SEM-V

Title of the Course: Database Engineering	**L**	**T**	**P**	**Credit**
Course Code: UITE0501	**3**	**-**	**-**	**3**

Course Pre-Requisite: Data Structures, Relational Algebra

Course Description: This course introduces database design and creation using a DBMS product. Emphasis is on data dictionaries, normalization, data integrity, data modelling, and creation of simple tables and queries. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables and queries.

Course Learning Objectives:

1. To understand Fundamental Concepts related to database.
2. To gain familiarity with SQL & DBMS.
3. To understand basic concepts of Database Design
4. To understand database transactions and database storage

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Define basic functions and features of DBMS & RDBMS.	I	Define
CO2	Apply normalization techniques on given database to assure data integrity and consistency.	III	Apply
CO3	Interpret file organization, indexing and hashing techniques for faster and efficient system performance.	II	Interpret
CO4	Distinguish transaction management and concurrency control methods for system reliability and security.	IV	Distinguish
CO5	Design and develop a database for any specified domain according to well-known design principles.	VI	Design and Develop

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2												1	
CO2		2	2										2	1
CO3	3			2									1	

	CO4	3												1	
	CO5		2	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/declared test/quiz/seminar/Group Discussions 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:

Unit 1: Introduction: Purpose of Database Systems, View of Data, Data Models, Database Architecture, Roles in Database Environment, The Entity-Relationship Model, Entity-Relationship Diagrams, Reduction to Relational Schemas, Introduction to Relational Model,.	**06 Hrs.**
Unit 2: Relational Model: Structure of Relational Databases, Relational Query Languages- The Relational Algebra, SQL Data Definition Language, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Integrity Constraints, Accessing SQL from a Programming Language, Triggers and Functions.	**08 Hrs.**
Unit 3: Relational Database Design: The purposes of Normalization, Data Redundancies and Update Anomalies, Functional Dependencies, The Process of Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form,	**07 Hrs.**

Fourth Normal Form, Fifth Normal Form.	
Unit 4: File Structure, Indexing and Hashing: Overview of File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer. Ordered Indices, B+ Tree Index Files, Queries on B+ tree, Multiple-Key Access, Hashing, Bitmap Indices, Index Definition in SQL.	**07 Hrs.**
Unit 5: Transactions and Concurrency Control: Transaction Concept, Simple Transaction Model, Serializability, Concurrency Control- Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.	**06 Hrs.**
Unit 6: Recovery system and database security: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Failure with Loss of Non-volatile Storage, Remote Backup Systems **security:** Authorization in SQL and case study on database security	**06 Hrs.**

Textbooks:

1. Database System Concept by Henry F. Korth, Abraham Silberschatz, Sudarshan (McGraw Hill Inc.) Sixth Edition.
2. Database Systems- A practical approach to Design, Implementation and Management by Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education

References:

1. Fundamentals of Database Systems – by Ramez Elmasri and Shamkant Navathe Publisher - Pearson Education, 5 th Edition.
2. Database Systems: Design, Implementation and management.- PeterRof, Carlos Coronel (7^{th} Edition), Publisher - Cengage Learning.
3. Principles of Database Systems by J.D. Ullaman (Galgotia Publications).

Title of the Course: Operating Systems	**L**	**T**	**P**	**Credit**
Course Code: UITE0502	**3**	**-**	**-**	**3**

Course Prerequisite: Fundamentals of Computers

Course Description: This course is introduced at third year level to get the students familiar with the basic concepts of computer operating systems in detail.

Course Learning Objectives:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management.
4. To gain knowledge of Inter-process communication

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Define the features and types of operating system.	1	Remembering
CO2	Interpret CPU Scheduling, synchronization, and deadlock.	2	Understanding
CO3	Analyze memory management techniques for memory.	4	Analyzing
CO4	Make use of Disk Scheduling and page replacement policies.	3	Applying

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2												1	
CO2	2												1	
CO3		2												
CO4		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/declared test/quiz/seminar/Group Discussions 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:

Unit 1: Introduction to Operating Systems Introduction to Operating Systems, System structures; Operating System Structure; Types of Operating Systems; Operating System Services; System Calls; Types of System Calls; System Programs; Virtual Machines; System Boot; Command Shell	**6 Hrs.**
Unit 2: Process Management Process Concept; Process Scheduling; Operations on Processes; Multi-Threaded Programming Overview; Multithreading Models; Thread Libraries; Threading Issues; Process Scheduling: Basic Concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-Processor Scheduling; Thread Scheduling	**5 Hrs.**
Unit 3: Process Synchronization Synchronization: The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Semaphores; Monitors, Classical Problems of Synchronization	**7 Hrs.**
Unit 4: Inter-Process Communication	**4 Hrs.**

Overview of IPC methods; Pipes; FIFOs; Message Queue; Shared Memory	
Unit 5: Deadlocks & Memory Management Deadlock: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock Memory Management: Management Strategies: Background; Swapping; Paging; Structure of Page Table; Virtual Memory Management: Background; Demand Paging; Page Replacement	**7 Hrs.**
Unit 6: IO Management and File System Overview, I/O Hardware, Application I/O Interface, Kernel IO Subsystem, Transforming I/O Request to Hardware Operations Disk Operations- Disk Scheduling algorithms File System: File concept, Access methods, Directory & disk structure, File system mounting, file sharing, Protection	**8 Hrs.**
Textbooks: 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009	
References: 1. Operating Systems –Concepts and design –Milan Milenkovic (TMGH) 2. Operating Systems: Internals and Design Principles (8th Edition)- by William Stallings(Pearson Education International) 3. Modern Operating Systems by Andrew S. Tanenbaum (Pearson Education International)	

Title of the Course: Design and analysis of Algorithm	L	T	P	Credit
Course Code: UITE0503	3	1	-	4

Course Prerequisite: Data Structures

Course Description: This course introduces fundamental concepts and key techniques for designing and analyzing algorithms along with study and apply different algorithm design methods namely, greedy method, divide and conquer, dynamic programming and backtracking.

Course Learning Objectives:

1. To define basic concepts of algorithms and analyze asymptotic performance of algorithms.
2. To introduce students the various methods of algorithm designs and analysis.
3. To expose students to various searching and sorting techniques.
4. To apply and synthesize efficient algorithms in real life problems.

Course Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Define the basic concepts of algorithms and measure the efficiency of any algorithm.	I & V	Define and Measure
CO2	Make use of algorithm design techniques such as divide and conquer, greedy algorithms, dynamic programming, backtracking to solve real life problems.	III	Make use of
CO3	Identify appropriate graph algorithms to model real life engineering problems	IV	Identify
CO4	Distinguish between P and NP Classes of problems.	IV	Distinguish

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-		2
CO2		2	3	3	-	-	-	-	-	-	-	-		3
CO3	-	2	3	3	-	-	-	-	-	-	-	-		3
CO4	-	2	-	2	-	-	-	-	-	-	-	-		

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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/Group Discussions 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:

Unit 1: Introduction: What is algorithm? **Algorithm Specification:** Pseudo code conventions ,Recursive Algorithms **Performance Analysis :**Space Complexity, Time Complexity, Asymptotic Notations, Big 'O', big-Ω , Θ Notation, Practical Complexities, Performance Measurement, **Recurrences** : The substitution method, Recursion tree method.	**05 Hrs.**
Unit 2: Algorithm Design and Analysis Techniques – I: **Divide and Conquer**-The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort and analysis of these algorithms. **The Greedy method:** The general method, Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge patterns, Huffman codes.	**08 Hrs.**
Unit 3: Algorithm Design and Analysis Techniques - II: **Dynamic Programming:** The general method, Multistage graphs, Optimal binary search trees, 0/1 knapsack, Reliability design, Travelling Salesperson problem**.**	**07 Hrs.**

Unit 4: Graph Algorithms: **Elementary Graph Algorithms:** Representations of graphs , Breadth-first search, Depth-first search, Strongly connected components, **Minimum Spanning Trees:** Growing a minimum spanning tree, The algorithms of Kruskal and Prim. **Single-Source Shortest Paths:** The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs, Dijkstra's algorithm, The Floyd-Warshall algorithm	**07 Hrs.**
Unit 5: Backtracking: Backtracking - The general method, 8-queen problem, Sum of subsets, Graph Colouring, Knapsack Problem, Hamiltonian Cycle.	**07 Hrs.**
Unit 6: NP Hard and NP Complete Problems: Basic Concepts, Deterministic and non deterministic algorithms, NP completeness and reducibility, NP-completeness proofs, NP complete problems, NP-Hard Problem	**05 Hrs.**

Textbooks:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, "Introduction to Algorithms", PHI
2. Fundamentals of Computer Algorithms - Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Universities Press, Second Edition.

References:

1. Fundamentals of Algorithmics – Gilles Brassard, Paul Bratley (Pearson Education).
2. Mastering Algorithms with C – Kyle Loudon (SPD O'Reilly).
3. Computer Algorithms- Introduction to Design and Analysis – Sara Baase, Allen Van Gelder (Pearson Education).

Title of the Course: Machine Learning Course Code: UITE0504	L	T	P	Credit
	3	1	-	4

Course Prerequisite: Basic knowledge of Data mining, Computer algorithms and probabilistic theory.

Course Description: Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention.

