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)

Title of the Course: Database Engineering 4IT301	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:
Object-Oriented Programming Data Structures, Computer Algorithms

Textbooks:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "Database System Concepts", McGraw-Hill Education, 6th Edition, 2010.
2. Raghu Ramakrishnan, "Database Management Systems", McGraw-Hill Education, 3rd Edition, 2003.

References:

1. J.D. Ullman, "Principles of Database Systems", Galgotia Publications, 2nd Edition, 1999
2. Wiederhold, "Database Design", McGraw Hill Inc, 2nd Edition, 1983
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8th Edition, 2006.

Course Objectives :

1. To introduce basic concepts of database management systems
2. To impart conceptual designs for databases
3. To describe issues associated with transaction management

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Manipulate the relational databases.	3	Applying
CO2	Inspect databases using Query languages.	4	Analyzing
CO3	Evaluate transaction processing techniques.	5	Evaluating

CO-PO Mapping :

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	2							1		3	1		
CO2		2			2						3	2	1	
CO3					2						2	3		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	**Hrs.**
Introduction: Database Systems, Types of Database Systems, Data abstraction, Data Models, Architecture of Database Systems. **E-R Model:** Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables, Specialization, Generalization, Aggregation.	**7**
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, Triggers, Normal forms, Functional Dependencies, Decomposition.	**7**
Module 3	**Hrs.**
Query Processing: Query processing, Query Cost, measures of query cost, Evaluation of expression, Equivalence of Expressions. Structured Query Language (SQL).	**6**
Module 4	**Hrs.**
File and System Structure: Storage media, RAID, Storage access, File organization, Organization of Records into files. **Indexing and Hashing:** Ordered and secondary Indices, B+ Tree Index Files, Static Hashing, Dynamic hashing, Comparison of Indexing, Grid files, Bitmap indices.	**7**
Module 5	**Hrs.**
Transactions: Properties and states, Concurrent execution, Serializability. **Concurrency Control:** Lock-Based Protocols, 2 phase locking protocol, Graph based protocols, Time stamp based protocols, Dead lock handling	**6**
Module 6	**Hrs.**
Crash Recovery: Failure Classification, storage Structure, Log-Based Recovery, Shadow Paging, recovery with concurrent transactions, buffer management, backups. Introduction to Database performance tuning.	**6**

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 techniques
Module 4: Describe concepts of File storage and implementation.
Module 5: Explore knowledge of transaction management of database systems
Module 6: Discuss recovery management of database systems.

Title of the Course: Operating System 4IT 302	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Basics of Theory of computation and system programs.

Textbooks:

1. James. L. Peterson and A. Silberchatz ,"Operating System Concepts", Addison Westley Publication, 9th Edition,2018.
2. Milan Milenkovic ,"Operating System – Concept and Design", TMGH,1st Edition,2001.

References:

1. William Stallings," Operating Systems : Internals and Design Principles",Peterson Publication,7th Edition,2013
2. Crowley Charles, "Operating Systems: A Design-Oriented Approach",Mc Graw Hill Publication,1st Edition,2017.

Course Objectives :

1. To introduce various system calls and system programs
2. To describe OS functionalities.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Distinguish between different types of OS	2	Understanding
CO2	Illustrate the concept of process and synchronization	3	Applying
CO3	Analyze the deadlocks and memory management challenges in system	4	Analyzing

CO-PO Mapping :

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1			1									**1**		
CO2				2	2								**1**	
CO3				2	2									**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	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 security. **System Structure:** Operating system services, user operating system interface, system calls, types of system calls, system programs, operating system design and implementation, operating system structure.	**5**
Module 2	**Hrs.**
Process Process Concept, Process Scheduling, Operation on process, Cooperating process, Threads, Inter-process Communication (Algorithms evaluation). **Process Scheduling:** Basic concept, Scheduling Criteria, Scheduling Algorithms, Multiple processor scheduling, Real time scheduling.	**8**
Module 3	**Hrs.**
Inter-process Synchronization Background, Classical problems of synchronization, Critical Region, The critical section problem, Synchronization Hardware, Monitors, Semaphores.	**6**
Module 4	**Hrs.**
Deadlocks System modes, Deadlock characterization, Methods for handling deadlocks Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	**6**
Module 5	**Hrs.**
Memory Management Background, Logical Versus Physical Address space, Swapping Contiguous Allocation, Paging, Segmentation, Segmentation with paging. **Virtual Memory:** Background, Demand paging, Page replacement, Page replacement algorithms, Allocation of frames, thrashing (Only concept), Demand segmentation. Virtualization concept and case studies	**8**
Module 6	**Hrs.**
File System Management File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection. **Implementing File System :** File system structure, file-system implementation, directory implementation, allocation methods, free-space management	**6**

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.

