	
Design: Concer	ot of original design, Difference between GI and Trade Marks,	
Concept of Aut	norized user, GI: Homonymous GI.	
Module 5: Pate	nt Licensing	Hrs.
Compulsory Li	censing; Compulsory Licensing-Working of Patents, Grounds	•
for Grant of Con	npulsory License, Revocation; Patent Licensing.	3
Module 6: Type	es of patent applications	Hrs.
Compulsory Lie	censing; Compulsory Licensing – Working of Patents, Grounds	
for Grant of Con	npulsory License, Revocation; Patent Licensing; Patent	
Applications ; F	atent Application – Who Can Apply, True and First Inventor,	4
How to Make a	Patent Application, What to include in a Patent Application,	
Types of Patent	Applications, Patents of Addition, Dating of Application.	
, ,	$\sim \sim $	
Module wise Mo	easurable Students Learning Outcomes : etion of the course the student should be able to:	
Module wise Mo	etion of the course the student should be able to: To Overview of IPR	
Module wise Mo	etion of the course the student should be able to: To Overview of IPR	
Module wise Mo After the comple Module 1:	etion of the course the student should be able to:	
Module wise Mo After the comple Module 1: Module 2:	etion of the course the student should be able to: To Overview of IPR To Comprehend the IPR	
Module wise Mo After the comple Module 1: Module 2: Module 3:	etion of the course the student should be able to: To Overview of IPR To Comprehend the IPR To identify the IPR	