Course Learning Objectives:

1. To learn and understand fundamentals of Learning systems and models
2. To learn and understand machine learning algorithms
3. To apply the algorithms to solve real life problems

Course Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Explain machine learning concepts.	II	Understand
CO2	Analyse the Machine learning model.	IV	Analyzing
CO3	Understand how to evaluate models generated from data.	II	Understand
CO4	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.	II	Understand

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												1	
CO2		2												2
CO3			2											
CO4														

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/Group Discussions 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:

Unit 1: Introduction Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.	**6 Hrs**
Unit 2: Regression Simple regression – hypothesis, cost function, parameter learning with gradient descent, learning rate, Gradient Descent for linear regression, examples, simple regression in matrix form. Multivariate Linear Regression – multiple features, hypothesis functions, Gradient Descent for multiple variables, Feature scaling, polynomial regression.	**6 Hrs**
Unit 3: Decision Tree Learning Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pruning	**7 Hrs.**
Unit 4: Ensemble Learning Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles.	**6 Hrs.**
Unit 5: Experimental Evaluation of Learning Algorithms Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing	**6 Hrs.**

Unit 6: Support Vector Machines	**7 Hrs.**
Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.	

Textbooks:

1. Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition
2. Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition

References:

1. Machine Learning for dummies John Paul Muller, Willey Publication-2013
2. Machine Learning with Python- an approach to applied ML, by Abhishek Vijayvargia, BPB publications

Title of the Course: Cloud Computing **Course Code:** UITE0521	**L**	**T**	**P**	**Credit**
	3	**-**	**-**	**3**

Course Prerequisite: Knowledge of - Computer Networks, Operating System-I Information Security

Course Description: Cloud Computing subject mainly deals with the science of cloud computing covering aspects such as – evolution of cloud environment, its architecture, types, prominent cloud platform examples, virtualization and the security and privacy.

Course Learning Objectives:

1. Cloud Computing platform & Its architecture
2. Virtualization tools and techniques
3. Need of migration to cloud and virtual machine provisioning
4. Environmental benefits of cloud computing platform
5. Security & privacy concerns.

Course Outcomes:

CO	**After the completion of the course the student should be able to -**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	List different cloud computing platforms and its services	I	Remembering
CO2	Summarize benefits of virtualization techniques used in cloud computing	II	Understanding
CO3	Compare different Architectures of cloud computing platforms	IV	Analyzing
CO4	Explain security risks & privacy concerns associated with cloud computing	II	Understanding

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2												1	
CO2	1				2								1	
CO3	1												1	

CO4	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/declared test/quiz/seminar/Group Discussions 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:

Unit 1: Introduction: Definition, Historical Developments, Computing Platforms and Technologies. Building cloud computing environments, Principles of Parallel and Distributed Computing: Parallel versus Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, and Technologies for Distributed Computing.	**06 Hrs.**
Unit 2: Virtualization: Characteristics, Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization	**06 Hrs.**
Unit 3: Cloud Computing Architecture: Cloud Reference Model, Types of Clouds, And Economics of Clouds, Open Challenges, Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, And Microsoft Azure.	**07 Hrs.**
Unit 4: Migration into cloud and Virtual machine Provisioning: Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.	**06 Hrs.**
Unit 5: Advanced Topics in Cloud Computing: Energy Efficiency in Clouds, Market Based Management of Clouds, Federated Clouds /InterCloud, Third Party	**04 Hrs.**

Cloud Services.	
Unit 6: Cloud Security Management & Privacy: Security Management Standards, Security Management in the cloud, Availability, SaaS, PaaS, IaaS management, Access Control, Security Vulnerability, Patch and Configuration Management. SLA – types, life cycle and SLA management in cloud. Privacy – Definition, Data life cycle, key privacy concerns, responsibility, changes to privacy risk management and compliance.	**07 Hrs.**

Textbooks:

1. Mastering Cloud Computing, Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013.
2. Buyya R, Broberg J, Goscinski A, "Cloud Computing - Principles and Paradigms", Wiley, 2011
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly 2009

References:

1. Cloud Computing Bible, Barrie Sosinsky ,Wiley Publishing Inc. 2011(Unit,VI)
2. Cloud Computing: A Practical Approach, Toby Velte, Antohy T Velte, Robert Elsenpeter, McGraw Hill 2010.

Title of the Course: Soft Computing **Course Code:** UITE0522	**L**	**T**	**P**	**Credit**
	3			**3**

Course Prerequisite: Basic Mathematics.

Course Description:

This course aims at giving students a basic knowledge of Soft Computing.

Course Learning Objectives:

1. To Understand fuzzy set theory and properties of Fuzzy sets.
2. To Understand Neuro -Fuzzy modeling concepts
3. To Understand Neural networks and training algorithms
4. To apply derivative based and derivative free optimization
5. To demonstrate applications of computational intelligence

Course Outcomes:

CLO	**After the completion of the course the student should be able to**	**Bloom's Cognitive level**	**Descriptor**
CO1	Interpret soft computing schemes using knowledge of discrete mathematics, data structures, theory of computer science and computer architectures.	II	Understanding
CO2	Demonstrate machine learning processes.	III	Applying
CO3	Compare and analyze soft computing schemes.	IV	Analyzing
CO4	Design & Evaluate for better schemes using soft computing	VI	Evaluating, Creating

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CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		1	1						2		
CO2	2	1	1	2	1	1						2		
CO3	1				1							1		
CO4	2	1	2	1	1	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/Group Discussions 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:

Unit 1: Introduction Artificial Neural Network, Advantages of Neural Network, Fuzzy Logic, Genetic Algorithms, Hybrid Systems: Neuro Fuzzy Hybrid System, Neuro Genetic Hybrid System, Fuzzy Genetic Hybrid System.	**04 Hrs.**

Unit 2: Artificial Neural Networks Fundamental Concept, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Terminologies of ANNs, McCulloch-Pitts Neuron, Linear Reparability, Hebb Network.	**07 Hrs.**
Unit 3: Supervised Learning Network Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neuron, Back Propagation Network, Radial Basis Function Network.	**07 Hrs.**
Unit 4: Introduction to Fuzzy Sets Introduction, Classical Sets, Fuzzy Sets, Fuzzy relations, Membership Function, Defuzzification, Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule base and Approximate Reasoning, Fuzzy Decision Making, Fuzzy Logic Control System.	**07 Hrs.**
Unit 5: Genetic Algorithms Introduction , Basic Operators and Terminologies in Gas, Traditional Algorithm vs. Genetic Algorithms , Simple GA, General Genetic Algorithm, The Schema Theorem, Classification of Genetic Algorithm, Holland Classifier System, Genetic Programming, Applications of GA.	**07 Hrs.**
Unit 6: Applications of Soft Computing GA Based Internet Search Technique; Soft Computing Based Hybrid Fuzzy Controllers.	**04 Hrs.**

Textbooks:

1) Principles of Soft Computing - S.N. Sivanandam , S.N. Deepa. (Wiley India Edition).
2) Elements of Artificial Neural Networks - K Mehrotra, C.K. Mohan, and S. Ranka Published by MIT Press, 1997)

References:

1. Soft Computing and Intelligent Systems Design – theory, tools and applications – F.O. Karray & C.D. Silva (Pearson Education).
2. Neuro-Fuzzy and Soft Computing – A computational approach to learning and machine intelligence – J.S.R. Jang, C.T. Sun & E. Mizutani (Pearson Education).

Title of the Course: Computer Graphics	**L**	**T**	**P**	**Credit**
Course Code: UITE0523	**3**	**-**	**-**	**3**

Course Pre-Requisite: Basic knowledge of C.

Course Description: This course gives knowledge to the students about animation techniques, computer graphics functions and transformation also sound and image editing process.

Course Learning Objectives:

1. To provide knowledge to the students about basics of computer graphics and different display devices.
2. To provide knowledge to the students about 2D and 3Dtransformations in computer graphics.
3. To expose students to the various multimedia components like sound, video, animation.
4. To make the students aware of generation of 2D animation.
5. To provide knowledge to the students about basics of rendering and Multimedia tools.

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Recall basic ideas of computer graphics and different Display Devices.	I	Remembering
CO2	Develop programs for 2D and 3D transformations.	III	Applying
CO3	Explain multimedia components like sound, video, animation, images	II	Understanding
CO4	Summarize different types of animation techniques and video standards.	II	Understanding
CO5	Make use of various multimedia software editing tools	III	Applying

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2		2												1
CO3	1													
CO4	1													
CO5	1				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/Group Discussions 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:

Unit 1: Introduction: Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems**,** Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software	**4 Hrs.**
Unit 2 : Transformations and multimedia: Basic 2D & 3D transformations - Translation, Scaling, Rotation, Reflection, Shearing, Multiple Transformations, Definitions -Where to use Multimedia, Uses of multimedia :Multimedia in Business, Multimedia in Schools, Multimedia in Home, Multimedia in Public Places, Virtual Reality	**8 Hrs.**
Unit 3 : Sound: The power of sound**,** Multimedia system sounds, Digital audio, MIDI Audio**,** MIDI V/S digital audio**,** Audio file format**,** Adding sound to multimedia project	**7 Hrs.**
Unit 4: IMAGES: Image file formats – gif, bmp, jpg, pix etc.**,**Making still images, Bitmap, ClipArt, Bitmap software**,** Capturing & Editing images**,** Scanning images**,** Vector drawing**,** Color, Computerized color, Color palettes	**7 Hrs.**
Unit 5: Animation & Video: The Power of motion, Principles of Animation, Making Animation that Work, A Rolling Ball, A Bouncing Ball, Creating an Animated Scene, Using video, Obtaining Video Clips, How Video Works, Broadcast Video Standards, Digital video, Shooting and Editing Video.	**7 Hrs.**

Unit 6 : Multimedia basic software tools: Text editing & word processing tools**,** OCR software**,** Painting & drawing tools**,** 3-D modeling and animation tools**,** Image editing tools**,** Sound editing tools, Animation, video and digital Movie tools	**7 Hrs.**

Textbooks:

1. Computer Graphics C Version second edition –Donald D. Hearn, M. Pauline Baker (Pearson)
2. Multimedia :Making It Work- Tay Vaughan
3. Mathematical elements for Computer Graphics - David F. Rogers, J. Alan Adams (MGH International)
4. Procedural elements for Computer Graphics - David F. Rogers (MGH International

References:

1. Principles of Computer Graphics Theory and Practice Using OpenGL and Maya, Shalini Govil-Pai, (Springer).
2. Computer Graphics (second Edition) - Zhigang Xiang & Roy Plastock (Schaum's Outline Series, TMGH).

