Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Third Year B. Tech. (Computer Engineering)

With effect from Year 2022-23

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Semester-V														
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	PCCO5010T	Data Mining and Warehouse	3			20	15	15	15	65	100	3	4
	PC	PCCO5010L	Data Mining and Warehouse Laboratory			2	25				25	50	1	
2	PC	PCCO5020T	Processor Organization and Architecture	3			20	15	15	15	65	100	3	4
	PC	PCCO5020L	Processor Organization and Architecture Laboratory			2	25				25	50	1	
3	PC	PCCO5030T	Artificial Intelligence	3			20	15	15	15	65	100	3	4
	PC	PCCO5030L	Artificial Intelligence Laboratory			2	25				25	50	1	
4@	PE	PECO5041T	Advanced Operating System	3			20	15	15	15	65	100	3	4
		PECO5041L	Advanced Operating System Laboratory			2	25				25	50	1	
		PECO5042T	Advanced Database Management System	3			20	15	15	15	65	100	3	
		PECO5042L	Advanced Database Management System Laboratory			2	25				25	50	1	
		PECO5043T	Network Engineering	3			20	15	15	15	65	100	3	
		PECO5043L	Network Engineering Laboratory			2	25				25	50	1	
5	PC	PCCO5050L	Programming Laboratory-II (Python)			4	50				25	75	2	2
6	HM	HMCO5060T	Professional and Business Communication	2			50					50	2	2
7	PJ	PJCO5070L	Semester Project-III			2	25				25	50	1	1
8	HM	HMCO5080L	Employability Skill Development Program-II			2	50					50	1	1
Total				14		16	330			60	435	825	22	

@ Any 1 Elective Course

Semester-VI

Sr.No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	PCCO6010T	Software Engineering	3			20	15	15	15	65	100	3	4
	PC	PCCO6010L	Software Engineering Laboratory			2	25				25	50	1	
2	PC	PCCO6020T	Advanced Algorithms	3			20	15	15	15	65	100	3	4
	PC	PCCO6020L	Advanced Algorithms Laboratory			2	25				25	50	1	
3	PC	PCCO6030T	Information Security	3			20	15	15	15	65	100	3	4
	PC	PCCO6030L	Information Security Laboratory			2	25				25	50	1	
4@	PE1	PECO6041T	Big Data Infrastructure	3			20	15	15	15	65	100	3	4
		PECO6041L	Big Data Infrastructure Laboratory			2	25				25	50	1	
		PECO6042T	Internet of Things	3			20	15	15	15	65	100	3	
		PECO6042L	Internet of Things Laboratory			2	25				25	50	1	
		PECO6043T	Business Analytics	3			20	15	15	15	65	100	3	
		PECO6043L	Business Analytics Laboratory			2	25				25	50	1	
5@	PE2	PECO6051T	Machine Learning	3			20	15	15	15	65	100	3	4
		PECO6051L	Machine Learning Laboratory			2	25				25	50	1	
		PECO6052T	Compiler Design	3			20	15	15	15	65	100	3	
		PECO6052L	Compiler Design Laboratory			2	25				25	50	1	
		PECO6053T	Human Machine Interaction	3			20	15	15	15	65	100	3	
		PECO6053L	Human Machine Interaction Laboratory			2	25				25	50	1	
6	PJ	PJCO6060L	Project Stage-I			2	25				25	50	1	1
7	MC	MCCO6070T	Environmental Studies	1									Audit Course	
			Total	16		12	250			75	475	800	21	

@ Any 1 Elective Course.

Prepared by: Salunkhe
Prof. S. P. Salunkhe

Checked by: JSonawane
Prof. J. S. Sonawane

Prof. Dr. Nitin N. Patil
BOS Chairman

Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

R. C. Patel Institute of Technology, Shirpur
SES SHIKSHAN EDUCATION SOCIETY
Autonomous

Semester - V

Data Mining and Warehouse (PCCO5010T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Pre-Requisite: Basic database concepts, Concepts of algorithm design and analysis.

Course Objectives:

1. To identify the scope and essentiality of Data Mining and Warehouse.
2. To analyze data, choose relevant models and algorithms for respective applications.
3. To develop research interest towards advances in data mining.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand Data Warehouse fundamentals and data mining principles.	L2	Understand
CO2	Design data warehouse with dimensional modelling.	L6	Create
CO3	Understand ETL process and apply OLAP operations.	L2	Understand
CO4	Apply appropriate pre-processing techniques.	L3	Apply
CO5	Identify appropriate data mining algorithms to solve real world problems.	L3	Apply
CO6	Compare and evaluate different data mining techniques like classification, clustering and association rule mining.	L5	Evaluate

Course Contents

Unit-I Introduction to Data Warehouse and Dimensional Modelling

08 Hrs.

Introduction to Strategic Information, Need for Strategic Information, Features of Data Warehouse, Data Warehouse versus Data Marts, Data Warehouse versus Data Lake, Top Down versus Bottom Up Approach. Data Warehouse Architecture, Metadata, E-R Modelling versus Dimensional Modelling, Information Package Diagram, STAR Schema, STAR Schema keys, Snowflake Schema, Fact Constellation Schema, Factless Fact Tables, Update to the Dimension Tables, Aggregate Fact Tables.

Unit-II ETL Process and OLAP

06 Hrs.

Major steps in ETL Process, Data Extraction Techniques, Data Transformation: Basic tasks, Major transformation type.

Data Loading: Applying Data, OLTP Vs OLAP, OLAP Definition, Dimensional Analysis, Hypercubes.

OLAP Operations: Drill Down, Roll Up, Slice, Dice and Rotation, OLAP models: MOLAP, ROLAP.

Unit-III Introduction to Data Mining, Data Exploration and Preprocessing

06 Hrs.

Data Mining Task and Techniques, KDD Process, Issues in Data Mining, Applications of Data Mining.

Data Exploration: Types of Attributes, Statistical Description of Data, Data Visualization, Measuring data similarity and dissimilarity.

Data Preprocessing: Major tasks in Preprocessing, Data Cleaning: Missing Values, Noisy data; Data Integration: Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution.

Data Reduction: Attribute Subset Selection, Histograms, Clustering and Sampling.

Data Transformation & Data Discretization: Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Concept hierarchy generation for Nominal data.

Unit-IV Classification and Prediction

06 Hrs.

Basic Concepts of Classification, Decision Tree Induction, Attribute Selection Measures using Information Gain, Tree pruning.

Bayes Classification Methods: Bayes' Theorem, Naïve Bayesian Classification.

Rule Based Classification: Using IF THEN Rules for Classification, Rule Extraction from a Decision Tree, Rule Quality Measures, Rule Pruning.

Model Evaluation & Selection: Metrics for Evaluating Classifier Performance, Holdout Method and

Random Subsampling, Cross Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves Improving Classification Accuracy: Ensemble classification, Bagging, Boosting and AdaBoost, Random Forests, Improving Classification Accuracy in Class Imbalance Data Prediction: Simple Linear regression.

Unit-V Clustering 05 Hrs.

Cluster Analysis and Requirements of Cluster Analysis. Partitioning Methods: k-Means, k-Medoids. Hierarchical Methods: Agglomerative, Divisive. Density Based Methods: DBScan Evaluation of Clustering: Assessing Clustering Tendency, Determining Number of Clusters and Measuring Cluster Quality: Intrinsic and Extrinsic methods.

Unit-VI Mining Frequent Patterns and Association Rules 06 Hrs.

Market Basket Analysis, Frequent Itemsets, Closed Itemsets, and Association Rule. Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improving the Efficiency of Apriori.

FP Growth, Mining Frequent Itemsets using Vertical Data Format. Introduction to Mining Multilevel Association Rules and Multidimensional Association Rules.

Unit-VII Spatial and Web Mining 05 Hrs.

Spatial Data, Spatial Vs. Classical Data Mining, Spatial Data Structures, Mining Spatial Association and Co-location Patterns, Spatial Clustering Techniques: CLARANS Extension, Web Mining: Web Content Mining, Web Structure Mining, Web Usage mining, Applications of Web Mining.

Text Books:

1. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", Wiley India.
2. Reema Theraja, "Data warehousing", Oxford University Press.
3. M. H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education.