Title of the Course: Computer Algorithm 3IT 303	**L**	**T**	**P**	**Cr**
	3	0	0	3

Pre-Requisite Courses: Data Structure

Textbooks:

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Third Edition the MIT Press Cambridge, London, England

References:

1. Horrowitz, Sahni Rajasekaran, "Computer Algorithms", Computer Science, W. H. Freeman and company Press, New york

Course Objectives :

1. To comprehend the logic of algorithm and its complexity
2. To realize standard algorithms and its implementation
3. To discuss the hardness level of algorithm and convince the importance of use of approximation algorithm.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	Select and apply appropriate algorithms for solving the problem.	3	Applying
CO2	Study the problem statement for algorithmic approach.	4	Analyzing
CO3	Design the appropriate algorithm for problem statement	6	Creating

CO-PO Mapping :

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1					3							1		
CO2		1			2								1	
CO3	1	2												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	Hrs.
Introduction, Design and Analysis of Algorithm Greedy Algorithms: An activity-selection problem, Knapsack problem, Huffman codes, Task scheduling problem. Dynamic Programming: Matrix-chain multiplication, Elements of dynamics programming, Longest common subsequence.	8
Module 2	Hrs.
Single-Source Shortest Path (SSSP): Shortest paths and relaxation, Bellman-Ford algorithm, Single-source shortest paths in directed Acyclic graphs, Dijkstra's algorithm, Problems, Topological sort	6
Module 3	Hrs.
All-Pairs Shortest Paths (APSP) and Maxflow: Shortest paths and matrix multiplication, The Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs. Flow Networks, Ford Fulkerson method, Maximum Bipartite matching	6
Module 4	Hrs.
Number-Theoretic Algorithm: Elementary number-theoretic notions, Greatest common divisor Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, DFT/FFT.	6
Module 5	Hrs.
String Matching: The naïve string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm. Computational Geometry: Line-segment properties, Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points.	6
Module 6	Hrs.
Complexity class and Approximation Algorithm: NP-Completeness: Polynomial time, Polynomial-time verification, NP completeness and reducibility, NP-complete problem. Approximation Algorithms: The vertex-cover problem, The travelling-salesman problem, The set-covering problem, The subset-sum problem	7

Module wise Measurable Students Learning Outcomes :

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

Module 1: Explain and Apply appropriate strategy for solving a given problem.
Module 2: Explain the basic algorithms of finding shortest path.
Module 3: Explain the basic algorithms of maximum flow and APSP.
Module 4: Demonstrate the importance of 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 explain practical approaches for NP problems.

Title of the Course: Web Technology 4IT304	L	T	P	Cr
	1	0	0	1

Pre-Requisite Courses: Basic Programming Concepts

Textbooks:

1. P.J. Deitel & H.M. Deitel Pearson, "Internet and World Wide Web How to program", Pearson Education India, 4th edition, 2009
2. Jon Duckett,"HTML and CSS: Design and Build Websites", John Wiley & Sons, Inc, 1st edition, 2011

References:

1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, 5th Edition, 2010
2. Ivan Bayross ,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Edition , 2006

Course Objectives :

1. To introduce the principles web based applications development process
2. To impart current client side and server side web technologies
3. To provide application development in web and content management system

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Develop web-based application using suitable client side and server side web technologies	3	Applying
CO2	Analyze a web page and identify its elements and attributes	4	Analyzing
CO3	Design solution to using appropriate web frameworks	6	Creating

CO-PO Mapping:

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

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 – 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 web application.
- **Module 6:** Create dynamic web applications with Rail.

Professional Core (Lab)

Title of the Course: Database Engineering Lab 4IT351	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses:
Object-Oriented Programming Data Structures, Computer Algorithms

Textbooks:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "Database System Concepts", McGraw-Hill Education, 6th Edition, 2010.
2. Raghu Ramakrishnan, "Database Management Systems", McGraw-Hill Education, 3rd Edition, 2003.

References:

1. J.D. Ullman, "Principles of Database Systems", Galgotia Publications, 2nd Edition, 1999
2. Wiederhold, "Database Design", McGraw Hill Inc, 2nd Edition, 1983
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8th Edition, 2006.

Course 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.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarize real world problems into relational databases.	2	Understanding
CO2	Execute Query languages on databases.	3	Applying
CO3	Study transaction processing techniques.	4	Analyzing

CO-PO Mapping :

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

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, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25

Lab ESE	Lab performance and related documentation	By Course Faculty	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, 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:

	Hrs.
4. Basic operations of relational model a. Study and design of ER model b. Program to implement SELECT and PROJECT operation on student database c. Program to implement INSERT,DELETE and UPDATE operation on student database	**4**
5. Advanced operations of relational model a. Program for aggregate functions b. Program for outer join(Full, Left and Right) c. Program for domain constraints & Referential Integrity	**6**
6. Indexing and hashing a. Program for Bit Slicing for data & store data on Diff. Files b. Program for sparse index and dense index c. Program for static hashing d. Program for dynamic hashing	**8**
7. Transaction processing a. Program for log based protocol for transaction b. Program for 2 PL protocol for transaction c. Program for Time Stamp protocol for transaction d. Program for Deadlock Detection	**8**