Title of the Course: Application Development Tools – I Lab **Course Code: UITE0531**	**L**	**T**	**P**	**Credit**
	1		2	2

Course Prerequisite: Knowledge of following are essential

1. Object Oriented Programming using C++
2. Threading concepts

Course Description: In this course students will be introduced to strict oop programming environment of Java and concepts like, JVM, JIT components. The course will also enable students to develop GUI based computer applications which will make use of advanced computer features, for example multi threaded application, based applications, database application.

Course Objectives:

1. To explain object oriented concepts of Java.
2. To distinguish OOP concepts implementation in Java compared to C++.
3. To expose students to advanced features in Java.
4. To develop GUI applications such as chatting server, student inventory management etc.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Use knowledge of fundamental and oop concepts for programming.	3	Use
CO2	Apply knowledge of various concepts of computer science and design solutions for different subjects like computer algorithm, threading, networking, database.	3	Apply
CO3	Develop simple applications. Example. Developing application to maintain students basic profile.	6	Develop

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												1	
CO2	2												1	
CO3			3										1	2

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Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE: Assignments, Oral, Mini-project , Quiz, etc

ESE: Assessment is based on practical and oral examination

Course Contents:

Unit 1: Fundamentals Interface, Inheritance: The Java Programming Environment- JVM, JIT Compiler, Byte Code Concept, Interfaces: Defining an Interface, Implementing an Interface, Using an Interface as a Type, Evolving Interfaces, and Default Methods in Java. Subclasses, Super keyword, Nested classes & Inner Classes, finalization and garbage collection	3 **Hrs.**
Unit 2: Packaging Packages: Class importing, Creating a Package, Naming a Package, Using Package Members, Managing Source and Class Files. Developing and deploying (executable) Jar File.	2 **Hrs.**
Unit 3: Exception Handling: Exception: Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, Catching Multiple Exceptions, Re-throwing and Chaining Exceptions, finally clause, Advantages of Exceptions,	2 **Hrs.**

Tips for Using Exceptions.	
Unit 4: Graphical User Interfaces using IDE: Introduction to the Swing, Swing features, Swing Top Level Containers- Creating a Frame,Panel, The JComponents, Layout Management: Introduction to Layout Management, APIs for Border Layout, Flow Layout, Grid Layout Event Handling: Basics of Event Handling.	3 **Hrs.**
Unit 5: Multithreading: Java: Processes and Threads, Runnable Interface and Thread Class , Thread Objects, Defining and Starting a Thread, Pausing Execution with Sleep, Interrupts, Thread States, Thread Properties, Joins, Synchronization	2 **Hrs.**
Unit 6: Collections: Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework.	2 **Hrs.**

Textbooks:

1. Core Java- Volume I Fundamentals: Cay Horstmann and Gary Cornell, Pearson, Eighth edition.
2. Core Java- Volume II Advanced Features: Cay Horstmann and Gary Cornell ,Pearson, Eight edition

References:

1. The Java Tutorials From ORACLE Java Documentation URL: http://docs.oracle.com/javase/tutorial/ (Refer For All Units)
2. The Java Tutorial: A Short Course on the Basics by Raymond Gallardo, Scott Hommel, Sowmya Kannan, Publisher: Addison-Wesley Professional. (6th Edition)
3. JAVA-The Complete Reference: Herbert Schildt, Oracle Press, Mcgraw Hill,(9th Edition).
4. JAVA™ HOW TO PROGRAM, By Deitel Paul , Deitel Harvey. Publisher: PHI Learning..(10th Edition)
5. Thinking in Java by Bruce Eckel, Prentice Hall,(4th Edition)
6. A Programmer's guide to JAVA SCJP Certification: Khaleed Mughal and Rolf W. Rasmussen, Addison Wesley, (3rd Edition)

Experiment List Students have to perform experiments based on following concepts
Experiment No. 1: Java Classes Objects and Constructor
Experiment No. 2: Inheritance
Experiment No. 3: Interfaces
Experiment No. 4: Packages
Experiment No. 5: Exception Handling
Experiment No. 6: GUI designing
Experiment No. 7: Event Handling
Experiment No. 8: Multithreading
Experiment No. 9: Collections Framework

Title of the Course: Database Engineering Lab **Course Code:** UITE0532	**L**	**T**	**P**	**Credit**
	-	**-**	**2**	1

Course Pre-Requisite: Data Structures, Relational Algebra

Course Description: This course is designed to develop SQL programming expertise. Upon completion, students should be able to write programs for database connectivity. Emphasis is on data definition, data manipulation, and data control statements.

Course Learning Objectives:

5. To understand Fundamental Concepts related to database
6. To gain familiarity with SQL & DBMS.
7. To understand basic concepts of Database Design

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Design E-R model.	VI	Design
CO2	Create SQL queries to solve data processing.	VI	Create
CO3	Apply Normalization to generate good database design.	III	Apply

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		2	1			2						1	1	
CO2			1			1						1	1	1
CO3		1	1										1	1

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Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc. ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1: Entity - Relationship Diagrams **Aim and Objectives:** Draw ER diagrams for different organizations using any suitable software & Convert them into tables. **Theoretical Background:** Study of Entity-Relationship Diagrams, Reduction to Relational Schemas **Experimentation:** 1. Install Dia software 2. Use E-R sheet to draw E-R diagram. 3. Convert each E-R diagram to relational schema,.	**02 Hrs.**
Experiment No. 2: Relational Algebra **Aim and Objectives:** Solve different queries with relational algebra. **Theoretical Background:** Relational Query Languages- The Relational Algebra. **Experimentation:** 1. Write relational algebra queries with its operations	**02 Hrs.**
Experiment No. 3: Installation of Database software (PostgeSQL/ MySQL/Oracle/SQL Server - any one of these) **Aim and Objectives:** Installing Database Software, Administrating it and Creating Users, Connecting to Database Software. **Theoretical Background:** Structured Query Language **Experimentation:** 1. Installing Database Software 2. Create Database 3. Create user with password 4. create schema	**02 Hrs.**
Experiment No. 4: Data Definition Language **Aim and Objectives:** Use DDL Queries to create, alter and drop tables with respect to all types constraints(key, referential, not null) **Theoretical Background:** Data Definition Language **Experimentation:** 1. Execute DDL command to create, alter and drop tables in SQL, 2. Apply all types of constraints such as primary key, foreign key, not null, etc.	**02 Hrs.**
Experiment No. 5: Data Manipulation Language **Aim and Objectives:** Use DML Queries to insert, delete and update records of the tables. **Theoretical Background:** Modification of the Database **Experimentation:** 1. Execute DML command on the table created in experiment no.4.	**02 Hrs.**

Experiment No. 6: Functional Dependencies **Aim and Objectives:** Write program to find closure for a given set of functional dependencies and closure of attribute set. **Theoretical Background:** Normalization and Functional Dependencies. **Experimentation:** 1. Consider a set of functional dependency as input 2. Apply armstrong's axioms and find closure of Functional Dependencies. 3. Find attributes closure.	**02 Hrs.**
Experiment No. 7: SQL Query Processing **Aim and Objectives:** Display the records using group by, order by, having and between clauses. **Theoretical Background:** Basic Structure of SQL Queries, Groupby, Orderby clause. **Experimentation:** 1. Write Java program in eclipse for Database Connectivity 2. Execute SQL queries through java eclipse on the table created in experiment no.4	**02 Hrs.**
Experiment No. 8: SQL Query Processing **Aim and Objectives:** Display the results of union, intersection, set difference, Cartesian product and Join operations. **Theoretical Background:** SQL set operations and join operations **Experimentation:** 1. Write Java program in eclipse for Database Connectivity 2. Execute SQL queries through java eclipse on the table created in experiment no.4	**02 Hrs.**
Experiment No. 9: SQL Query Processing **Aim and Objectives:** Display the records using Aggregate functions and Create Indexes & Views for the table. **Theoretical Background:** SQL aggregate functions, index and views. **Experimentation:** 1. Write Java program in eclipse for Database Connectivity 2. Execute SQL queries through java eclipse on the table created in experiment no.4	**02 Hrs.**
Experiment No. 10: Static Hashing **Aim and Objectives:** Write a program to implement Static Hashing. **Theoretical Background:** Indexing and Hashing **Experimentation:** 1. Consider any one table as input created in experiment no.4 2. Select search key 3. Apply hash function 4. Find hash value and put record in appropriate bucket.	**02 Hrs.**
Experiment No. 11: Concurrency Control **Aim and Objectives:** Write a program to simulate any one concurrency control protocol. **Theoretical Background:** Concurrency Control- Lock-Based Protocols **Experimentation: 1.** Consider any one table as input created in experiment no.5 2. Create two programs one for shared lock and another for exclusive lock 3. Show result of compatibility matrix.	**02 Hrs.**
Experiment No. 12: Database Logs **Aim and Objectives:** Write program to create logs of the different activities. **Theoretical Background:** Recovery and Atomicity **Experimentation:** 1. Consider any one transaction with basic operation 2. Create deferred and immediate logs.	**02 Hrs.**
Textbooks: 1. Database System Concept by Henry F. Korth, Abraham Silberschatz, Sudarshan (McGraw	

Hill Inc.) Sixth Edition.