Reference Books:

1. Han, Jiawei, Jian Pei, and Micheline Kamber, "Data Mining: concepts and techniques", Elsevier, 3rd Edition, 2011.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Data Mining and Warehouse Laboratory(PCCO5010L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Practical exposure on implementation of data mining, preprocessing tasks.
2. Handling and analysis of datasets of any size.
3. Acquire knowledge of multidimensional schemas appropriate for data warehousing.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Recall the fundamental applications and concept of data mining and data warehouses	L1	Remember
CO2	Apply Data Preprocessing Techniques on realistic dataset	L3	Apply
CO3	Extract knowledge from given dataset using data mining techniques	L3	Apply
CO4	Apply Classification Techniques on realistic dataset.	L3	Apply
CO5	Apply Clustering Algorithms on given dataset	L3	Apply

List of Laboratory Experiments

1. Build Data Warehouse/Data Mart for a given problem statement
   (a) Identifying the source tables and populating sample data
   (b) Making information package diagram
   (c) Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)
2. Perform data Pre-processing task on your dataset
3. To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot
4. Implementation of Classification algorithm
   (a) Using Decision Tree ID3
   (b) Naïve Bayes algorithm
5. Implementation of Clustering algorithm
   (a) K-means
   (b) Hierarchical clustering (single/complete/average)
   (c) DBScan
6. Implementation of Association Rule Mining algorithm
   (a) Apriori algorithm
   (b) FP Tree algorithm
7. Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA, R tool, XL Miner, etc.)
8. Case study on recent data mining applications

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO5010T with experiments to be performed in Python / R programming languages. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Processor Organization and Architecture (PCCO5020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Pre-requisite: Digital Electronics, Operating systems.

Course Objectives:

1. To have a thorough understanding of the basic structure and operations of a computer system.
2. To study the hierarchical memory system including cache memories and virtual memory.
3. To prepare students for higher processor architectures and embedded systems.
4. To apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the arithmetic and logic algorithms for processors	L2	Understand
CO2	Understand the concepts of memory organization and mapping techniques.	L2	Understand
CO3	Explain, Interpret and implement the instructions and addressing modes of 8086 microprocessor and write assembly and mixed language programs.	L3, L4	Apply, Analyze
CO4	Understand the architecture and concepts of an 8051 microcontroller.	L2	Understand
CO5	Understand advanced trends and technologies in processor architectures.	L2	Understand

Course Contents

Unit-I Introduction to Computer Architecture & Organization

06 Hrs.

Introduction, Basic Organization of Computer Architecture, Von Neumann Model and Harvard Architecture, Data Representation and Arithmetic Algorithms- Addition, Subtraction, Multiplication - Unsigned Multiplication, Booth's Algorithm (Signed Multiplication), Division of Integers - Restoring Division, Non-Restoring Division.

Unit-II Memory Organization **08 Hrs.**

Types of RAM (SRAM, DRAM, SDRAM, DDR, SSD) and ROM, Characteristics of Memory, Memory Hierarchy- Cost and Performance Measurement.

Virtual Memory: Concept, Segmentation and Paging.

Address Translation Mechanism, Interleaved and Associative Memory, Cache Memory Concepts, Cache Coherency.

Unit-III Intel 8086 Architecture and Addressing Modes **06 Hrs.**

Major Features of 8086 Processor, 8086 CPU Architecture and Pipelined Operations, Programmer's Model and 8086 Pin Description, 8086 Addressing Modes.

Unit-IV 8086 Instruction set, Interrupts and Programming **10 Hrs.**

Instruction Set of 8086 Microprocessor, Assembler Directives, Procedure and Macros.

Interrupts in 8086 Microprocessor: Dedicated Interrupts, Software Interrupts, DOS Interrupts (Programming Examples), Assembly Language Programming for 8086 Microprocessor, Mixed Mode Programming for 8086.

Unit-V 8051 Microcontroller **05 Hrs.**

Architecture of 8051 Microcontroller, Addressing Modes for 8051.

Instruction Set for 8051 Microcontroller: Data Transfer, Arithmetic and Logical.

Interrupts in 8051 Microcontroller.

Unit-VI Intel Pentium Processor **06 Hrs.**

Features of Intel Pentium Processor, Pentium Superscalar Architecture, Pipelining, Branch Prediction, Instruction and Data Cache Concept.

Reference Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 10^{th} Edition, Pearson Publication, 2013.
2. John P. Hayes, "Computer Architecture and Organization", 3^{rd} Edition, McGraw-Hill, 1988.
3. John Uffenbeck, "8086/8088 Family: Design Programming and Interfacing", 2^{nd} Edition, PHI.
4. Douglas Hall, "Microprocessor and Interfacing", 2^{nd} Edition, Tata McGraw Hill.
5. M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2^{nd} Edition, Pearson Education.
6. Kenneth J. Ayala, "The 8051 Microcontroller", 3^{rd} Edition, Cengage Learning India Pvt. Ltd.
7. James L. Antonakos, "The Intel Microprocessor Family: Hardware and Software Principles and Applications", Cengage Learning.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Processor Organization and Architecture Laboratory(PCCO5020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To understand various multiplication and division algorithms.
2. To implement programs using 8086 instruction set and addressing modes.
3. To write mixed mode programs for 8086.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement multiplication and division algorithms.	L3	Apply
CO2	Compare and apply first fit and best fit memory allocation policy.	L2, L5	Compare, Apply
CO3	Understand and implement page replacement policies.	L2, L3	Understand, Apply
CO4	Implement assembly and mixed language programs using the instructions and addressing modes of 8086 microprocessor.	L6	Create

List of Laboratory Experiments

1. To implement shift and add method of multiplication algorithm.
2. To implement Booth's multiplication algorithm.
3. To study and implement Restoring division algorithm.
4. To study and implement Non- Restoring Division algorithm.
5. To implement First Fit Memory allocation policy.
6. To implement Best Fit Memory allocation policy.
7. To study and implement FIFO page replacement policy
8. To study and implement LRU page replacement policy
9. Assembly program for 16-bit addition
10. Assembly Program to transfer n block of data from one segment to another segment.
11. Assembly program to sort numbers in ascending/ descending order
12. Assembly program to find minimum/ maximum no. from a given array.
13. Assembly language program using Macros.
14. To implement mixed language programming using Assembly Language and C.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO5020T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including the practicals performed during laboratory sessions.

Artificial Intelligence (PCCO5030T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Pre-requisite: Knowledge of Basic Mathematics and Algorithms

Course Objectives:

1. Provide the basic ideas and techniques underlying the design of intelligent systems.
2. Impart the knowledge of various search techniques for problem solving.
3. Learn knowledge representation and provide the knowledge to deal with uncertain and incomplete information.
4. Impart the knowledge of planning and expert systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a basic understanding of AI building blocks presented in intelligent agents.	L3	Apply
CO2	Design appropriate problem solving method for an agent to find a sequence of actions to reach goal state.	L6	Create
CO3	Analyze various AI approaches to knowledge– intensive problem solving, reasoning and planning.	L4	Analyze
CO4	Design models for reasoning with uncertainty as well as different types of learning.	L6	Create
CO5	Design and develop the AI applications in real world scenario.	L6	Create

Course Contents

Unit-I Introduction to Artificial Intelligence — 05 Hrs.

Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Current trends in AI.

Intelligent Agents : Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.

Unit-II Problem solving — 12 Hrs.

Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems.

Search Methods: Uninformed search, Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID).

Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search.

Local Search Algorithms and Optimization Problems:Hill climbing search, Simulated annealing, Local beam search, Genetic algorithms, Ant Colony Optimization.

Adversarial Search: Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.

Unit-III Knowledge and Reasoning — 10 Hrs.

Knowledge based Agents, The Wumpus World, Propositional Logic, First Order Logic, Inference in FOL, Forward chaining, Backward chaining,Knowledge Engineering in First-Order Logic, Unification, Resolution,logic programming (PROLOG).

Knowledge Representation: Ontological Engineering, Semantic networks, Description logics, RDF, OWL, Semantic Web.

Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of Bayesian belief network, Inference in belief network. Rule-based methods for uncertain reasoning, Dempster-Shafer theory, Fuzzy sets and fuzzy logic.

Unit-IV Planning — 05 Hrs.

The planning problem, Planning with state space search, Planning graphs, Partial order planning, Hierarchical planning.

Planning and Acting in Nondeterministic Domain : Sensorless planning, Contingent planning, Online replanning, Multiagent planning.

Unit-V Learning — 06 Hrs.

Types of Learning, Inductive Learning.

Artificial Neural Networks: McCulloh Pitts Model, Perceptron, Feed Forward Network, Backpropagation Algorithm, Self Organizing Map.

Unit-VI Expert System 04 Hrs.

Introduction, Phases in building Expert Systems, ES Architecture.