Title of the Course: Computer Algorithm Lab 4IT353	L	T	P	Cr
	-	0	2	1

Pre-Requisite Courses: Data Structure

Textbooks:

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, *"Introduction to Algorithms",*MIT Press Cambridge, England, Third Edition, 2009
2. Jon Klenberg, Eva Tardos, "*Algorithm Design*", Pearson Education India

References:

1. Horrowitz, SahniRajasekaran, *"Computer Algorithms", Computer Science, W. H. Freeman and company Press, New York,*

Course Objectives :

1. To recognize the logic of algorithm and its complexity
2. To realize standard algorithms and its implementation
3. To categorize the algorithms based on complexity and adopt to the equivalent approximate algorithm.

Course Learning Outcomes: (Write from student perspective)

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Select and apply appropriate algorithms for solving the problem.	3	Applying
CO2	Study the problem statement for algorithmic approach.	4	Analyzing
CO3	Design the appropriate algorithm for problem statement	6	Design

CO-PO Mapping : (Use 1, 2, 3 as correlation strengths)

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

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 Submission**	**Marks**	**Marks**
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25	
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25	
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25	
Lab ESE	Lab performance and related documentation	By Course Faculty	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, 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.

Title of the Course: Web Technology Lab 4IT354	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses: Basic Programming Concepts

Textbooks:

1. P.J. Deitel & H.M. Deitel Pearson, "Internet and World Wide Web How to program", Pearson Education India, 4th edition, 2009
2. Jon Duckett,"HTML and CSS: Design and Build Websites", John Wiley & Sons, Inc, 1st edition, 2011

References:

1. Steven M. Schafer, "HTML, XHTML and CSS", Wiley India Edition, 5th Edition, 2010
2. Ivan Bayross ,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Edition , 2006

Course Objectives :

1. To introduce the principles web based applications development process
2. To impart current client side and server side web technologies
3. To provide application development in web and content management system

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Apply different client side and server side scripting for web based applications.	3	Applying
CO2	Analyse a web page and identify its elements and attributes	4	Analyzing
CO3	Design solution to using appropriate web frameworks	6	Creating

CO-PO Mapping:

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

Assessments:

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 Submission**	**Marks**	**Marks**
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25	
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25	
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week	25	

			14	
Lab ESE	Lab performance and related documentation	By Course Faculty	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, 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 Content(Lab)

Assignment List:

1. Program on HTML basic tags for text formatting.
2. Program on HTML tag to handle multimedia elements on web page.
3. Program on HTML tag to create forms and UI elements.
4. Program on CSS properties for HTML web page.
5. Program on applying event handling on HTML web page using JavaScript.
6. Program on applying layout to HTML webpage.
7. Program on PHP controls statements.
8. Program on PHP string operations.
9. Program on PHP form creation and data handling.
10. Program on session management using PHP.
11. Program on Cookies management using PHP.
12. Program on PHP to connect MySql database for CURD operations.
13. Program on Rails Application using Layout, Components.

Title of the Course: Mini-Project II 4IT341	L	T	P	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 able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Demonstrate the network application & use the open source tool for the network application.	3	Applying
CO2	Identify the real world challenges & try to address it.	4	Analyzing
CO3	Write & explain a detailed project report for submission and evaluation.	4	Analyzing

CO-PO Mapping :

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

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.

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

Title of the Course: Professional Elective-1:Cloud Computing 4IT311	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Computer Networks

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering cloud computing", Mc Graw Hill Education, 3rd Edition, 2011
2. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, 1st Edition, 2010

References:

1. Richardo Puttini, Thomas Erl, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Pearson Prentice Hall, 2nd edition, 2013
2. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, 2nd Edition, 2012

Course Objectives :

1. To introduce fundamentals of virtualization
2. To impart various service and deployment model in cloud computing
3. To acquaint the significance of virtualization in data center

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Comprehend the fundamentals of cloud computation	2	Understanding
CO2	Choose virtualization techniques to deploy the service on cloud infrastructure	3	Applying
CO3	Analyze service models for data center applications	4	Analyzing

CO-PO Mapping :

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2									1			2	1	
CO3	2													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: Data Center Architecture	**Hrs.**
Data centre and services, Traditional data centre architecture, Challenges, Modern data centre	**4**
Module 2: Virtualization	**Hrs.**
Hosted and Bare-Meta, Server Virtualization, Desktop Virtualization, Application Virtualization, Storage Virtualization	**5**
Module 3: Cloud Computing Basics	**Hrs.**
Virtualization and Cloud Computing, Cloud Reference Model: *IAAS, PAAS, SAAS*, Cloud Deployment Model: *Public Cloud, Private Cloud and Hybrid Cloud*	**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, Intrusion Detection Systems*	**4**
Module 5: Virtual Private Clouds (VPC)	**Hrs.**
VPC fundamentals, Public and Private Subnets, Security Groups, Network Access Control List, Network Address Translation	**4**
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.