2. Database Systems- A practical approach to Design, Implementation and Management by Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education

References:

1. Fundamentals of Database Systems – by Ramez Elmasri and Shamkant Navathe Publisher - Pearson Education, 5 th Edition.
2. Database Systems: Design, Implementation and management.- PeterRof, Carlos Coronel (7^{th} Edition), Publisher - Cengage Learning.
3. Principles of Database Systems by J.D. Ullaman (Galgotia Publications).

Title of the Course: Operating Systems Lab **Course Code:** UITE0533	**L**	**T**	**P**	**Credit**
	-	**-**	**2**	**1**

Course Pre-Requisite: Fundamentals of Electronics and Computer network

Course Description: This course is introduced at third year level to get the students familiar with the basic concepts of computer operating systems in detail.

Course Objectives:

1. To gain practical experience with designing and implementing concepts of operating systems.
2. To gain knowledge of system calls.
3. To study CPU scheduling, process management, memory management.
4. To analyse file systems and deadlock handling using C language in Linux environment.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Understand and implement basic services and functionalities of the operating system	II	Understand
CO2	Implement memory management schemes and page replacement schemes	VI	Apply
CO3	Understand the concepts of deadlock in operating systems	II	Understand
CO4	Simulate Process Synchronization using different techniques	V	Create

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2													
CO2	2		2										1	

CO3	2			1									1	
CO4		2	1	1										

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on Practical oral examination

Course Contents:

Experiment No. 1: Unix commands and Shell Script **Aim and Objectives: S**tudy Unix commands and Shell Script **Experimentation:** Use different commands and write scripts	**02 Hrs.**
Experiment No. 2: Process management **Aim and Objectives:** Study of fork(), wait(), waitpid(), exec() **Experimentation:** Use of fork(), wait(), waitpid(), exec()	**02Hrs.**
Experiment No. 3: Thread Management **Aim and Objectives:** understand threading, multithreading **Experimentation:** Write a program to demonstrate threading	**02Hrs.**
Experiment No. 4: Process synchronization using semaphores-classical Problems **Aim and Objectives:** Study of Producer-Consumer and Reader-Writer Problems **Experimentation:** Write a program to demonstrate Producer-Consumer and Reader-Writer Problems	**02Hrs.**
Experiment No. 5: Process synchronization using semaphores-classical Problems **Aim and Objectives:** Study of Dining Philosopher problem **Experimentation:** Write a program to demonstrate Dining Philosopher problem	**02Hrs.**

Experiment No. 6: IPC using Message Queue & Pipe/FIFO **Aim and Objectives:** Study of Message Queue & Pipe/FIFO**.** **Experimentation:** Write a program to demonstrate Message Queue & Pipe/FIFO	**02Hrs.**
Experiment No. 7: IPC using Shared Memory **Aim and Objectives:** Study of Shared Memory **Experimentation:** Write a program to demonstrate Shared Memory.	**02Hrs.**
Experiment No. 8: Bankers Algorithm **Aim and Objectives:** Study of Bankers Algorithm**.** **Experimentation:** Write a program to demonstrate Bankers Algorithm.	**02Hrs.**
Experiment No. 9: Memory Management **Aim and Objectives:** Study of memory & it's management techniques **Experimentation:** Write a program to implement memory management.	**02Hrs.**
Experiment No. 10: File systems **Aim and Objectives:** Study of file concepts and access controls **Experimentation:** Use OS functionalities to identify file statistics	**02 Hrs.**

Title of the Course : Mini Project-II	**L**	**T**	**P**	**Credit**
Course Code : UITE0541	**-**	**-**	**2**	**1**

Course Pre-Requisite: Java, Machine Learning.

Course Description: This course aims at developing mini project based on technologies learnt and real life problem requirement analysis

Course Learning Objectives:

1. To expose the students to use the engineering approach to solve the real life problems.
2. To learn the skills of team building & team work
3. To develop the logical skills and use of appropriate technologies for solving the engineering problems.

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	To use the engineering approach to solve the real life problems.	II & III	Understanding & Applying
CO2	Learn the skills of team building & team work	II	Understanding
CO3	Develop logical skills to use appropriate technologies for solving real life engineering problems.	V	Creating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**				**1**	**2**			**3**	**1**			**1**	
CO2		**3**	**2**			**1**			**3**	**3**			**1**	**3**
CO3			**3**			**2**			**2**	**2**	**1**		**1**	**2**

Assessments:

Teacher Assessment:

In Semester Evaluation (ISE), and End Semester Examination (POE) having equal weights of 50 marks respectively.

Assessment	Marks
ISE	50
ESE(POE)	50

ISE Assessment: ISE are based on seminar and project demonstrations .The ISE assessment will be done jointly twice in a semester by a panel of teachers appointed by the department. The term work marks distribution should be as following.

1) Mid Term assessment (Presentation) - 25 marks.

2) End term assessment (Project Demo + Presentation) - 25 marks.

Practical Oral Exam: Final Performance evaluation is to be done by guide and external examiner -50 marks

Description: The mini project should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The mini project must be based upon any real life problem statement.

Platforms: Free and Open source software.

1. The group will select a problem with the approval of the guide and prepare the solution guidelines for its implementation.
2. The same should be put in the form of synopsis (3 to 5 pages), stating the usage of logic, algorithms and suitable data structures necessary for implementation of the solution.
3. Further the group is expected to complete analysis of problem by examining the possible different inputs to the system and the corresponding outputs.
4. The term work submission is to be done in the form of a report containing the details of the problem, solution techniques, implementation details, input-output scenarios and the conclusion. The project must be implemented using technologies covered earlier in previous semester.

Title of the Course: Professional Certification-I	L	T	P	Credits
Course Code: UITE0561	---	---	2	-

Course Pre-Requisite:

Course Description: This Course contains various IT domain online MOOC courses (min 10 weeks, max 12 weeks).

Course Objectives:

1. To interpret the knowledge of any professional course in the field of IT.
2. To demonstrate knowledge in particular IT domain.
3. To apply domain knowledge in project implementation.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarize knowledge of professional course.	2	Understand Level
CO2	Demonstrate knowledge in practical task.	3	Applying Level
CO3	Apply knowledge in project implementation.	3	Applying Level

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
												2	2	
												2		1
												2	2	

Assessments :

Teacher Assessment:

End Semester Examination (ESE) is having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% Quiz/Theory related to any professional course registered by the student.

Course Contents:

Course Domains:

1. Networking
2. IoT
3. Computer Programming
4. Information Security

5. Software Testing 6. Database Engineering 7. Cloud Computing	
List of portals providing online courses 1. NPTEL Swayam 2. MOOC 3. Coursera 4. Edx 5. Any other professional portal	

SEM-VI

Title of the Course: Cryptography and Network Security **Course Code:** UITE0601	**L**	**T**	**P**	**Credit**
	3	1	--	4

Course Prerequisite: Fundamentals of Computer Network

Course Description: This course gives you practical survey of both the principles and practice of cryptography and network security. In the first part of course, the basic issues to be addressed by a network security capability are explored by providing a tutorial and survey of cryptography and network security technology. The latter part of course deals with the practice of network security: practical applications that have been implemented and are in use to provide network security.

Course Learning Objectives:

1. Explain different types of symmetric and asymmetric security techniques
2. Compare different types of cryptographic algorithms to ensure data integrity
3. Explain different types of security protocols in TCP/IP protocol suite
4. Compare different types of technique used for distribution of secret keys
5. Explain different types of security threats for computer system

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain the use of cryptographic algorithm to ensure data integrity	II	Understanding
CO2	Describe different Network and Internet security protocol in TCP/IP stack	II	Understanding
CO3	Elaborate key management and distribution technique	II	Understanding
CO4	Analyze security facilities designed to protect computer system	IV	Analyzing
CO5	Compare different types of security attacks in LAN environment	IV	Analyzing
CO6	Make use of symmetric and asymmetric technique for encryption & decryption of information	III	Applying

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												1	
CO2	3												1	
CO3	2												1	
CO4					2								1	
CO5			2										1	
CO6		3											1	

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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/Group Discussions 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:	
Unit 1: Introduction to Information Security **Overview: (2)** Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security **Classical Encryption Techniques: (3)** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography	**05 Hrs.**
Unit 2: Symmetric and Asymmetric Key Cryptography **Block Ciphers and the Data Encryption Standard (4)** Block Cipher Principles, Data Encryption Standard (DES), A DES Example, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles,AES Cipher **Public Key Cryptography (4)** Principles of Public-Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange, ElGamal Cryptosystem	**08 Hrs.**
Unit 3: Cryptographic Authentication Functions **Cryptographic Hash Functions: (3)** Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA) **Message Authentication Codes: (3)** Message Authentication Requirements, Message Authentication Functions, Requirements for MAC and Security of MACs **Digital Signatures: (3)** Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS)	**09 Hrs.**
Unit 4: Key Management and Distribution **Key management (3)**	**06 Hrs.**

Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure **User Authentication Protocol (3)** Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos	
Unit 5: Internet Security Protocols and Applications **Transport-Level Security (3)** Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, SSH,SET **Electronic Mail Security (1)** Pretty Good Privacy (PGP), S/MIME **IP Security (2)** IP Security Overview, IP Security Policy, Encapsulating Security Payload	**06 Hrs.**
Unit 6: System Security **Intruders (2)** Intrusion Detection, Password Management **Malicious Software (2)** Viruses and Related Threat, Countermeasures, DoS **Firewalls (2)** Firewall Design Principles, Trusted Systems	**06 Hrs.**
Textbooks: 1. Williams Stallings – Cryptography and Network Security Principles and Practices Pearson Education (LPE), 6th Edition and 4th Edition(For Unit 6)	
References: 1. Cyber Security, Nina Godbole, Wiley Publications. 2. Cryptography & Network Security B.A. Forouzan McGrawHill 3. Cryptography and network security – Atul Kahate (TMGH) 4. Handbook of Applied Cryptography - Menezes, an Oorschot, and S.A. Vanstone	

Title of the Course: System Software Course Code: UITE0602	L	T	P	Credit
	3	-	-	3

Course Pre-Requisite: Data structures, assembly language programming, microprocessors.