Applications : Natural Language Processing, Robotics, Character Recognition, Genetic Algorithm in game playing, Travelling Salesman Problem, Best path finding, Recommender Systems, Prediction Systems, Atari Games, Face Recognition.

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", 2nd Edition, Pearson Education.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning.
3. George F. Luger, "Artificial Intelligence", Low Price Edition, 4th Edition, Pearson Education.
4. Deepak Khemani, "A First Course in Artificial Intelligence", 1st Edition, McGraw Hill Education (India), 2013.

Reference Books:

1. Ivan Bratko, "ROLOG Programming for Artificial Intelligence", Pearson Education, 3rd Edition.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", 3rd Edition, McGraw Hill.
3. Davis E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", 13th Edition, Addison Wesley, N.Y., 1989.
4. Martin T. Hagan, Demuth, Beale, "Neural Network Design", 2nd Edition, CENGAGE Learning, India Edition.
5. Patrick Henry Winston, "Artificial Intelligence", 3rd Edition, Addison-Wesley.
6. Han Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgann Kaufmann Publishers.
7. N. P. Padhy, "Artificial Intelligence and Intelligent Systems", 1st Edition, Oxford University Press.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Artificial Intelligence Laboratory(PCCO5030L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Provide understanding of various techniques and algorithms of AI used in problem solving, optimization problems and game programming.
2. Familiarize with Perceptron Learning/ Backpropagation algorithm.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the problem and PEAS for a given problems.	L2	Understand
CO2	Identify and apply searching algorithms to solve problems.	L3	Apply
CO3	Write a program for AI gaming problem.	L6	Create
CO4	Write a program to perceptron learning.	L6	Create

List of Laboratory Experiments

1. Select a problem statement relevant to AI.
   (a) Identify the problem
   (b) PEAS Description
   (c) Problem formulation
2. Program to implement Family Tree in Prolog
3. Identify and analyze uninformed search Algorithm to solve the problem.
   Implement BFS/DFS/DFID search algorithms to reach goal state.
4. Identify and analyze informed search Algorithm to solve the problem.
   Implement A* search algorithm to reach goal state.
5. Program to implement Local Search algorithm: Hill climbing search
6. Program on Genetic Algorithm to solve a optimization problem in AI.
7. Identify, analyze, implement a planning problem/Rule based Expert System in a real world scenario.
8. Implementation on any AI Problem: Wumpus world, Tic-tac-toe, 8-Queens Problem
9. Program to implement learning: Perceptron Learning/ Backpropagation Algorithm.
10. Case study of an AI Application.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO5030T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Advanced Operating System (PECO5041T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Pre-requisite: Operating System and Computer Organization.

Course Objectives:

1. To understand the difference between distributed, multiprocessor and virtualization concepts.
2. To explore Real Time Operating System concepts.
3. To explore mobile operating system.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the difference between different types of operating systems.	L4	Analyze
CO2	Describe real time operating systems.	L2	Understand
CO3	Apply correct distributed and multiprocessor operating system concepts to solve real life problems.	L3	Apply
CO4	Improve system performance by applying virtualization concepts.	L6	Improve
CO5	Understand mobile operating system.	L2	Understand

Course Contents

Unit-I Introduction — 04 Hrs.

Functions of Operating Systems, Design Approaches: Layered, Kernel Based And Virtual Machine Approach, Need for Advanced Operating Systems, Types of Advanced Operating Systems (NOS, DOS, Multiprocessor OS, Mobile OS, RTOS, Cloud OS).

Unit-II Distributed Operating Systems — 10 Hrs.

Architecture of Distributed Operating Systems, System Architecture Types, Issues in Distributed Operating Systems, Inherent Limitation of Distribute Systems.

Distributed Mutual Exclusion: Classification of Mutual Exclusion Algorithms, Lamport's, Token-Based Algorithm, Suzuki-Kasami's Broadcast Algorithm, Raymond's Tree Based Algorithm, Distributed Deadlock Detection, Distributed File Systems, Distributed Shared Memory, Distributed Scheduling.

Unit-III Real Time Operating Systems — 10 Hrs.

Basic Model of Real Time Systems, Characteristics, Applications of Real Time Systems, Real Time Task Scheduling, Types of Tasks and their Characteristics. Task Scheduling, Clock Driven Scheduling, Hybrid Schedulers, Event Driven Scheduling, EDF Scheduling, Rate Monotonic Algorithm, Handling Resource Sharing.

Resource Handling: Resource Sharing, Priority Inversion, PIP, PCP, HLP, Scheduling Real Time Tasks in Distributed Systems.

Unit-IV Multiprocessor Operating Systems — 06 Hrs.

Introduction, Basic Multiprocessor System Architectures, Design Issues, Threads/ Process Synchronization: The Test and Set Instruction, the Swap Instruction, Implementation of the Process Wait.

Processor Scheduling: Issues, Co-Scheduling, Smart Scheduling, Affinity Based Scheduling

Unit-V Virtualisation — 06 Hrs.

Introduction to Virtualisation, Types of Virtualisation, Bare Metal (XEN), Hosted (KVM) Virtualisation, Para Virtualisation, Full Virtualisation, Emulation, Server Virtualisation, Network Virtualisation and Storage Virtualisation.

Unit-VI Mobile Operating System — 06 Hrs.

Symbian O.S: Introduction, Kernel Design in Symbian OS, Scheduling in Symbian OS, File Systems on Mobile Phones, I/O in Symbian OS, Application Development using Android.

Text Books:

1. Andrew S. Tanenbaum, "Modern operating system", 4th Edition,Pearson.
2. Pradeep K. Sinha, "Distributed operating system-Concepts and design", 1st Edition, Pearson.
3. Andrew S. Tanenbaum, "Distributed operating system", 1st Edition, Pearson.
4. Rajib Mall, "Real-Time Systems: Theory and Practice", 1st Edition, Pearson.

Reference Books:

1. Mukesh Singhal, Niranjan Shivaratri, "Advance Concepts in Operating System", 1st Edition, Mc Graw Hill.
2. K. C. Wang, "Embedded and Real Time Operating System", 1st Edition, Springer.
3. Cris Wolf and Eric M. Halter, "Virtualization from Desktop to Enterprise", 1st Edition, Apress.
4. Ben Morris, "The Symbian OS Architecture Source Book", 1st Edition, Willey India.
5. Sunita Mahajan and Seema Shah, "Distributed System", 2nd Edition, Oxford.

Evaluation Scheme:

Theory:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Advanced Operating System Laboratory(PECO5041L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To understand the challenges of the system software in cloud computing.
2. To learn thoroughly deadlock detection concept.
3. To explore virtualization using different methods.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply concurrent client server mechanism.	L3	Apply
CO2	Solve the Ricart-Aggrawala algorithm.	L3	Apply
CO3	Demonstrate the various virtualization methods.	L2	Understand
CO4	Illustrate deadlock detection using edge chasing algorithm.	L2	Understand
CO5	Illustrate the concept of android programming	L2	Understand

List of Laboratory Experiments

LAB	Topic / Activity	Explanation of Activity
Lab1	Distributed Programming	Implement concurrent client-server application.
Lab2	Logical Clock	Simulate Lamport's logical clock
Lab3	Distributed Mutual Exclusion	Implement Ricart-Aggarwala Algorithm.
Lab4	Distributed Deadlock	Demonstrate deadlock detection using Edge Chasing algorithm.
Lab5	Hosted Virtualization	Demonstrate hosted virtualization using KVM.
Lab6	Bare Metal Virtualization	Load a new operating system virtually on the client machine using the concept of bare metal virtualization by XEN.
Lab7	Android Programming Basics	Hello world, linking activities, passing data.
Lab8	Handing image and text using Android Programming	ICreate a simple list view with image and text.
Lab9	Building an Application using Android	Integrate a website inside an application, use of SQLite.
Lab10	Case study	Symbian OS

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO5041T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Advanced Database Management System (PECO5042T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Pre-requisite: Basic knowledge of Database management System.

Course Objectives:

1. To provide overview of advancement in SQL and Database technology.
2. To impart knowledge of query processing and optimization.
3. To provide an overview of distributed database systems.
4. To introduce the concept of document-oriented database.
5. To create awareness about potential security threats to a database and mechanisms to handle it.
6. Understand the usage of advanced data models for real life application.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Discuss new developments in database technology.	L2	Understand
CO2	Measure query cost and optimize query execution.	L5	Evaluate
CO3	Design distributed database for better resource management.	L6	Create
CO4	Demonstrate the understanding of the concepts of document-oriented databases.	L3	Apply
CO5	Apply appropriate security techniques database systems.	L3	Apply
CO6	Implement advanced data models for real life applications.	L3	Apply

Course Contents

Unit-I Advance Databases — 06 Hrs.