Title of the Course: Professional Elective-1:Wireless Networks 4IT312	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Computer Networks

Textbooks:

1. C. S. R. Murthy " Ad hoc wireless networks: Architectures and Protocols ", Pearson Education India, 3rd Edition, 2004
2. Ilya Grigorik " High Performance Browser Networking", O'Reilly Media, Inc., 2nd Edition, 2013)

References:

1. Tti Saha Misra, "Wireless Communication and Networks 3G and beyond", Tata McGraw Hill, 1st edition, 2011
2. Johen Schiller, "Mobile Communications", Pearson Education India , 2nd Edition, 2010

Course Objectives :

1. To introduce the concept of wireless network technology.
2. To discuss concepts of ad-hoc, mobile and browser networks.
3. To define performance parameters of ad-hoc, mobile wireless network.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Distinguish wired and wireless network scenario.	2	Understanding
CO2	Analyze performance of ad-hoc and mobile wireless network.	4	Analyzing
CO3	Design wireless applications.	6	Creating

CO-PO Mapping :

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

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 with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.

Introduction to wireless networks, ubiquitous connectivity, types of wireless networks, performance fundamentals of wireless networks, measurement of real world wireless-performance.	**4**
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 :

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.

Title of the Course: Professional Elective-1:Computer Graphics & Multimedia Techniques 4IT313	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Data Structures, Computer Programming

Textbooks:

1. David F. Rogers, J Alan, Adams, "Mathematical Elements for Computer Graphics", TMGH, 2nd Edition, 2002, 27th reprint , 2015
2. Tay Vaughan, "Multimedia Making it Work", TMGH, 8th Edition, 2010.

References:

1. Newman Sproull, "Principal of Interactive Computer Graphics", MGH, 2nd Edition, 1979
2. Steven Harrington "Computer Graphics, A Programming Approach", MGH, 2nd Edition ,1987

Course Objectives :

1. To introduce basics of computer graphics
2. To acquaint students with algorithms of computer graphics and modelling.
3. To impart key concepts of digital multimedia in computer graphics

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the geometric transformations in the context of computer graphics.	2	Understanding
CO2	Implement algorithms of computer graphics and modelling.	3	Applying
CO3	Study the impact of digital multimedia with applications	5	Evaluating

CO-PO Mapping :

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

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 grou discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used fo 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 conter (normally last three modules) covered after MSE.

Course Contents:

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 Filling Polygon listing & filling criteria- ordered edge list representations Polygon filling algorithms- Edge fill, fence fill, edge flag and seed fill algorithms Antialising- polygon interiors, simple area antialising Halftoning- 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 Curves Curve 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 graphics **Module 2:** Practice geometric transformation on graphical objects **Module 3:** Analyze polygon filling algorithms with error minimization **Module 4:** Identify various algorithms for object visibility **Module 5:** Describe curve drawing methodologies **Module 6:** Choose appropriate media techniques and storage devices	
Tutorial Content: Tutorial can be conducted as12 Assignments based on module 1 to 6.	

Title of the Course: Professional Elective-1:Advanced Data Structures 4IT314	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses:

Computer Programming, Data Structures

Textbooks:

1. Robert Kruse, C L Tando, Bruce Leung, "Data Structure and Program Design in C", Pearson, 2nd, 2007
2. Thomas H. Cormen, Charles E. Leiserson, et al., "Introduction to Algorithms", PHI Learning, 3rd, 2010

References:

1. Peter Brass, " Advanced Data Structures", Cambridge University Press, 1st Edition, 2008
2. Jean-Paul Tremblay, Paul Sorenson, "An Introduction to Data Structures with Application", McGraw-Hill, 2nd, Edition, 2017

Course Objectives:

1. To introduce time complexity issue & balanced search trees
2. To impart advanced concepts and types of heaps, graphs and hashing
3. To state the use of appropriate data structures and algorithms in real applications

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	Solve real world problems using advanced data structures.	3	Apply
CO2	Compare different data structures	4	Analyse
CO3	Evaluate time complexity of different algorithms	5	Evaluate

CO-PO Mapping:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**1**			**2**									**1**	
CO2		**2**	**3**											**2**
CO3				**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/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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1:	**Hrs.**
Data Structure and Time Complexity: Review of Basic Concepts: Abstract data types, Algorithms, Big Oh, Small Oh, Omega and Theta notations, Solving recurrence equations, Data structures & its effect	**4**

on time complexity**,** Iterative Vs Recursive coding, amortized analysis.	
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 solving.