Course Description: This course introduces basics of language processors like assemblers and macro pre processors. Upon completion, students should be able to implement the concepts of compiler.

Course Objectives:

1. To learn and understand fundamentals of System Software Programs.
2. To learn and understand Macro- processors.
3. To learn and understand compilers and phases of compilers.
4. To study and analyze different phases of compilers.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain theoretical and practical aspects of System Software Programs	II	Understand
CO2	Show working and design of assemblers and macro processors	II	Understand
CO3	To understand the concept of compilers.	II	Understand
CO4	To analyze different phases of compilers.	III	Analyzing

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												1	
CO2		2												3
CO3	3	2											2	
CO4	1	2		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/declared test/quiz/seminar/Group Discussions etc.

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

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Overview of System Soft wares: Introduction: What is system software, Goals, System programs and System programming, Views of System Software, Programming languages and Language Processors, Language processing activities, Fundamentals of language processing, Symbol tables.	**5 Hrs**
Unit 2:--- Assemblers: Elements of Assembly Language Programming A simple Assembly Scheme, Pass structure of Assemblers, Design of Two Pass Assembler, Single pass assembler.	**6 Hrs**
Unit 3:--- Macros and Macro pre processors: Introduction, Macro definition and call, Macro Expansion, Nested macro calls, Advanced macro facilities, Design of macro preprocessor	**7 Hrs**.
Unit 4:--- Introduction to Compiling: Structure of compiler, Scanning- Role of lexical analyzer, Parsing- Programming Language Grammars, Top Down Parsing, Bottom up Parsing, Language Processor Development Tools, LEX, YACC.	**6 Hrs.**
Unit 5:- Syntax Directed Translation and Intermediate Code Generation: Syntax directed definitions, construction of syntax tree, S-attributed definitions, L-attributed definitions, Code Optimization: Sources of optimization, Peephole optimization and basic blocks.	**7 Hrs.**
Unit 6:--- Code Generation: Issues in design of a code generator and target machine, Run time storage	

management, Basic blocks and flow graphs, Next use information and simple code generator	**7 Hrs.**

Textbooks:

1. D.M. Dhamdhere ,"Systems Programming and Operating Systems", Tata McGraw-Hill, ISBN- 13:978-0-07-463579-7 (For unit 1 to unit 3)
2. Alfred V. Aho, Ravi Sethi, Reffrey D. Ullman, "Compilers Principles, Techniques, and Tools", Addison Wesley, ISBN 981-235-885-43. John J Donovan ,"Systems Programming", Tata McGraw-Hill Edition 1991, ISBN 0-07-460482-1 (For unit 4, 5 & 6)

References:

1. Leland L. Beck, "System Software An Introduction to Systems Programming" 3rd Edition, Person Education, ISBN 81-7808-036-2

Title of the Course: Distributed Computing	**L**	**T**	**P**	**Credit**
Course Code: UITE0603	**3**	**-**		**3**

Course Pre-Requisite: Knowledge of Operating system, Network Programming

Course Description: This course aims at giving students a basic knowledge of distributed systems, cluster computing, grid computing and cloud computing. Emphasis on communication between distributed systems and synchronization algorithms.

Course Learning Objectives:

1. Understand foundation of Distributed Systems
2. Understand basic concepts of Grid Computing
3. Understand in detail the system level and support required for distributed system
4. Understand principals of cloud computing

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	Explain foundation of Distributed Systems	II	Understanding
CO2	Explain basic concepts of Grid Computing	II	Understanding
CO3	Explain the communication in distributed systems	II	Understanding
CO4	Explain the principles of cloud computing	II	Understanding

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		**1**										**1**		
CO2		**1**	**1**									**1**		
CO3		**1**										**1**		
CO4		**1**	**1**									**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/Group Discussions 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:

Unit 1: Principles of distributed computing Eras of computing, Elements of distributed computing – General concepts and definitions, architectural styles for distributed computing, Examples of distributed system. **Cluster Computing** - Distributed shared memory, parallel I/O Clusters, Scheduling parallel jobs on clusters, Load sharing and Fault tolerance manager, parallel programming scheduling techniques, Dynamic load balancing, Cluster System – Beowlf, COMPaS and NanOS.	**06 Hrs.**
Unit 2: Principles of grid computing Introduction to grid, Open Grid Service Architecture (OGSA), Open Grid Service Infrastructure (OGSI), The Globus Toolkit 3 (GT3), OGSI.Net Middleware solution.	**07 Hrs.**
Unit 3: Communication	**06 Hrs.**

Fundamentals, Remote Procedure Call, Remote Method Invocation(RMI), Message-oriented communication, Message Passing Interface(MPI), Stream-oriented communication, Multicast communication.	
Unit 4: Distributed File Systems and Fault Tolerance Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Introduction to fault tolerance, Process Resilience, Distributed Commit, Recovery.	**06 Hrs.**
Unit 5: Synchronization Clock Synchronization- Physical Clocks, Global Positioning System, Clock Synchronization Algorithms. Logical Clocks, Mutual Exclusion- A Centralized Algorithm, A Decentralized Algorithm, A Distributed Algorithm, A Token Ring Algorithm. Election Algorithms- Traditional Election Algorithms, Elections in Wireless Environments, Elections in Large-Scale Systems.	**07 Hrs.**
Unit 6: Principals of Cloud Computing Getting to know the Cloud, Cloud and other similar configurations, Components of Cloud Computing, Cloud Types and Models: Private Cloud, Community Cloud, Public Cloud, Hybrid Clouds, Cloud Computing Services- SaaS, PaaS, IaaS	**07 Hrs.**

Textbooks:

1. Distributed Systems: Principles and Paradigms- Tanenbaum, Steen.
2. The Grid Core Technologies", Maozhen Li, Mark Baker, (Wiley)
3. DISTRIBUTED SYSTEMS Concepts and Design Fifth Edition - George Coulouris Pearson Education, 2012.

References:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
3. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

Title of the Course: Unix Operating Systems **Course Code:UITE0621**	**L** **3**	**T** **-**	**P** **-**	**Credit** **3**

Course Pre-Requisite: Knowledge of Operating Systems is essential.

Course Description:
This course is introduced at third year level to get the idea of internal working of Unix operating system in detail.

Course Learning Objectives: To expose students to

1. Fundamental architecture of UNIX operating system kernel.
2. Detail algorithms of buffer cache management.
3. Internal File system organizations and related algorithms in UNIX.
4. System calls for UNIX file system.
5. Process structure, creation and management in UNIX.
6. Architecture and algorithms of process scheduling and memory management.
7. I/O subsystem architecture and algorithms.

Course Outcomes:

	At the end of the course the student will be able to,	Bloom's Cognitive	
		Level	Descriptor
CO1	List Features of Unix Operating System.	1	List
CO2	Describe Block diagram of Unix Kernel.	2	Describe
CO3	Illustrate internal representation of Unix File.	4	Illustrate
CO4	Compare IPC mechanisms of Unix.	5	Compare

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	2	-	-	-	-	-	-	-	-	-	-

Note: ***Correlation levels 1, 2 or 3 are as defined below:***

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessments:

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/group discussions 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:

Unit 1: Introduction and buffer cache: General Overview of the System - History, System Structure, User Perspective, Operating System Services, Assumption About Hardware, Architecture of UNIX OS, Introduction to system concepts, Kernel Data Structure, System Administration. 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.	**8 Hrs.**
Unit 2: Internal Representation of Files I-nodes, structure of the regular file, directories, conversion of a pathname to i-node, super block, i-node assignment to a new file, allocation of disk blocks, other file types.	**5 Hrs.**
Unit 3: System Calls for file system: System Calls for 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 Un-mounting file systems, Link, Unlink, File System Abstractions, File system maintenance.	**6 Hrs.**
Unit 4: The 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.	**6 Hrs.**
Unit 5: Process Control and Scheduling: 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: - Process Scheduling, system call for time, clock.	**6 Hrs.**
Unit 6: Memory management and I/O Subsystem: Swapping, Demand passing, a hybrid system with demand paging and swapping. Driver interfaces, disk drives, terminal drivers, Streams.	**6 Hrs.**

Textbooks:

1. The Design of Unix Operating System - Maurice J. Bach (PHI)
References: 1. Linux System Programming - Robert Love, Publisher - SPD, O' REILLY 2. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).

Title of the Course: Internet of Things **Course Code:** UITE0622	**L**	**T**	**P**	**Credit**
	3	**-**	**-**	**3**

Course Prerequisite: Basic knowledge of Data Communication, Computer Networks

Course Description: To impart the necessary fundamental principles of Internet of Things. To develop various applications related to smart cities, agriculture etc.