Indexing and Hashing: Types of Single-Level Ordered Indexes, Multilevel Indexes,Dynamic Multilevel Indexes Using B-Trees and B+-Trees.

New Database Applications and Architectures: e.g., Data Warehousing, Multimedia Database, Mobility Database, NoSQL, Native XML Databases (NXD), Document Orientated Databases, Graph Database, Federated Databases.

Unit-II Query processing and Optimization — 08 Hrs.

Query Processing: Overview, Measures of Query cost, Selection Operation, Sorting, Join Operations, and Other Operations, Evaluation of Expression.

Query Optimization: Translations of SQL Queries into Relational Algebra, Heuristic Approach and Cost-Based Optimization.

Unit-III Distributed Databases — 08 Hrs.

Introduction: Types of Distributed Database Systems, Distributed Database Architectures.

Distributed Database Design: Data Fragmentation, Replication and Allocation Techniques, Distributed Query Processing (Semi join).

Transaction Management, Concurrency Control (Locking) and Recovery in Distributed Databases.

Unit-IV Document oriented database — 08 Hrs.

Object Oriented Database: Need of Object-Oriented Database, Impedance Matching Problem between OO Languages and Relational Database, Case Study db4O.

Document Oriented Database: Need of Document Oriented Database, Difference between Document Oriented Database and Traditional database, Types of Encoding XML, JSON, BSON, Representation XML, Json Objects. Case study on Doc oriented Based such a Mariadb.

Unit-V Advanced data models — 06 Hrs.

Temporal Data Models: Aspects of Valid Time, Bitemporal Time and Bi-temporal Time with Examples of Each.

Spatial Model: Types of Spatial Data Models - Raster, Vector and Image MYSQL Postgres, Mobile Databases.

Unit-VI Data Security — 06 Hrs.

Introduction to Database Security Issues; Authentication and Authorization, Database Auditing, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control

and Role-Based Access Control for Multilevel Security,Introduction to Statistical Database Security.

Text Books:

1. Elmasri & Navathe, "Fundamentals of Database Systems", 4th Edition, PEARSON Education, 2003.

2. Korth, Silberschatz, S. Sudarshan, "Database System Concepts", 5th Edition, McGraw Hill, 2006.

3. Raghu Ramkrishnan & Johannes Gehrke, "Database Management System", 3th Edition, Tata McGraw Hill, 2003.

4. Ruosell J. T. Dyer, "Learning MySQL and Mariadb", O'reilly, 2015.

Reference Books:

1. Chhanda Ray, "Distributed Database System", Pearson Education, 2009.

2. Hector Garcia-Molina, Jeffery D. Ullman, Jennifer Widom, "Database system Implementation", Pearson Education, 2009.

3. Thomas M. Connolly Carolyn Begg, "Database Systems: A practical Approach to Design", Implementation and Management, 4th Edition, Addison-Wesley, 2005.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Advanced Database Management System Laboratory(PECO5042L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Discuss professional and commercial databases.
2. Implement query optimization.
3. Design distributed database system to perform fragmentation.
4. Implement advanced data models for real life applications.
5. Handle different database security issues.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Compare professional and commercial databases.	L2	Understand
CO2	Simulate and implement query optimization.	L3	Apply
CO3	Implement distributed database design with fragmentation and replication.	L3	Apply
CO4	Process and analyze spatial and temporal data.	L4	Analyze
CO5	Discuss security issues and their measures.	L2	Understand

List of Laboratory Experiments

LAB	Topic / Activity	Explanation of Activity
Lab1	SQL Programming	Case study on Professional and Commercial Databases: Summary and Comparison.
Lab2	Query Optimization	Simulate Query optimization by applying an SQL Query on any database.
Lab3	Query Monitoring	Implementation of Query monitor (QEP- Query Execution Plan, Query Statistics).
Lab4	Distributed Database Design	Perform Fragmentation (Range, List, Hash and Key) in DDBS design.
Lab5	Distributed Database Design	Implementation of Replication transparency in DDB.
Lab6	Distributed Database Design	Implementations of two phase / three phases commit protocol.
Lab7	XML Programming	Query execution on XML database.
Lab8	Document Database	Data handing using JSON. (eg. Display user information from JSON file downloaded from Mobile).
Lab9	Spatial and Temporal Data Handling	Processing of Spatial and temporal data.
Lab10	Case study	Case study on Database security issues and measures taken to handle those issues.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO5042T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Network Engineering (PECO5043T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Pre-requisite: Computer Networking.

Course Objectives:

1. Study the Design and Analysis of Advance Computer network.
2. Acquire knowledge of design and analysis of networking paradigms and protocols.
3. Gain advance knowledge of Network layer routing protocols and IP addressing.
4. Study complex network concepts and design issues.
5. Study advance networking architectures vise Software defined network (SDN).
6. Understand the high-performance networking and apply them in real time applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the existing network architecture.	L4	Analyze
CO2	Understand the routing design principles.	L2	Understand
CO3	Describe different protocol specifications and their components.	L1	Knowledge
CO4	Design the complex network by converging different technologies.	L6	Create
CO5	Understand and explain advance network architectures and its components	L2	Understand
CO6	Understanding and developing high performance networks.	L2, L6	Understand, Create

Course Contents

Unit-I Design and Analysis of networks 06 Hrs.

Address Masks, Prefixes, and Sub networks, Network Address Translation (NAT) IP Switching and Routing - Local Delivery and Loopbacks - Address Resolution Protocol Route, Control and Recording Fast Retransmit and Fast Recovery - Congestion-Avoidance Mechanisms – DECbit - Random Early Detection - Source-Based Congestion Avoidance – Tahoe, Reno, and Vegas QoS Application Requirements - Real-Time Audio - Taxonomy of Real-Time Applications - Approaches to QoS Support

Unit-II Internet Routing Design 08 Hrs.

Router Architectures: Functions, Types, Elements of a Router, Packet Flow. Packet Processing: Fast Path versus Slow Path Router Architectures, QoS Attributes Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN Heterogeneous Service, Single-Link Case A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing

Unit-III Protocol Engineering 08 Hrs.

Protocol Specification: Components of specification, Service specification. Communication Service Specification Protocol entity specification: Sender, Receiver and Channel specification, Interface specifications, Interactions, Multimedia specifications, Alternating Bit Protocol Specification, RSVP specification.

Protocol Specification Language (SDL): Salient Features. Communication System Description using SDL Structure of SDL. Data types and communication paths.

Examples of SDL based Protocol Specifications: Question and answer protocol, X-on-X-off protocol, Alternating bit protocol, Sliding window protocol specification

Unit-IV Complex Networks 08 Hrs.

Types of network: Social networks, Information networks, Technological networks, Biological networks.

Properties of network: Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree,network resilience.

Applications: Search on networks, exhaustive network search, guided network search, network navigation; network visualization.

5G Mobile network: Requirement, Designing and deployment of 5G networks.

Unit-V Software Defined Networking 04 Hrs.

SDN vs. P2P/Overlay Networks Players in the SDN Eco-system SDN Applications, SDN Open source,

SDN Future.

Unit-VI High Performance Networks 08 Hrs.

Network Performance analysis: Objectives and requirements for Quality of Service (QoS) in high performance networks, Architecture of high performance networks (HPN), Design issues, protocols for HPN, VHF backbone networks, Virtual interface architectures, virtual interface for networking.