Tutorial Content:

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

Title of the Course: Professional Elective-1:Artificial Intelligence 4IT315	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses:
Computer Algorithm

Textbooks:
1. Elaine Rich and Kelvin Knight ,Nair," Artificial Intelligence," McGraw Hills 3rd edition
2. Janakiraman et al., "Foundations of Artificial Intelligence and Expert Systems", Macmilan India Ltd.
3. Russell and Norvig," Artificial Intelligence – A Modern Approach", Prentice-Hall, 2010 (3rd edition).

References:
1. Saroj Kaushik, "Artificial Intelligence"
2. Townsend, "Introduction to Turbo prolog"

Course Objectives :
1. To learn theory developed in Artificial Intelligence.
2. To learn techniques used in major application areas of Artificial Intelligence.
3. To learn about the state of the art in Artificial Intelligence.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Apply schemes of knowledge representation.	3	applying
CO2	Demonstrate expert system.	3	applying
CO2	Evaluate performance of AI systems.	5	Evaluate

CO-PO Mapping :

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**2**		3											**2**
CO2			1						3				**1**	
CO3	**2**										**3**	**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/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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction and searching in AI	**Hrs.**

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, Unificattion	**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, Non linear planning.	**4**
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 AI 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

Professional Core(Theory)

Title of the Course: Advanced Database Engineering: 4IT321	L	T	P	Cr
	3	0	0	0

Pre-Requisite Courses:

Database Engineering / Database Management Systems

Textbooks:

1. Raghu Ramakrishnan, Johannes Gehrke, *"Database Management Systems",* 3rd Edition, McGraw-Hill Higher Education, 2014

References:

1. Carlos Coronel, Steven Morris, "*Database Systems: Design, Implementation, & Management",* 13th Edition, Cengage Learning, 2018.
2. Shio Kumar Singh, "*Database Systems: Concepts, Design and Applications*", 2nd Edition, Pearson Education India, 2011.

Course Objectives :

1. To introduce parallel and distributed databases architectures.
2. To deliver application oriented appropriate database system.
3. To develop design and implementation skills for database systems.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	Distinguish application oriented database systems	2	Understanding
CO2	Differentiate parallel and distributed database architectures	4	Analyzing
CO3	Build application oriented database systems	6	Creating

CO-PO Mapping :

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1				1										2
CO2				1	2									
CO3		1							2			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 with 70-80% weightage for course content (normally last three modules) covered after MSE.

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, Updating distributed data, Distributed concurrence control, Distributed recovery.	**7**
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. Data Mining: Introduction, Counting Co-occurrences, Mining for rules, Tree structured rules, Clustering, Similarity search over sequences.	**8**
Module 3: Object Database Systems	**Hrs.**
Structured data types, Operations, inheritance, Objects, OID and Reference types, 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 engines, web crawling, web search statistics. Data model for XML. XML Quires.	**7**
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. Advance transaction processing, Mobile database, Geographic Information systems. Temporal and Sequence database.	**7**

Module 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 systems.

Tutorial

Partial list of tutorials consisting assignments (design and study) and computer programming to demonstrate results.

1. Design the database according to given rules.
2. Implement user interfaces for entering/updating data in database tables (distributed 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/or platform to show use of application database.

Title of the Course: : Digital Image Processing 4IT322	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Mathematics-(Matrix, Fourier Transformation).

Textbooks:

1. S.Shridhar, "Digital Image Processing",Oxford University Press,2nd Edition,2016.
2. Millan sonka,Vaclav Hiavac, Roger Boyle, "Image Processing Analysis and Machine Vision",CL Engineering,3rd Edition,2013.

References

1. S. Jayraman, S Esakkiarajan , Veerakumar, "Digital image processing",MGH,1st Edition,2017.
2. Rafel C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2008

Course Objectives :

1. To explain image fundamentals and mathematical transforms for image processing
2. To describe and explain image enhancement techniques
3. To elaborate image processing applications

Course Learning Outcomes: (Write from student perspective)

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	Discuss fundamental concepts of a digital image processing system	2	Understanding
CO2	Interpret image segmentation and representation techniques	3	Applying
CO3	Analyze images in the frequency domain using various transforms	4	Analyzing

CO-PO Mapping :

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

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/declared test/quiz/seminar etc.

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

Module 1Digital Image Fundamentals	**6 Hrs**
Fundamental steps in DIP, Components of digital image processing Applications of image processing, image function, image representation, sampling, quantization, color images, metrics and topological properties of digital images, histograms, image quality, noise image.	

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).	

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

Course Contents: (Arrange contents logically/process-wise/conceptually/theory followed by application)

Module 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 techniques.

Module 6: Relate image compression techniques.

Title of the Course: Unix Operating System 4IT 323	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Operating System

Textbooks:

1. Maurice J. Bach, "The Design of Unix Operating System", PHI.
2. "Unix Manuals".

References:

1. Sumitabha Das, "Unix Concepts and Applications", TMGH, 3rd Edition.
2. Raghvan, Lad, Neelkandan, "Embedded Linux System Design and Developments", Auerbach Publication.