Course Learning Objectives:

6. To learn basics of Internet of Things Technology
7. To get basic knowledge of RFID, sensor and GPS technologies
8. To make students aware of wireless technologies, IoT applications.
9. To implement applications using Raspberry Pi

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Recall basics of Internet of Things	I	Remembering
CO2	Recall RFID, sensors etc	I	Remembering
CO3	Summarize various wireless technology and IoT applications	II	Understanding
CO4	Develop various IoT applications	III	Applying

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	2													
CO3		2												
CO4			3										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/Group Discussions 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:

Unit 1: Introduction to Internet of Things:- Introduction , Physical design of IoT, Logical design of IoT, IoT Enabling Technologies,IoT Level and deployment Template	**6Hrs.**
Unit 2: IoT and M2M Introduction, M2M, Difference between IoT and M2M,SDN and NFV for IoT	**6 Hrs.**
Unit 3: Radio Frequency Identification Technology and Wireless Sensor Networks Introduction, Principles of RFID, Components of an RFID system, Reader, RFID tags, RFID middleware, Issue. Wireless Sensor Networks: History and context, the node, connecting nodes, networking nodes, securing communication.	**8 Hrs.**
Unit 4: IoT Physical device and end points Python Introduction, What is an IoT device, Raspberry Pi, About the board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming on Raspberry Pi with Python	**8Hrs.**
Unit 5: Case studies Illustration IoT Design Introduction, Home automation, cities, Environment, Agriculture, Productivity applications.	**6 Hrs.**
Unit 6 : IoT Physical Servers and Cloud Offerings Introduction to Cloud storage models and communication API's, WAMP –AutoBahn for IoT, Amazon web services for IoT	**6 Hrs.**

Textbooks:

4. Internet of Things: A Hands-On Approach By Arshdeep Bahga, Vijay Madisetti (Unit 1,2,4,5,6)
5. The Internet of Things: Connecting Objects to the Web, Hakima Chaouchi, Wiley Publications (Unit 3)

Title of the Course: Ad-hoc Wireless Networks	**L**	**T**	**P**	**Credit**
Course Code: UITE0623	**3**	**-**	**-**	**3**

Course Pre-Requisite: Basic computer network concepts

Course Description: Ad-hoc wireless networks subject deals with study of ad-hoc wireless network architecture, protocols and its services.

Course Learning Objectives:

8. To explain fundamental principles of Ad-hoc Networks.
9. To discuss a comprehensive understanding of Ad-hoc network protocols.
10. To outline current and emerging trends in Ad-hoc Wireless Networks
11. To analyze energy management in ad-hoc wireless networks

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Compare the differences between cellular and ad hoc networks and analyze the challenges at various layers and applications.	II	Understanding
CO2	Summarize the protocols used at the MAC layer and scheduling mechanisms.	II	Understanding
CO3	Compare and analyze types of routing protocols used for unicast and multicast routing.	IV	Analyze
CO4	Examine the network security solution and routing mechanism.	V	Evaluate
CO5	Evaluate the energy management schemes and Quality of service solution in ad hoc networks.	V	Evaluate

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		2											1	
CO2		2		1									1	
CO3		2		1									1	
CO4		2											1	
CO5	1	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/declared test/quiz/seminar/Group Discussions 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:

Unit 1: Introduction to ad-hoc wireless network: Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; Cellular and Ad Hoc wireless networks, Applications, Issues in Ad Hoc wireless networks.	**06 Hrs.**
Unit 2: MAC Protocols for Ad-hoc wireless networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanism.	**08 Hrs.**
Unit 3: Routing protocols in Ad-hoc wireless protocol: Introduction, Issues in designing a routing protocol for ad hoc wireless networks, Classification of routing protocols, Table driven protocols :-DSDV, WRP, CGSR; On-Demand Hybrid routing protocols:-DSR, AODV, LAR, ABR, SSA , ZRP.	**08 Hrs.**
Unit 4: Multicast Routing for Ad hoc wireless networks: Introduction, Issues in designing a multicast routing protocol, Operation of multicast routing protocols, An architecture reference model for multicast routing protocols, Classification of multicast routing protocols, Tree-based Multicast Routing Protocols:-	**06 Hrs.**

BEMR, MZRP, MAODV ; Mesh-based multicast routing protocols:-NSMP, CAMP.	
Unit 5: Transport Layer and Security Protocols: Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol TCP over ad-hoc wireless networks:-TCP-F, Ad-Hoc TCP, Split TCP; **Security in ad hoc wireless networks:** Network security requirements, Issues and challenges in security provisioning, Network security attacks, Secure routing protocol - SAR, Security- Aware AODV Protocol.	**08 Hrs.**
Unit 6: Energy Management and Quality of service: Introduction, Need, Classification of energy management schemes, System Power Management schemes-Processor Power Management Scheme, Device Power Management Scheme. Issues and challenges, Classification of QoS , QoS framework – INSIGNIA.	**06 Hrs.**

Textbooks:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

References:

1. C.K. Toh: Ad-hoc Mobile Wireless Networks -Protocols and Systems, Pearson Education, 2002.
2. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.

Title of the Course: Free and Open Source Software for Engineering Education (FOSSEE)	**L**	**T**	**P**	**Credit**
Course Code: UOEL0636	**3**	**-**	**-**	**3**

Course Pre-Requisite: Nil

Course Description: The course aims to promote FOSS and make students aware about benefits of FOSS. This course also aims to reduce dependency on proprietary software

Course Learning Objectives:

12. To provide awareness about software licensing.
13. To teach students how they can begin to participate in a FOSS project in order to contribute.
14. To teach some important FOSS tools and techniques

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	explain common open source licenses and the impact of choosing a license	II	Understanding
CO2	install and use Linux as Desktop Operating System independently.	II	Applying
CO3	select and use a version control system and to interface with version control systems used by development communities	IV	Evaluate
CO4	explore and use different FOSS tools in their day to day computational needs	V	Evaluate

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2							3						
CO2														
CO3				3		3	2			1				

CO4			2			3	3		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/declared test/quiz/seminar/Group Discussions 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:

Unit 1: Introduction: What is FOSS? Why FOSS? Proprietary-Free-FOSS, Di erent types of software licensing, al-ternatives to commercial software.	**04 Hrs.**
Unit 2: Linux fundamentals**:** Linux origins, Linux principles, Linux Distros, OS Installation, Package Management.	**06 Hrs.**
Unit 3: Linux usage basics**:**Logging, GUI terminal, Virtual Terminal, command line shortcuts, running commands, getting help - man, whatis, apropos, info, browsing history, inverse search history, terminal shortcuts.	**06 Hrs.**
Unit 4: Users, Groups, Permissions, shell scripts Users, Groups, Linux File Security, Permission Precedence, Viewing Permissions from the Command-Line, Changing File Ownership, Changing Permissions - Symbolic Method, Chang-ing Permissions - Numeric Method Changing Permissions - Nautilus, Scripting Basics, Creating Shell Scripts..	**06 Hrs.**
Unit 5: Popular FOSS Tools:Popular FOSS tools required in engineering domain such as - LibreO ce, gnuplotDia, Latex, Blender, SciLab, GIMP.	**08 Hrs.**
Unit 6: Version Control & CMS**:** Version Control System - What? Why?, Distributed Version Control System, Case Study - any one of (git / svn / cvs / mercurial)..	**06 Hrs.**
Textbooks:	

1. http://www.spoken-tutorial.org/ NMEICT Project of Govt. Of India.
2. http://fossee.in/

Title of the Course: Web Designing **Course Code: UOEL0637**	**L** **3**	**T** **---**	**P** **---**	**Credits** **3**

Course Pre-Requisite: Basic knowledge of HTTP and HTML

Course Description: This Course contains various techniques and technologies used for website designing and development**.**

Course Objectives:

4. To learn basic user interface.
5. To develop static and responsive web pages using HTML and CSS
6. To develop interactive websites using jQuery and JS.
7. To learn how to host the website

Course Outcomes:

COs	**After the completion of the course the student will be able to**	Bloom's Cognitive level	Descriptor
CO1	**Apply** basic knowledge of HTML and CSS to design web pages	1	Applying Level
CO2	**Create attractive web pages**	2	Applying Level
CO3	**Make use of** bootstrap to develop responsive website	3	Applying Level
CO4	**Design** and host websites using javascript and jquery	3	Applying Level

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1		2										
CO2	3											
CO3			3									
CO4		3										
CO5				2								
CO6			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/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three units) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three units) covered after MSE.	
Course Contents:	
Unit 1:--- HTML 5.0 Introduction to HTML5, Features of HTML5, HTML5 DocType, New Structure Tags, Section, Nav, Article, Aside, Header, Footer, Designing a HTML Structure of Page, New Media Tags, Audio Tag, Video Tag, Canvas and Svg Tag, Introduction to HTML5 Forms, New Attributes, Placeholder Attribute, Require Attribute, Pattern Attribute, Autofocus Attribute, email , tel, url types, number type, date type, range type, voice search, Examples of Form	7 **Hrs.**
Unit 2:--- CSS 3.0 Introduction to CSS 3, New CSS 3 Selectors, Attribute Selectors, First-of-type, Last-of-type, Nth-child, Element:empty, New CSS3 Properties, Custom Fonts, Text-Shadow Property, Text-Stroke Property, Rounded Corners, Box Shadows, CSS Gradients, CSS Multiple backgrounds, Opacity Property, Transition effect, Transform effect, Animation effects, Css Media Queries, Using CSS3 in Practical Layout	7 **Hrs.**
Unit 3:--- BootStrap Introduction to Responsive Design, Mobile first design concepts, Common device dimensions, View-port tag, Using css media queries, Menu conversion script, Basic Custom Layout, Introduction to Bootstrap, Installation of Bootstrap, Grid System, Forms, Buttons, Icons Integration, Using CSS3 in Practical Layout	7 **Hrs.**
Unit 4:--- JavaScript Introduction to Client Side Scripting, Introduction to Java Script, Javascript Types, Variables in JS, Operators in JS, Conditions Statements, Java Script Loops, JS Popup Boxes, JS Events, JS Arrays, Working with Arrays, JS Objects, JS Functions, Using Java Script in Realtime, Validation of Forms, Related Examples**,** Frameworks of js**.**	7 **Hrs.**
Unit 5:--- jQuery and jQuery UI Introduction to jQuery, jQuery Features, Installing jQuery, jQuery Syntax, jQuery Ready Function, jQuery Selectors, jQuery Actions, jQuery plugins, jQuery Validation plugin, jQuery Slideshow, jQuery Dropdown, jQuery UI, Working with jQueryUI, jQuery Accordions, jQuery Tabs, jQuery Tooltips, jQuery Autocomplete	7 **Hrs.**
Unit 6:--- Web Hosting	7 **Hrs.**

Web Hosting Basics, Types of Hosting Packages, Registering domains, Defining Name Servers, Using Control Panel, Creating Emails in Cpanel, Using FTP Client, Maintaining a Website, Introduction to Joomla & Wordpress CMS	

Reference Books:

1. HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell
2. JavaScript: The Definitive Guide, 6th Edition By David Flanagan
3. Learning jQuery Fourth Edition by Jonathan Chaffer , Karl Swedberg

Unit wise Measurable Learning Outcomes:

Unit 1:--- HTML 5.0

Students are able to

a) identify different tags in HTML5.0

b)Use different HTML Tags

Unit 2:--- CSS3.0

Students are able to

a) Design attractive web pages.

b) Use css attributes in web pages.