Reference Books:

1. V. Ahuja, "Design and Analysis of Communication Networks", ISE Editions, McGraw Hill.
2. UifTroppens, R. Erkens and W. Muller, "Storage Networks Explained", 2nd Edition, John Wiley & Sons, 2003, .
3. Alex Goldman, "Storage Area Networks Fundamentals", Cisco Press, 2002.
4. Richard Barker and Paul Massiglia, "Storage Area Network Essentials: a Complete Guide to understanding and implementing SANs", John Wiley, India.
5. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", 1st Edition, Morgan Kaufmann, Elsevier, USA, 2014.
6. PallapaVenkataram and Sunilkumar S. Manvi, "Communication Protocol Engineering", 2nd Edition, PHI, 2004.
7. S. N. Dorogovtsev and J. F. F. Mendes, "Evolution of Networks", Oxford University press.
8. James D. McCabe, "Network analysis, Architecture and Design", 2nd Edition, Elsevier,2003.
9. Bertsekas & Gallager, "Data Networks", 2nd Edition, Pearson Education, 2003
10. R. Shetty, "5G Mobile core Network: Design, Deployment, Automation and Testing strategies", Apress publication.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Network Engineering Laboratory(PECO5043L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Configure a DHCP Server to serve contiguous IP addresses.
2. Use open-source tools for network debugging and diagnostics.
3. Demonstrate various computer network protocols.
4. Evaluate Network Performance using NS-2.
5. Analyze HTTP Traffic using tools like Wireshark.
6. Create and set up a virtual LAN.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Configure a DHCP Server and use various open-source tools for debugging and diagnostics.	L3	Apply
CO2	Demonstrate various computer network protocols.	L2, L3	Understand, Apply
CO3	Evaluate Network Performance using NS-2 and various open source tools.	L5	Evaluate
CO4	Analyze HTTP Traffic and Configure iptables.	L4	Analyze
CO5	Create and set up a virtual LAN.	L6	Create

List of Laboratory Experiments

1. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default
2. Configure, implement and debug the following: Use open-source tools for debugging and diagnostics.
3. Demonstrate any one of the protocol –
   (a) ARP/RARP protocols
   (b) RIP routing protocols
   (c) BGP routing
   (d) OSPF routing protocols
4. Evaluate Network Performance Evaluation using NS-2.
5. Comparative analysis of routing protocols with respect to QOS parameters using Xgraph /gnuplot for different load conditions.
6. Analyze HTTP Traffic using Wireshark.
7. Configure and use iptables.
8. Simulate simple SDN network.
9. Evaluate different QoS parameters through ns2.
10. Creating and set up a virtual LAN.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO5043T with minimum 06 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Programming Laboratory –II (Python)(PCCO5050L)

Practical Scheme
Practical : 04 Hrs./week
Credits : 02

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 25 Marks
Total : 75 Marks

Course Objectives:

1. To learn the basic and OOP concepts of Python.
2. To study various advance python concept like inheritance, exception handling, modules etc.
3. Learn to develop GUI based standalone and web application.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand basic and object-oriented concepts, data structure implementation in Python.	L2	Understand
CO2	Apply file, directory handling and text processing concepts in Python.	L3	Apply
CO3	Apply database connectivity, client-server communication using Python.	L3	Apply
CO4	Apply various advance modules of Python for data analysis.	L3	Apply
CO5	Develop Python-based application (web/Desktop) using django web framework/Tkinter.	L3	Apply

Course Contents

Unit-I Python Basics — 12 Hrs.

Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, Functions, List and Tuples, Dictionaries Exception, Introduction to OOP, Classes, Objects, Linked List, Stack, Queues, Inheritance.

Unit-II Advanced Python — 10 Hrs.

Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders, Python OS Module, Python Datetime Module, Python Math and Random Modules.

Text Processing, Regular expression in Python.

Unit-III Python Integration Primer — 10 Hrs.

Graphical User interface using Tkinter : Form designing.

Networking in Python: Client Server socket programming.

Python database connectivity: Data Definition Language (DDL), and Data Manipulation Language (DML).

Emails with Python: Introduction to Emails with Python, Sending Emails with Python, Receiving Emails with Python.

Unit-IV Python advance Modules — 12 Hrs.

Numpy: Working with Numpy, Constructing Numpy arrays, Printing arrays, Arithmetic Operations on matrix.

OpenCV: Open CV - Installation, Sample code – Open CV.

Matplotlib: Matplotlib-Installation & Sample code, Bar Chart.

Pandas: Data Processing, Pandas-Data structure, Pandas-Series data, Data Frames.

Unit-V Django Framework — 12 Hrs.

Introduction to Django: Django's take on MVC: Model, View and Template, Installation and set up.

models.py, urls.py, views.py, Setting up database connections.

Managing Users & the Django admin tool

Designing a good URL scheme, Generic Views.

Form classes, Validation, Authentication, Advanced Forms processing techniques.

Django REST framework.

Text Books:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press.
2. James Payne, "Beginning Python: Using Python 2.6 and Python 3.1", Wrox publication.
3. E. Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education.

Reference Books:

1. "Learn Python the Hard Way", 3rd Edition, (Zed Shaw's Hard Way Series).
2. Laura Cassell, Alan Gauld, "Python Projects", Wrox publication.

Digital Material:

1. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
2. http://spoken-tutorial.org
3. www.staredusolutions.org
4. https://www.tutorialspoint.com/python/index.htm

List of Laboratory Experiments

1. Exploring basics of python like data types (strings, list, array, dictionaries, set, tuples) and control statements.
2. Creating functions, classes and objects using python.
3. Menu driven program for data structure using built in function for link list, stack and queues.
4. Demonstrate exception handling.
5. Python program to explore different types of Modules.
6. Demonstrate File handling and Directories.
   (a) Python program to append data to existing file and then display the entire file.
   (b) Python program to count number of lines, words and characters in a file.
   (c) Python program to display file available in current directory.
7. Make use of RE module to perform text processing.
8. Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes.
9. Program to demonstrate CRUD (create, read, update and delete) operations on database (SQLite/ MySQL) using python.
10. Implementation of simple socket programming for message exchange between server and client.
11. Make use of advance modules of Python like OpenCV, Matplotlib, NumPy.
12. Creating web application using Django web framework to demonstrate functionality of user login and registration (also validating user detail using regular expression).

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA) 50 Marks:

Laboratory work will be based on PCCO5050L with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 10 Marks
2. Journal Submission: 10 Marks
3. Viva-voce: 10 Marks
4. Subject Specific Lab Assignment/Case Study: 20 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE) 25 Marks:

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Professional and Business Communication (HMCO5060T)

Teaching Scheme
Lectures : 02 Hrs/week
Credits : 02

Examination Scheme
Teacher Assessment : 50 Marks
Total Marks : 50 Marks

Prerequisite: Basic course in Effective Communication Skills.

Course Objectives:

1. To inculcate professional and ethical attitude at the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective presentation skills.
4. To hone written skills for technical documentation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Plan, organize and write technical documents like reports, proposals and research papers in the prescribed format using appropriate language and style with an understanding of ethics in written communication.	L6	Create
CO2	Apply techniques of writing resume, participating in a group discussion and facing interviews.	L3	Apply
CO3	Develop interpersonal skills in professional and personal situations.	L2	Understand
CO4	Understand the documentation process of meetings and conduct meetings in a professional manner.	L6	Create
CO5	Understand communication across cultures and work ethics.	L3	Apply
CO6	Design and deliver effective presentations using Power Point.	L3	Apply

Course Contents

Unit-I Technical Writing — 08 Hrs.

Report Writing: Types of report, parts of formal report, collection of data and survey analysis, pre-writing of report, language and style in reports, formatting of reports, referencing in report.

Proposal Writing: Types of technical proposals, format of proposal, language and style, presentation of proposal.

Technical Paper Writing: parts of a technical paper, language and formatting, referencing in IEEE format.

Plagiarism: Types of plagiarism, consequences of plagiarism.

Unit-II Employment Skills — 06 Hrs.

Group Discussion: Purpose of a GD, types of GD, criteria for evaluating a GD, Dos and Don'ts of a GD, Tips to be successful in GD.

Cover Letter & Resume Writing: Format and content of cover letter, types of resume, structure, content and formatting of resume.

Interview Skills: Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview.

Unit-III Introduction to Interpersonal Skills — 05 Hrs.

Emotional Intelligence: Definition, difference between IQ and EQ, how to develop EQ.

Leadership: Types of leadership, leadership styles, case studies.

Team Building: Difference between group and team, importance of team work, strategies to be a good team player.

Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals.

Conflict Management: Types of conflicts, strategies to manage conflict, case studies.

Unit-IV Meetings and Documentation — 02 Hrs.

Planning and preparation for meetings, strategies for conducting effective meetings, notice, agenda and minutes of a meeting, business meeting etiquettes.

Unit-V Cross-cultural communication and Ethics — 03 Hrs.

Communication across cultures, professional and work ethics, responsible use of social media Introduction to Intellectual Property Rights.

Unit-VI Presentation Skills 02 Hrs.

Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation.