Course Objectives :

1. To introduce design principal and philosophy of the Unix/Linux OS.
2. To impart the architecture of Unix/Linux OS.
3. To use system call of Linux/Unix.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Interpret design principal and philosophy of the Unix/Linux OS	2	Understanding
CO2	Comprehend the architecture of Unix/Linux OS	2	Understanding
CO3	Use system call of Linux/Unix	3	Applying

CO-PO Mapping :

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

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	Hrs.

Introduction General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware. Introduction to the KERNEL: Architecture of UNIX OS, Introduction to system concepts, Kernel Data Structure, System Administration.	**7**
Module 2	**Hrs.**
The Buffer Cache Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, advantages and disadvantages of cache.	**4**
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 Root, Change Owner and Change Mode, Stat and Fstat, Pipes, Dup, Mounting and Unmounting file systems, Link, Unlink, File System Abstractions, File system maintenance.	**8**
Module 5	**Hrs.**
Structure of Process Process stages and transitions, layout of system memory, the context of a Process, saving context of a process, manipulation of the process address space. Process Control: Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process, Process Scheduling, system call for time, clock.	**8**
Module 6	**Hrs.**
Memory Management Policies Swapping, Demand passing, a hybrid system with demand paging and swapping The I/O Subsystem: Driver interfaces, disk drives, terminal drivers, Streams.	**6**

Module wise Measurable Students Learning Outcomes :

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

Module 1: Explain Unix architecture and kernel.

Module 2: Identify the importance of buffer cache for improving OS performance

Module 3: Explain inode and its importance w.r.to file and process.

Module 4: Apply and analyze use the file system related system calls

Module 5: Apply the operations on processes and process scheduling.

Module 6: Explain memory management policies and I/O subsystem.

Title of the Course:Parallel Programming 4IT324	L	T	P	Cr
	1	0	0	1

Pre-Requisite Courses:

Programming Language in C.

Textbooks:

1. Michael J. Quinn, "*Parallel Programming in C with MPI and Open MP* "

References:

1. Implement & benchmark parallel programming in C using MPI, Open MP, CUDA.
2. An introduction to parallel programming‖, Morgan Kaufmann, Peter S. Pacheco, 2011.

Course Objectives :

1. To familiar with parallel and distributed languages MPI, Open MP.
2. To learn the GPU based parallel programming using CUDA.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Identify parallel structures in the application.	1	Remembering
CO2	Apply shared, distributed & NUMA- Address space programming methods.	3	Applying
CO3	Analyze the parallel programs using different tools	4	Analyzing

CO-PO Mapping :

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

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 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)

Title of the Course: Unix Operating System Lab 4IT 373	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses:
Programming Language in C, Operating System.

Textbooks:
1. "The Design of Unix Operating System", Maurice J. Bach, PHI.
2. "Unix Manuals".

References:
1. "Unix Concepts and Applications", Sumitabha Das, TMGH, 3rd Edition.
2. W. Richard Stevens "Unix Network Programming ", second Edition, Prentice Hall (PHI), 1990.
3. Raghvan, Lad, Neelkandan, "Embedded Linux System Design and Developments", Auerbach Publication.
4. Website : www.cs.cf.ac.uk/Dave/C/CE.html

Course Objectives :
1. To introduce and use various system call of Unix/Linux OS
2. To use the various IPC's available in OS.
3. To impart the IPC for solving the real world problems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the difference between thread and process	2	Understanding
CO2	Implement effective programing on Unix/Linux.	3	Applying
CO3	Distinguishing various IPC's available in OS.	4	Analyzing

CO-PO Mapping :

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

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, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and	By Course	During week 15 to week 18	25

	related documentation	Faculty	submission at the end of week 18	

Week 1 indicates starting week of the semester
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:

Content	Hours
1. Processing Environment a. fork, vfork, wait, wait pid(),exec (all variations exec), and exit b. IPC: Interrupts and Signals: signal(any fives type of signal), alarm, kill, signal, sigaction, pause	**10**
2. File system Internals a. Stat, fstat, ustat. b. Threading concept: clone, threads of java. c. IPC: Semaphores: semaphore. h-semget, semctl, semop.	**6**
3. IPC: Message Queues: msgget, msgsnd, msgrcv.	**4**
4. IPC: Shared memory and sockets c. IPC: Shared Memory: (shmget, shmat, shmdt. d. IPC: Sockets: socket system call in C/socket programming of Java.	**6**

Title of the Course: Parallel Programming Laboratory 4IT374	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses:

Programming Language in C.

Textbooks:

2. Michael J. Quinn, "*Parallel Programming in C with MPI and Open MP* ",

References:

3. Implement & benchmark parallel programming in C using MPI, Open MP, CUDA.
4. An introduction to parallel programming‖, Morgan Kaufmann, Peter S. Pacheco, 2011.