Unit 3:--- Bootstrap.

Students are able to

a) use gridlayout of bootstrap to make pages responsive

b) apply different css classes of bootstrap

Unit 4:--- Javascript

Students are able to

a) write basic programs using javascript

b) Perform validations using javascript.

Unit 5:---Jquery

Students are able to

a) Understand use of jQuery.

b) Use different Jquery UI tags.

Unit 6:--- Web Hosting

Student are able to

a) Host websites on webservers.

b) Develop websites using CMS.

Title of the Course: Application Development Tool-II Lab	**L**	**T**	**P**	**Credit**
Course Code: UITE0631	**2**	**-**	**2**	**3**

Course Pre-Requisite: Fundamentals of Object Oriented Programming Language

Course Description: This course aims to study the C# GUI Programming and Haskell Functional Programming

Course Learning Objectives:

1. To study fundamentals of .NET framework
2. To understand fundamental concepts like objects, classes, interfaces, polymorphism, delegates and events and its implementation in C#
3. To learn robust GUI applications using event handling and Windows form controls with proper exception handling
4. Study of basics of Haskell Functional Programming Language
5. To understand functions, IO, and Modules of Haskell

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Explain components of .NET framework	II	Understanding
CO2	Design application using GUI programming	III	Applying
CO3	Recall the basics concept of Functional programming.	II	Understanding
CO4	Write haskell programs related to simple-moderate mathematical/logical problems	III	Apply

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2				3									
CO2		3	2	2	3	2							2	2
CO3		2		3	2									

CO4					2	2							2	2

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Unit 1: .NET Framework and C# Basics **Introduction to .net:** Evolution of .net, Benefits of .net, CLR, CTS, MSIL, JIT, BCL, metadata and assemblies in detail, GAC and strong name assemblies, Security Manager **C# fundamentals:** Data types - Value types, Reference types, Namespaces, Parameter Passing ref, out, params. **classes, objects, structs:**definition and creation	**05 Hrs.**
Unit 2: GUI Programming& Database with ADO.NET **GUI Programming:** Introduction to GUI Application and their components, Windows forms – buttons, check boxes, radio buttons, panels, group boxes, list boxes, picture boxes, Menus, ToolStrips, StatusStrips and progress bars, events, Creating and using MDI application **ADO.NET:** Exploring ADO.NET Entity framework, Connected and disconnected architecture, data access with ADO.NET, LINQ	**07 Hrs.**
Unit 3: Introduction to Functional Programming Language What is Functional Programming? Introduction to Haskell, Features, the ghci interpreter, Operators, I/O, Lazy Evaluation, **Setting up programming**	**03 Hrs.**

Unit 4: Declaring the Data Model Characters, Numbers, List and List Comprehension, String, Boolean, Tuple, Patterns, Enumerated types, Abstract types, Records, Type Polymorphism, Type classes, Arrays, Lambda Calculus	**05 Hrs.**
Unit 5: Functions and Modules **Functions:** Declaration, Definition, Call, Recursive Functions, Defining functions over data types using patterns, Lambda Expressions, Built in Functions, Function Composition **Modules:** Built in Modules, Custom Modules, Packages	**04 Hrs.**
Unit 6: IO, Functor, Modads **IO-** Files and Streams, Command Line Arguments, Randomness **Functors, Monads and Zipper**	**04 Hrs.**

Textbooks:

1. C# 4.0 The Complete Reference : Herbert Schildt, McGraw Hill
2. Haskell Programming from first principles- Christopher Allen and Julie Moronuki

References:

1. Beginning Haskell A project based Approach by Alejandro Serrano Mena
2. NET 4.5 Programming (6 – in -1) Black Book – Kogent – Dreamtech Press

Laboratory Work

Minimum 10-12 Experiments are to be performed in batches, on above topics. Term work should comprise detailed documentation on the below 10-12 experiments. Students in batches should implement programs based on the following topics preferably on Linux platform.

1. Introduction to .Net framework & implementation of simple console application.
2. Study and implementation of different types of Constructors in C#.
3. Write a program to study use of Properties in C#.
4. Write a program to implement inheritance concepts.
5. Study of window-based application.
6. Program to study various controls for windows form application.
7. 10) Create a small registration form layout using Windows Form Applications.
8. Demonstrate the Menu controls and Different Dialog controls in windows form application.
9. Program to display the account details with help of ADO.Net and windows form

application and LINQ.

10. Installation of Haskell
11. Write programs using different data models of Haskell
12. Write different programs using functions in Haskell
13. Create user defined modules and packages using Haskell
14. Write a program to perform read, write operations on file using Haskell

Title of the Course: Distributed Computing Lab	**L**	**T**	**P**	**Credit**
Course Code: UITE0632	**-**	**-**	**2**	**1**

Course Pre-Requisite: Knowledge of Operating system, Network Programming

Course Description: This course aims at giving students a basic knowledge of distributed systems, cluster computing, grid computing and cloud computing. Emphasis on communication between distributed systems and synchronization algorithms.

Course Learning Objectives:

1. Understand foundation of Distributed Systems
2. Understand basic concepts of Grid Computing
3. Understand in detail the system level and support required for distributed system
4. Understand principals of cloud computing

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	Apply the concepts of communication in distributed systems.	III	Applying
CO2	Analyse the synchronisation algorithms	IV	Analyzing
CO3	Develop the new web services in Grid Computing	VI	Creating
CO4	Build application in cloud	VI	Creating

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	1	2	1							2		
CO2		2	1	1	1							2		
CO3	1	2	1	2	1							2	1	2
CO4		1	1	2	1							1		
CO5	2	2	1	2	1							2	1	2

Assessments: One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE(POE)	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc. POE: Assessment is based on Practical oral examination

Course Contents:

Experiment No. 1: Implementation of Remote Procedure Call (RPC) in distributed system.	02 Hrs.
Experiment No. 2: Implementation of Remote Method Invocation(RMI) in distributed system.	02 Hrs.
Experiment No. 3: Implementation / Configuring P2P clients	02 Hrs.
Experiment No. 4: Implementation of Clock Synchronization (logical/physical)	02 Hrs.
Experiment No. 5: Simulation of Election algorithms	02 Hrs.
Experiment No. 6: Implementation of Mutual Exclusion algorithms	02 Hrs.
Experiment No. 7: Implementation of multi-threaded client/server processes.	02 Hrs.
Experiment No. 8: Simulation of Distributed Commit	02 Hrs.
Experiment No. 9: Simulation of recovery techniques	02 Hrs.
Experiment No. 10: Grid Computing Use Globus Toolkit or equivalent and Develop a new Web Service for Calculator.	02 Hrs.

Experiment No. 11: Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate.	02 Hrs.
Experiment No. 12: Creating a Warehouse Application in SalesForce.com‘s Force.com. (use any cloud service provider)	02 Hrs.

Textbooks:

1. Distributed Systems: Principles and Paradigms- Tanenbaum, Steen.
2. The Grid Core Technologies”, Maozhen Li, Mark Baker, (Wiley)
3. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.

References:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education.

Title of the Course: Unix Operating System Lab **Course Code: UITE0633**	**L**	**T**	**P**	**Credit**
	-	**-**	**2**	**1**

Course Prerequisite: Knowledge of Unix Operating System is essential.

Course Description:

This course provides hands-on experience on Unix Features through installation, use of different system calls and basic building blocks provided by Unix.

Course Learning Objectives:

1. To give competency with Unix and Linux based systems.
2. Understand working of different system calls.
3. To provide hands-on experience on Unix tools.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Make use of system calls and tools provided by Unix and Linux based systems	3	Make use of
CO2	Develop Shell Scripts.	3	Develop
CO3	Analyze various algorithms of Operating systems	4	Analyze

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		2												
CO2				3										
CO3			2											

Assessments :

Teacher Assessment: One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE(OE)	50

ISE is based on practical performed / Quiz/ Internal oral etc.
ESE: Assessment is based on Oral Examination

Course Contents:	
Experiment No. 1: Study & Installation of Unix Operating System	**2 Hrs.**
Experiment No. 2: Command line navigation in Unix	**2 Hrs.**
Experiment No. 3: Getting started with the shell programming	**2 Hrs.**
Experiment No. 4: Implementation of buffer retrieval algorithm	**2 Hrs.**
Experiment No. 5: Reading and Writing through Named and Unnamed Pipe	**2 Hrs.**
Experiment No. 6: Study & demonstration of Unix Process Management	**2 Hrs.**
Experiment No. 7: Study & demonstration of IPC mechanisms	**2 Hrs.**
Experiment No. 8: Study & demonstration of signal handler	**2 Hrs.**
Experiment No. 9: Study & demonstration of Time, Sleep and Clock Management	**2 Hrs.**
Experiment No. 10:-- Implementing Loadable Kernel Module for Linux	**2 Hrs.**

Textbooks:

1. The design of Unix Operating System - Maurice J. Bach (PHI)

References:

1. Linux System Programming - Robert Love, Publisher - SPD, O' REILLY

2. Unix concepts and administration – 3rd Edition – Sumitabha Das (TMGH).

3. Unix / Linux Manuals.

Title of the Course: Internet of Things Lab **Course Code:** UITE0634	**L**	**T**	**P**	**Credit**
	-	-	2	1

Course Prerequisite: Basic knowledge of Data Communication, Computer Networks

Course Description: To impart the necessary fundamental principles of Internet of Things. To develop various applications related to smart cities, agriculture etc.