Reference Books:

1. Fred Luthans, "Organizational Behavior", McGraw Hill, Edition.
2. Lesiker and Petit, "Report Writing for Business", McGraw Hill, Edition.
3. Huckin and Olsen, "Technical Writing and Professional Communication", McGraw Hill.
4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning.
5. Heta Murphy, "Effective Business Communication", McGraw Hill, Edition.
6. Sharma R. C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw-Hill Education.
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill.
8. Bell, Smith, "Management Communication", Wiley India Edition, 3rd Edition.
9. Dr. Alex, K., "Soft Skills", S. Chand and Company.
10. Subramaniam R., "Professional Ethics", Oxford University Press.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Continuous Assessment shall consist of Presentation, Group Discussion and Assignments.
The distribution of marks will be as follows:

1. Presentation: 10 Marks
2. Group Discussion: 10 Marks
3. Assignments: 30 Marks

Total : 50 Marks

List of Assignments (Each assignment carries 06 marks):

1. Business Proposal (PowerPoint presentation)
2. Resume writing

3. Interpersonal Skills (documentation of activity)

4. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)

5. Business ethics

The final certification and acceptance of journal/manual/report will be subject to satisfactory performance of Continuous Assessment and upon fulfilling minimum passing criteria in the CA.

Semester Project - III (PJCO5070L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objective:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of semester project is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Employability Skill Development Program-II (HMCO5080L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 50 Marks
Total : 50 Marks

Prerequisites: Basic Mathematics, Basic knowledge of C programming

Course Objectives:

1. To enhance the problem solving skills with real life examples.
2. To enable the students to express their thoughts and knowledge on various platforms.
3. Able to describe the basic database management system.
4. Able to implement basic programming project using python.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze and solve the logical problem based on words, venn diagram etc.	L4	Analyze
CO2	Understand and solve the English comprehension, Sentence completion, Sentence Correction problems.	L2, L4	Understand, Analyze
CO3	Understand and illustrate the concept of Exception Handling, Garbage collection.	L2, L3	Understand, Apply
CO4	Understand and describe the fundamental of DBMS, NoSql, MongoDB.	L2	Understand

Course Contents

Unit-I — 10 Hrs.

Reasoning : Data sufficiency, Logical Deductions, Logical Sequence of Words, Logical Venn Diagrams, Statement and Arguments, Statement and Assumptions, Statement and Conclusions Syllogism.

English: Reading Comprehension, Para Jumbles, Cloze Test, Tenses/ Voice/ Speech, Prepositions/ SVA/ Articles, Vocab /Verbal Analogy, Sentence completion, Sentence Correction.

Unit-II — 10 Hrs.

Modules: Introduction, Importance of Modularity programming, Import keyword, User defined modules creation, Function based modules, Classes based modules, Connecting modules, 'from' keyword.

Files Handling: Reading file char by character, Reading file line by line, Modes of files, Writing into file, Append data to a file, Reading CSV file, Pickling and Un pickling

Garbage collection: Introduction, Importance of manual GC, Self-referenced objects, 'gc' module, Collect() method, Threshold function.

Unit III — 08 Hrs.

Collections Framework: Introduction to collection of data types, Importance of Data processing, DS algorithms introduction.

List: Create a list, Adding elements, Deleting elements, Pre-defined functionality of List, Nested List, Immutability and Mutability of List.

Set: The functionality of Set object, Frozen set, Dictionaries, Create a dictionary, Adding elements

Dict: Pre-defined functions of Dict class, Programs using Collection types

Unit IV — 08 Hrs.

Tkinter: – GUI Types of Layouts , Create Labels and Display images, Create Buttons, Create Events, StringVar class, Calculator program using GUI.

Basic ML AI including Projects: Iterators, Nested functions, Generators, Closures, Decorators, Basic ML and AI, PIP, Visualization etc...

Project Domain (Per domain 1 or 2 project)

- ML/AI Based Projects
- Data Analysis Based projects
- Test Summarization based projects
- Web scrapping and crawling

Unit V

10 Hrs.

DBMS Using Python: Introduction to Mysql, Mysql – Python connectivity, DDL, DRL, DML, Transaction management examples (rollback and commit), GUI –Database connectivity.

NoSql Using Python: Installation and Configuration, MongoDB Tools, Collection and Documents, CRUD and the MongoDB Shell, Introduction to CRUD, Introduction to the MongoDB API, Creating a Database, Collection and Documents.

Data Modelling and Schema Design: MongoDB Database References Model Tree Structures, MongoDB Analysing Queries, Atomic Operations, Map Reduce, Text Search, Regular Expression, Capped Collections Administration MongoDB Deployment and Cluster setup, MongoDB GridFS, Trident Spout, Working with Replica Sets, MongoDB Sharding.

Reference Books:

1. Dr. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publication
2. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication.
3. Behrouz Forouzan, "A Computer Science Structure Programming Approaches using C", Cengage Learning.
4. Yashwant Kanetkar, "Let Us C", BPB Publication.

Evaluation Scheme:

Teacher Assessment(TA):

Teacher's Assessment (TA) will carry weightage of 50 marks. The components of TA and the distribution of marks for term work shall be as follows:

1. MCQ Test based on Aptitude: 20 Marks
2. MCQ Test based on Programming skills: 30 Marks
3. Total Marks: 50 Marks

Any other component recommended by BOS and approved by Dean Academics.

Semester - VI

Software Engineering (PCCO6010T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites:

1. Concepts of Object Oriented Programming & Methodology.
2. Knowledge of developing applications with front end & back end connectivity.

Course Objective: To provide the knowledge of Standard Software Engineering discipline.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and Demonstrate basic knowledge in Software Engineering.	L2	Understand
CO2	Identify requirements, analyse, design and develop the software projects.	L3	Apply
CO3	Plan, schedule and track the progress of the projects.	L3	Apply
CO4	Identify risks, manage the configuration and change in software.	L3	Apply
CO5	Apply testing principles on software projects.	L3	Apply
CO6	Apply latest tools and techniques on software projects.	L3	Apply

Course Contents

Unit I — 10 Hrs.

Introduction to Software Engineering and Process Models: Nature of Software, Software Engineering, Software Process, CMM, Generic Process Model.

Prescriptive Process Models: The Waterfall Model, V Model.

Incremental Process Model: Incremental Model.

Evolutionary Process Models: Prototyping Paradigm, The Spiral Model.

Concurrent Process Models: Concurrent Process Model.

The Unified Process

Agile Methodology: Agility Principals, Agile Process Models: Extreme Programming (XP), Adaptive Software Development (ASD), Dynamic Systems Development Method (DSDM), Scrum, Crystal, Feature Driven Development (FDD), Agile Modeling (AM), Kanban Model.

Unit II — 08 Hrs.

Requirement Analysis and Project Estimation: Requirement Elicitation, Software Requirement Specification (SRS).

Requirement Models: Scenario Based Models, Class Based Models, Behavioural Models and Flow Models.

Software Project Estimation: LOC, FP, Empirical Estimation Models COCOMO I, COCOMO II, Specialized Estimation Techniques.

Unit III — 06 Hrs.

Design Engineering and Analysis: Design Principles, Design Concepts, Effective Modular Design-Cohesion and Coupling.

Translating the requirement models into the design model.

Designs: Architectural Design, Component Level Design, User Interface Design.

Unit IV — 04 Hrs.

Project Scheduling and Control: Management Spectrum, 3Ps, Process and Project Metrics.

Scheduling: Work Breakdown Structure, Network Diagram, Gantt Chart.

Unit V — 05 Hrs.

Software Risk: Risk Identification, Risk Assessment, Risk Projection, Risk Refinement, RMMM Plan.

Software Configuration Management: SCM, SCM Repositories, SCM Process, Change Control and Version Control.

Unit VI 06 Hrs.

Software Testing Fundamentals: Strategic Approach to Software Testing, Unit Testing, Integration Testing, Verification, Validation Testing, System Testing, Test Strategies for WebApps.

Software Testing Techniques: White Box Testing, Basis Path Testing, Control Structure Testing and Black Box Testing, TDD

Unit VII 03 Hrs.

Latest Trends in Software Development Engineering

DevOps: DevOps Toolchain, DevOps Architecture (e.g. Docker), DevOps for Deployment.

Text Books:

1. Roger Pressman, "Software Engineering: A Practitioner's Approach", 7th Edition, McGraw-Hill Publications.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education.
3. Ali Behfrooz and Fredeick J. Hudson, "Software Engineering Fundamentals", Oxford University Press.