Course Objectives :

3. To familiar with parallel and distributed languages MPI, Open MP.
4. To learn the GPU based parallel programming using CUDA.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	To identify parallel structures in the application.	1	Remembering
CO2	Apply shared, distributed & NUMA- Address space programming methods.	3	Applying
CO3	Analyze the parallel programs using different tools	4	Analyzing

CO-PO Mapping :

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

Assessments :

Teacher 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 Submission Marks	Marks
LA1	Lab activities, attendance, journal	By Course Faculty	During week 1 to week 4 submission at the end of week 5	25
LA2	Lab activities, attendance, journal	By Course Faculty	During week 5 to week 8 submission at the end of week 8	25
LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	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, 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: 1. Program based on multithreading. 2. Program based on OPEN MPI. 3.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	T	P	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 able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Demonstrate the database design & Use tools like WAMP, LAMP and XAMP	3	Applying
CO2	Identify the real world challenges & try to address it.	4	Analyzing
CO3	Write & explain a detailed project report for submission and evaluation.	4	Analyzing

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)

Professional Elective 2

Title of the Course: Professional Elective 2:Machine Learning 4IT321	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses:

Computer Programming, Data Structures**,** Computer Algorithms.

Textbooks:

1. Aurelien Geron , " Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow: Concepts, Tools and Techniques to Build Intelligent Systems", O'Reilly, 2nd Edition, 2019

References:

1. Richard Duda, Peter Hart and David Stork, "Pattern Classification", 2nd Edition,2007
2. Tom Mitchell, "Machine Learning", McGraw-Hill, 2nd Edition, 1997

Course Objectives:

1. To explain the concept supervised and unsupervised machine learning techniques
2. To introduce various machine learning algorithms
3. To discuss problem solving approaches using appropriate machine learning techniques

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Distinguish various machine learning algorithms	2	Understand
CO2	Apply appropriate learning methods for problems	3	Apply
CO3	Verify Machine Learning algorithms with performance parameters	5	Evaluate

CO- Mapping:

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

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/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 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1:	Hrs.
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:: Linear Regression, Non-linear Regression, Model evaluation methods: Bias/Variance 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. **Support Vector Machines:** Optimization Objective, Mathematics behind Large Margin classification, Kernels, Using an SVM.	**5**
Module 4:	**Hrs.**
Unsupervised Learning Techniques in Machine Learning:: K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Principal Component Analysis, Outlier Detection	**4**
Module 5:	**Hrs.**
Practical Examples: Content-based recommender systems, Collaborative Filtering,Large Scale Machine learning	**4**
Module 6:	**Hrs.**
Neural Networks: Regularization: The problem of Over fitting, Regularized Linear Regression and Logistic Regression. Neural Networks: Non Linear Hypothesis, Representation, Multiclass Classification, One vs all.	**4**

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 Learning.
- **Module 5:** Prove Machine earning techniques in practical scenarios.
- **Module 6:** Substantiate Neural Network technique for solving Machine Learning problems.

Tutorial Content:

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

Title of the Course: Professional Elective 2:Virtualization Techniques 4IT322	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Operating Systems.

Textbooks:

1. James E. Smith and Ravi Nair, "Virtual Machine: Versatile Platforms for Systems and Processes", Elsevier India,1st Edition, 2005

References:

Author/s, "Name of Book", Publisher, Edition, year

1. Sean Campbell and Michael Jeronimo, "Applied Virtualization Technology", Intel Press, 1st Edition, 2006.
2. Nelson Ruest, Danielle Ruest, "Virtualization: A Beginner's Guide", McGraw-Hill, 1st Edition, 2009.

Course Objectives :

1. To introduce basic concepts of virtualization.
2. To impart the different virtualization techniques and various ways of using virtualization.
3. To apprise importance of virtualization to increase resource utilization.

Course Learning Outcomes: (Write from student perspective)

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Explain the concepts of virtualization to increase resource utilization.	II	Understanding
CO2	Compare virtualization techniques to implement cloud computing	III	Applying
CO3	Analyze different virtualization techniques.	IV	Analyzing

CO-PO Mapping : (Use 1, 2, 3 as correlation strengths)

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

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/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: *Hosted and Bare-Meta,* 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: processor, memory & I/O. performance enhancement of system virtual machines.	

Module wise Measurable Students Learning Outcomes :

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.

Title of the Course: Professional Elective 2: IoT Systems and Applications 4IT333	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Basic Electronics, Computer Networks

Textbooks:

1. Pethuru Raj and Anupama C. Raman "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 1st Edition, 2017
2. Arshdeep Bahga and Vijay Madisetti "Internet of Things: A Hands-on Approach", Universities Press, 1st Edition, 2015

References:

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 1st Edition, Willey, 2010.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.