Course Learning Objectives:

10. Implement basic programs using Python
11. Make use of various sensors using Raspberry Pi
12. Make use of various sensors using Raspberry Pi

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Identify and solve the problems using Python	I	Remembering
CO2	Experiment with Raspberry Pi kit	III	Applying
CO3	Experiment with Arduino kit	III	Applying

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													
CO2	2													1
CO3		2												1
CO4			3											

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Assessments :

Teacher Assessment:

One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50

ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on Practical oral examination

Course Contents:

Experiment No. 1: **Aim and Objectives:** To understand data types in python, controlling statements, functions and variable scope in python. **Theoretical Background:** Identifiers, reserved keywords, variables, comments, operators, numbers **Experimentation:** 1. Write a program to check the number is prime or not.	**02Hrs.**
Experiment No. 2: Networking in python **Aim and Objectives:** To understand client server model **Theoretical Background:** Socket programming **Experimentation:** 1. Implement simple client server message passing program	**02Hrs.**
Experiment No. 3: File Read/Write operation in python **Aim and Objectives:** Understand file operation using python **Theoretical Background:** Basics of file handling **Experimentation:** Write a program to implement file read write operation using python	**02Hrs.**
Experiment No. 4: Basic setup for Raspberry Pi **Aim and Objectives:** To understand Raspberry Pi Pin configuration, Raspberry Pi os setup **Outcomes:** Student will be able to setup and configure Raspberry Pi	**02Hrs.**
Experiment No. 5: Blinking LED **Aim and Objectives:** Installing GPIO library **Theoretical Background:** Python programming **Experimentation:** Write a program to implement blinking LED using Raspberry Pi	**02Hrs.**
Experiment No. 6: Implementation of IoT with Raspberry Pi **Aim and Objectives:** Write program to implement application with Raspberry Pi	**02Hrs.**

Theoretical Background: Sensor, Actuators. **Experimentation:** Implement DHT sensor interface with Raspberry Pi	
Experiment No. 7: Introduction to Arduino **Aim and Objectives: T**o understand Arduino Pin configuration, Arduino setup **Theoretical Background:** Sensor, Actuators. **Experimentation:** Implement DHT sensor interface with Arduino	**02Hrs.**

Textbooks:

1. Database System Concept by Henry F. Korth, Abraham Silberschatz, Sudarshan (McGraw Hill Inc.) Sixth Edition.
2. Database Systems- A practical approach to Design, Implementation and Management by Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education

References:

6. Fundamentals of Database Systems – by Ramez Elmasri and Shamkant Navathe Publisher - Pearson Education, 5 th Edition.
7. Database Systems: Design, Implementation and management.- PeterRof, Carlos Coronel (7^{th} Edition), Publisher - Cengage Learning.
8. Principles of Database Systems by J.D. Ullaman (Galgotia Publications).

Title of the Course: Ad-hoc Wireless Networks Lab	**L**	**T**	**P**	**Credit**
Course Code: UITE0635	-	-	**2**	1

Course Prerequisite: wire shark, computer network QoS parameters and basics of wireless network

Course Description: This course is designed to understand and analyze ad-hoc wireless network architecture and it protocols.

Course Learning Objectives:

15. To understand architecture of ad-hoc wireless architectures.
16. To gain knowledge of wireless network simulators.
17. To analyze routing protocols in ad-hoc wireless network.
18. To analyze energy management in ad-hoc wireless network.

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand simulation tools.	II	Understand
CO2	Design network to analyze routing protocols.	III	Create
CO3	Design wireless network infrastructure and test in simulator.	VI	Apply

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1			1		2									
CO2	1		2										1	
CO3	1		2										1	

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Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks

ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc. ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1: Study and Installation of ns2 **Aim and Objectives:** Understand and install network simulator ns2 **Experimentation:** Installation of ns2 on linux platform	**02 Hrs.**
Experiment No. 2: Study and installation of ns3 **Aim and Objectives:** Understand and install ns3. **Experimentation:** Installation of ns3 linux platform	**02 Hrs.**
Experiment No. 3: Study and install of OPNET **Aim and Objectives:** Understand and install network simulator OPNET. **Experimentation:** Installation of OPNET	**02 Hrs.**
Experiment No. 4: Study and analyze pro-active routing protocols in ns2 **Aim and Objectives:** Analyze DSDV protocol in wireless ad-hoc network**.** **Experimentation:** Design wireless network with DSDV routing protocol and trace packet transmission.	**02 Hrs.**
Experiment No. 5: Study and analyze reactive routing protocol in ns2 **Aim and Objectives:** Analyze AODV protocol in wireless ad-hoc network**.** **Experimentation:** Design wireless network with AODV routing protocol and trace packet transmission.	**02 Hrs.**
Experiment No. 6: Study and analyze ad-hoc wireless network topology in ns3 **Aim and Objectives:** Analyze ad-hoc wireless network topology in ns3**.** **Experimentation:** Design ad-hoc wireless network topology with UDP client and trace the packets	**02 Hrs.**
Experiment No. 7: Study and analyze MAC protocol in ad-hoc wireless network **Aim and Objectives:** Analyze MAC protocol in ad-hoc wireless network with respect throughput and delay. **Experimentation:** Design ad-hoc wireless network topology with MAC protocol and trace the packets with respect to throughput and delay.	**02 Hrs.**
Experiment No. 8: Study and analyze real time MANET in OPNET	**02 Hrs.**

Aim and Objectives: Analyze real time MANET topology in OPNET**.** **Experimentation:** Design real time IEEE 802.11 network connected devices and analyze packet tracing.	
Experiment No. 9: Study and analyze multicast routing in ad-hoc wireless network **Aim and Objectives:** Analyze multicast protocol in ad-hoc wireless network with respect throughput and delay. **Experimentation:** Design ad-hoc wireless network topology with multicast routing and trace the packets with respect to throughput and delay.	**02 Hrs.**
Experiment No. 10: Study and analyze energy efficiency in ad-hoc wireless network **Aim and Objectives:** Analyze energy efficiency of node in ad-hoc wireless network **Experimentation:** Design ad-hoc wireless network topology and analyze energy efficiency of selected node.	**02 Hrs.**

Textbooks:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

References:

1. C.K. Toh: Ad-hoc Mobile Wireless Networks -Protocols and Systems, Pearson Education, 2002.
2. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
3. www.isi.edu/nsnam/ns
4. www.nsnam.org

Title of the Course: Mini Project III	**L**	**T**	**P**	**Credit**
Course Code: UITE0641	**-**	**-**	**2**	**1**

Course Pre-Requisite: Knowledge of C#, Java Programming

Course Description: This course aims at developing mini project based on technologies learnt.

Course Learning Objectives:

1. To apply Software engineering approach to solve real life problem.
2. To learn skills of team work & team building to accomplish common goal
3. To design and develop logical skills to use appropriate data structures for solving real life engineering problem.

Course Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	To apply software engineering approach to solve real life problem.	III	Applying
CO2	Learn the skills of team work & team building to accomplish common goal	II	Understanding
CO3	Design and Develop logical skills to use appropriate data structures for solving real life engineering problems	V	Creating

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3				1	2			3	1			1	
CO2		3	2			1			3	3			1	3
CO3			3			2			2	2	1		1	2

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Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50

ESE	50

ISE are based on practical performed Presentation (Synopsis, SRS, Poster)/ Group Discussion / Internal Project Demo, etc.

ESE: Assessment is based on Project Demo

Course Contents:

Description:

The mini project should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The mini project must be based upon any real life problem statement.

Platforms: Any supporting IDE and Framework

1. The group will select a problem with the approval of the guide and prepare the solution guidelines for its implementation.
2. The same should be put in the form of synopsis (3 to 5 pages), stating the usage of logic, algorithms and suitable data structures necessary for implementation of the solution as per software engineering approach.
3. Further the group is expected to complete analysis of problem by examining the possible different inputs to the system and the corresponding outputs.
4. The term work submission is to be done in the form of a report containing the details of the problem, solution techniques, implementation details, input-output scenarios and the conclusion. The project must be implemented using technologies covered earlier in previous semester

Title of the Course: Professional Certification-II	L	T	P	Credits
Course Code: UITE0661	---	---	2	-

Course Pre-Requisite:

Course Description: This Course contains various IT domain online MOOC courses (min 10 weeks, max 12 weeks).

Course Objectives:

1. To interpret the knowledge of any professional course in the field of IT.
2. To demonstrate knowledge in particular IT domain.
3. To apply domain knowledge in project implementation.

Course Outcomes:

COs	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Summarize knowledge of professional course.	2	Understand Level
CO2	Demonstrate knowledge in practical task.	3	Applying Level
CO3	Apply knowledge in project implementation.	3	Applying Level

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
												2	2	
												2		1
												2	2	

Assessments :

Teacher Assessment:

End Semester Examination (ESE) is having 100% weight.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% Quiz/Theory related to any professional course registered by the student.

Course Contents:

Course Domains:

8. Networking
9. IoT
10. Computer Programming
11. Information Security

12. Software Testing 13. Database Engineering **14.** Cloud Computing	
List of portals providing online courses 6. NPTEL Swayam 7. MOOC 8. Coursera 9. Edx 10. Any other professional portal	