Reference Books:

1. Ugrasen Suman, "Software Engineering-Concepts and Practices", 2nd Edition, Cengage Learning.
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", 3rd Edition, Springer/Narosa.
3. Jibitesh Mishra and Ashok Mohanty, "Software Engineering", 1st Edition, Pearson.
4. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, Prentice Hall India.
5. Du Zhang and P. Tsai, "Machine Learning Applications in Software Engineering", Vol. 16, 1st Edition, World Scientific.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Software Engineering Laboratory (PCCO6010L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To impart state-of-the-art knowledge on Software Engineering in an interactive manner through the Web.
2. Present case studies to demonstrate practical applications of different concepts.
3. Provide a scope to students where they can solve small, real life problems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Can produce the requirements and use cases the client wants for the software being produced.	L3	Apply
CO2	Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture.	L1	Remember
CO3	Create and specify such a software design based on the requirement specification that the software can be implemented based on the design.	L6	Create
CO4	Can assess the extent and costs of a project with the help of several different assessment methods.	L5	Evaluate

List of Laboratory Experiments

Suggested List of Experiments:

1. Prepare detailed statement of problem for the selected / allotted mini project and identify suitable process model for the same with justification.
2. Develop Software Requirement Specification (SRS) document in IEEE format for the project.
3. Use project management tool to prepare schedule for the project.
4. Prepare RMMM plan for the project.
5. Identify scenarios & develop UML Use case and Class Diagram for the project.
6. Draw DFD (upto 2 levels) and prepare Data Dictionary for the project.
7. Develop Activity / State Transition diagram for the project.
8. Develop Sequence and Collaboration diagram for the project.
9. Change specification and make different versions using any SCM Tool.
10. Develop test cases for the project using testing techniques.
11. Experiment on DevOps application.

Any other practical covering the syllabus topics and subtopics can be conducted.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO6010T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including the practicals performed during laboratory sessions.

Advanced Algorithms (PCCO6020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Concepts of Data structures, Discrete Mathematics and Analysis of Algorithm.

Course Objective: To provide conceptual and practical knowledge of Advanced Algorithm.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the chosen algorithm.	L4	Analyze
CO2	Choose appropriate data structure and algorithm for given problem statement.	L3	Apply
CO3	Design the algorithm.	L6	Create

Course Contents

Unit-I Analysis of Algorithm Based on Time — 06 Hrs.

Asymptotic notations: Omega, Theta, Big-O, Small-o, small Omega and Tilde.

Amortized Analysis: Aggregate Method, Accounting Method, Potential Method, Beyond worst-case analysis, Dynamic tables and its amortized analysis, RAM model analysis of algorithm.

Unit-II Probabilistic and Randomized Algorithm — 06 Hrs.

Probabilistic approach to algorithm and Randomized Analysis, Indicator Random Variable (IRV), Randomized Quick Sort, Analysis of Hiring Problem (Flipped Classroom: Analysis of Birthday Paradox Problem, Bins and Balls Problem using IRV), Numerical Probabilistic algorithms with example, Las Vegas and Monte Carlo algorithm, Game theoretic randomized algorithm techniques (Tic-Tac-Toe)

Unit-III Advanced Data Structures — 12 Hrs.

Balanced Search Trees: Red-Black Tree, Randomized BST, Tango Tree.

Heap and Operations: Binomial Tree, Binomial Heap.

Spatial Data Structure: KD Tree, R Tree (Flipped Classroom: R* Tree).

Probabilistic Data Structure: LogLog and HyperLogLog, MinHash with Data mining context. (Flipped Classroom: Count-Min Sketch with Data mining context)

Unit-IV Graph Based Algorithms — 06 Hrs.

Flow Network Introduction: Residual Network, Augmenting Path, Ford-Fulkerson Method, Edmonds-Karp Method, Push-Relable Algorithm (Flipped Classroom: Relable to Front algorithm.

Bipartite Matching: Maximum Bipartite Matching, Weighted Bipartite Matching, Weighted Non-Bipartite Matching (Edmonds algorithm).

Max Flow Min Cut

Unit-V — 06 Hrs.

Computational Geometry: Line Segment Properties, Convex Hull Graham's scan algorithm, Determining whether any pair of segments intersects, Finding the closest pair of points. (Flipped Classroom: Conic Programming).

Geometric Searching: Point Location in polygon using Ray Crossing.

Online Algorithms: River Search Problem, Competitive Ratio, K-Server (Flipped Classroom: List accessing, Paging).

Unit-VI 06 Hrs.

Algorithm Classes: P, NP, NP Hardness and NP Completeness

Np Completeness Proofs: Satisfiability(3 sat), Reducibility, TSP (Flipped Classroom: Sum of Subsets).

Approximation Algorithms: Vertex Cover Problem, Travelling SalesPerson problem.

Network Approximation: Randomized Rounding, Primal Dual algorithms.

Randomized Classes: RP, BPP, ZPP (Adleman's theorem).

Special Topic: Turing Machine Halting Problem (time and space bounds, nondeterminism), Diagonalization problem.

Text Books:

1. Thomas H Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition.
2. S. Sridhar, "Design and analysis of algorithms", 1st Edition, Oxford.
3. Horowitz, Sahani and Rajsekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia.
4. Harsh Bhasin, "Algorithms Design and Analysis", 1st Edition, Oxford, 2015.

Reference Books:

1. Rajeev Motwani, Prabhakar Raghavan, "Randomized Algorithm", 1st Edition, Cambridge University.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", 2nd Edition PHI.
3. Vijay V. Vajirani, "Approximation Algorithms", 1st Edition, Springer.
4. "Computational Complexity", Stanford University.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Advanced Algorithms Laboratory (PCCO6020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objective: To provide practical knowledge to design implementable solution.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze performance of algorithm.	L4	Analyze
CO2	Apply appropriate algorithm along with required advance data structures to design solution of algorithm.	L3	Apply

List of Laboratory Experiments

Suggested List of Experiments:

1. Experiment on Amortized Analysis.
2. Experiment on Randomized Algorithms (Randomized Quick Sort).
3. Experiment on Advanced Data Structure (Red-black Tree Operations).
4. Experiment on Graph Based Algorithms (Ford Fulkerson Method).
5. Experiment on Online Algorithms (K-Server algorithm).
6. Students need to select the problem statement of relevance and provide the implementable solution by selecting appropriate Advanced Data structure and Advanced Algorithm.
7. Also perform Analysis of the same.

Any other practical covering the syllabus topics and subtopics can be conducted.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO6020T with minimum 06 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Information Security (PCCO6030T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Knowledge of Programming Basics and Computer Network.

Course Objectives:

1. To introduce classical encryption techniques and concepts of modular arithmetic and number theory.
2. To explore the working principles and utilities of symmetric cryptographic algorithms.
3. To distinguish symmetric and asymmetric cryptography and explore the working principles and utilities of asymmetric cryptographic algorithms.
4. To understand data integrity and explore the design issues and working principles of various authentication protocols, PKI standards and various secure communication standards.
5. To understand network and system attacks and develop utility programs for secure communication.
6. To explore Software vulnerability and develop and apply preventive measures.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.	L2	Understand
CO2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.	L2, L2, L5	Understand, Compare, Apply
CO3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.	L3, L5	Apply, Evaluate
CO4	Apply different digital signature algorithms to achieve authentication and design secure applications.	L3	Apply
CO5	Understand network security basics, analyze different attacks on networks and systems.	L2, L4	Understand, Analyze
CO6	Understand Software vulnerability and Apply preventive measures.	L2, L3	Understand, Apply

Course Contents

Unit-I Introduction and Number Theory — 07 Hrs.

Services, Mechanisms and attacks-the OSI security architecture-Network security model classical Encryption techniques (Symmetric cipher models, substitution techniques, transposition Techniques), Number theory Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem, Chinese Remainder theorem.

Unit-II Symmetric Cryptography — 07 Hrs.

Block cipher principles block cipher modes of operation, Simplified Data Encryption Standard (DES), DES, Double DES, Triple DES, Simplified Advanced Encryption Standard (S-AES), AES- Blowfish, IDEA.

Unit-III Asymmetric Cryptography — 08 Hrs.

Symmetric vs. Asymmetric Cryptography, Principles of public key cryptosystems, and Essential Number Theory for Public-Key Algorithm: Euclidean algorithm, Extended Euclidean Algorithm, Euiler's Phi Function, Fermat's Little Theorem and Euiler's Theorem. The RSA algorithm, Key management, Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography.

Unit-IV Integrity, Authentication and Digital Certificates — 07 Hrs.

Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, CMAC. User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. RSA Signature Schemes, Elgamal Digital Signatures, Digital Signature Algorithm. Digital Certificate: X.509, PKI.

Unit-V Network Security — 08 Hrs.