Course Objectives :

1. To infer the concept of Internet of Things (IoT).
2. To apply basic WSN protocols for IoT systems.
3. To create IoT based applications in different paradigms.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Apply IoT concept in real time scenario.	3	Applying
CO2	Analyze use of WSN protocols in IoT applications.	4	Analyzing
CO3	Develop IoT enabled services.	6	Creating

CO-PO Mapping :

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

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 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 systems.

Module 6: Test IoT based services.

Tutorial Content:

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

Title of the Course: Professional Elective 2:Information Storage Management 4IT334	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Computer networks

Textbooks:

1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management", EMC Education Services (Wiley India), 2nd Edition, 2012.
2. Ulf Troppen, Rainer Erkens, Wolfgang Müller,, "Storage Networks Explained"(Wiley India). 2nd Edition, 2016

References:

1. Robert Spalding, "Storage Networks: The complete Reference", McGraw Hill Education Indian edition 2017.
2. Tom Clark, "Designing Storage Area Networks", A Practical Reference for Implementing Fibre Chanel and IP SANsAddisonWesley Professional; 2nd edition 2010.

Course Objectives :

1. To introduce Storage technologies
2. To acquaint with Storage system architectures
3. To categorize backup and recovery technologies

Course Learning Outcomes: (Write from student perspective)

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain the logical and physical components of a storage infrastructure	2	Understanding
CO2	Use the knowledge of storage networking technologies in data center	3	Applying
CO3	Distinguish between backup and recovery technologies	4	Analyzing

CO-PO Mapping :

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

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/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: (Arrange contents logically/process-wise/conceptually/theory followed by application)

Module 1: Introduction to information storage and Data centre 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	**4Hrs.**
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 Intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX	**5**
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, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, Concepts in Practice: EMC Connectrix and EMC VPLEX	**5**
Module 4: IP SAN and FCoE and Network-Attached Storage, Object-Based and Unified Storage	**Hrs.**
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-Addressed Storage, CAS Use Cases, Unified Storage, Concepts in Practice: EMC Atmos, EMC VNX, and EMC Centre	**4**
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 Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.	**4**
Module 6: Replication, Securing the Storage Infrastructure, Managing the Storage Infrastructure	**Hrs.**
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,	**4**

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 2: Identify various mechanisms for effective and protective storage

Module 3: Describe different fibre channel storage area networks

Module 4: Explore various storage technologies

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 Right(IPR) 4IT335	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: --NA

Textbooks:

1. Howard B. Rockman, "Intellectual Property Law for Engineers and Scientists" Wiley, first edition, May 2004.
2. JeffreyG. Sheldon, How to Write a Patent Application, Third Edition, Practising Law Institute, 2016.

References:

1. Indian Patents Act, 1970
2. Ove Granstrand, The Economic and management of Intellectual Property, 1999
3. Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, 2006
4. Idris, K., Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888,Switzerland, 2003
5. Additional Reading - WIPO - http://www.wipo.int/patents/en/

Course Objectives :

1. To disseminate fundamental aspects of Intellectual property Rights and its process
2. To provide awareness of IPR and government policies about IPR.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Identify and apply IPR for intellectualwork.	3	Applying
CO2	Analyze the intellectual work for economical, moral, ethical issues and social importance with respect to IPR	4	Analyzing

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, Instruments relating to the protection of IP:Berne Convention, Paris Convention, TRIPS	**3**
Module 2: Patent and patentability	**Hrs.**
Introduction to patent: Definition, concepts, Patentability Criteria:How to 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.	**5**
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, Infringement of patents and remedies. Important sections of form2. Drafting patent and claim.	**5**
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, Performers rights and Broadcasters rights, Infringement of copyright, Fail use and Fair Dealing concepts, Categories of Trademark: Certification Mark,	**6**

Collective Mark , Well known Mark and Non-conventional Marks, Concept of distinctiveness, Doctrine honest user, registration and protection. Design: Concept of original design, Difference between GI and Trade Marks, Concept of Authorized user, GI: Homonymous GI.	
Module 5: Patent Licensing	**Hrs.**
Compulsory Licensing; Compulsory Licensing—Working of Patents, Grounds for Grant of Compulsory License, Revocation; Patent Licensing.	**3**
Module 6: Types of patent applications	**Hrs.**
Compulsory Licensing; Compulsory Licensing—Working of Patents, Grounds for Grant of Compulsory License, Revocation; Patent Licensing; Patent Applications ; Patent Application—Who Can Apply, True and First Inventor, How to Make a Patent Application, What to include in a Patent Application, Types of Patent Applications, Patents of Addition, Dating of Application.	**4**

Module wise Measurable Students Learning Outcomes :

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

Module 1: To Overview of IPR
Module 2: To Comprehend the IPR
Module 3: To identify the IPR
Module 4: To identify various IPRs types
Module 5: To comprehend the patent licensing.
Module 6: To draft the sample patent.

Tutorial Content:

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