Network security basics: TCP/IP vulnerabilities (Layer wise), Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP SYN flood, DNS Spoofing. Denial of Service: Classic DOS attacks, Source Address spoofing, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Defenses against Denial-of-Service Attacks. Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewalls, IDS and types, Honey pots, Case Study on Network Security.

Unit-VI Software Security — 05 Hrs.

Software Vulnerabilities: Buffer Overflow, Salami Attack, Format string, cross-site scripting, SQL injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits Introduction to Secured Software Development Life Cycle. , Case Study on Software Security.

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", 7th Edition, Pearson Education, June 2017.
2. Behrouz A. Forouzan, "Cryptography & Network Security", 1st Edition, Tata Mc-Graw Hill, 2007.

Reference Books:

1. Bruce Schneier, "Applied Cryptography, Protocols Algorithms and Source Code in C", 2nd Edition Wiley.
2. Charles Pfleeger, Shari Lawrence Pfleeger & Jonathan Margulies, "Security in Computing", 5th Edition, Prentice Hall.
3. Michael Howard, Steve Lipner, "The Security Development Life Cycle", 1st Edition, Microsoft Press.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B): Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Information Security Laboratory (PCCO6030L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Implement Encryption and Decryption algorithms and apply different attacks.
2. Implement RSA Cryptosystem using RSA Algorithm.
3. Demonstrate the data integrity using various cryptographic algorithms like MD-5, SHA-1.
4. Use packet sniffer tools and capture ICMP, TCP and http packets in promiscuous mode.
5. Implement Network Intrusion Detection System using SNORT and IPTABLE.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the cryptographic algorithms for data communication.	L3	Apply
CO2	Demonstrate the data integrity using various cryptographic algorithms.	L2, L3	Understand, Apply
CO3	Implement Digital signature for secure data transmission.	L6	Create
CO4	Utilize the different open source tools for network security and analysis	L3	Apply
CO5	Demonstrate Network Intrusion Detection using network security tool.	L2, L3	Understand, Apply

List of Laboratory Experiments

Suggested List of Experiments:

1. Design and Implement Caesar cipher cryptographic algorithm by considering letter [A..Z] and digits [0..9]. Apply Brute Force Attack to reveal secret.
2. Design and Implement Encryption and Decryption algorithm using Simple Columnar Transposition cipher technique. Study how dictionary attack can be applied on it.
3. Design and Implement your "own" cipher combining "Substitution" and "Transposition" techniques.
4. Implement RSA Cryptosystem using RSA Algorithm / Implement Elliptical Curve Digital Signature Algorithm (ECDSA).
5. Demonstrate the data integrity using various cryptographic algorithms viz. MD-5, SHA-1 using VLAB, IIT Bombay.
6. Implement registration webpage asking for information along with the password (Strong enough). Store the password in database in encrypted form after adding few salt characters in the password. Verify the strength of password and perform analyses using various attack.
7. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
8. Study of packet sniffer tools wireshark : Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. Explore how the packets can be traced based on different filters.
9. Implementation of Network Intrusion Detection System using SNORT and IPTABLE.
10. Implement DOS Attack using HPing, Hping3 and other tools.
11. Implement Buffer Overflow Attack using Ollydbg, Splint, Cppcheck.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO6030T with minimum 07 experiments, 1 Power Point Presentation and minimum 2 assignments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Big Data Infrastructure (PECO6041T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Databases, Python, Java, R, Linux OS.

Course Objectives:

1. To define big data solutions for business intelligence.
2. To analyse business case studies for big data analytics.
3. To develop map-reduce analytics using Hadoop and related tools.
4. To perform data storage and management using NoSqL.
5. To perform realtime analysis on streaming data.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe big data and use cases from selected business domains.	L1	Remember
CO2	Perform map-reduce analytics using Hadoop.	L3	Apply
CO3	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics.	L3	Apply
CO4	Build and maintain reliable, scalable, distributed systems using Apache Spark.	L3	Apply
CO5	Design and build MongoDB based Big data Applications and learn MongoDB query language.	L6	Create
CO6	Use streaming tools for real time analysis of bigdata.	L3	Apply

Course Contents

Unit-I Introduction to Big Data and Hadoop — 02 Hrs.

Introduction to Big Data, Distributed file system, Big Data characteristics, Drivers, types of Big Data, Traditional vs. Big Data business approach, Case Study of Big Data Solutions, Bigdata Applications, Societal and Ethical issues associated with the use of big data analytics, The key privacy issues.

Unit-II Introduction to Hadoop and Hadoop Architecture — 08 Hrs.

Big Data: Apache Hadoop & Hadoop EcoSystem.

Moving Data in and out of Hadoop: Understanding inputs and outputs of MapReduce Concept of Hadoop.

HDFS Commands

MApReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution

Unit-III HDFS, Hive and HiveQL, HBase — 12 Hrs.

HDFS: Overview, Installation and Shell, Java API

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating.

Map Reduce Scripts, Joins & Sub queries.

HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG- Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.

Zookeeper, how it helps in monitoring a cluster.

Build Applications with Zookeeper and HBase.

Unit-IV SPARK — 06 Hrs.

Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.

Unit-V NoSQL — 08 Hrs.

Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL

Introduction to MongoDB key features: Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language.

Unit-VI Processing of Real Time Data and Streaming Data 06 Hrs.

Data Streams: Introduction and Ingestion, Kafka, Storm & Storm Assignment, Spark Streaming.

Text Books:

1. Chris Eaton, Dirk deroos et al., "Understanding Big data", 1st Edition, McGraw Hill.
2. Kyle Banker, Piter Bakkum, Shaun Verch, "MongoDB in Action", 2nd Edition, Dream tech Press.
3. Balaswamy Vaddeman, "Beginning Apache Pig-Big Data Processing Made Easy", 1st Edition, Apress.
4. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilley, 2012.
5. Eric Sammer, "Hadoop Operations", 1st Edition, Reilly, 2012.

Reference Books:

1. Paul Zikopoulos, Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, "Understanding Big Data: Analytics for Enterprise Class Hadoop and streaming Data", The McGraw-Hill Companies, 2012.
2. Vignesh Prajapati, "Big data analytics with R and Hadoop", 1st Edition, Packt Publishing, SPD 2013.
3. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", 1st Edition, O'Reilley, 2012.
4. Alan Gates, "Programming Pig", 1st Edition, O'Reilley, 2011.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Big Data Infrastructure Laboratory (PECO6041L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Demonstrate the knowledge of big data analytics.
2. Implement different file management task in Hadoop.
3. Analyze and perform different operations on data using Hive and Pig.
4. To perform realtime analysis on streaming data.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Set up single node Hadoop Clusters.	L3	Apply
CO2	Design MapReduce program to analyze structured or unstructured data.	L6	Create
CO3	Set up and data analysis with Spark.	L3	Apply
CO4	Analyze real time data with Kafka and Spark Streaming.	L4	Analyze

List of Laboratory Experiments

Suggested List of Experiments:

1. Installation of Hadoop on a single node cluster.
2. Execution OF HDFS Commands.
3. Execution of MapReduce program for sorting of numbers and counting word occurrences in a text file.
4. Execute HIVE commands to load, insert, retrieve, update, or delete data in the tables.
5. Execute PIG built in commands and rum pig scripts on HDFS.
6. Installation and Configuration of Apache Spark.
7. Execution of ML algorithms using Apache Spark Mlib.
8. Perform CRUD Operations using Mongodb.
9. Read streaming data using Kafka.
10. Perform Twitter Sentiment analysis usinfg Spark Streaming

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6041T with minimum 06 experiments along with a mini project to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Internet of Things (PECO6042T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Basics of python programming, Computer Networks.

Course Objectives:

1. Provide an overview of concepts, trends and challenges of Internet of Things.
2. Impart the knowledge of sensors and embedded systems.
3. Describe IoT deployment levels and M2M technologies
4. Facilitate use of hardware and software technologies related to Internet of Things.
5. Provide the knowledge of IoT communication models and protocols.
6. Develop skills to relate the IoT technologies for practical IoT applications

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Comprehend the Internet of Things concepts and investigate the challenges.	L2	Understand
CO2	Gain knowledge of sensors and embedded systems.	L2	Understand
CO3	Develop and deploy IoT system prototype with enhanced IoT Technologies.	L3	Apply
CO4	Get hand-on exposure to different IoT processors and controllers.	L3	Apply
CO5	Use IoT communication models and protocols.	L3	Apply
CO6	Design and develop small IoT applications to create smart objects.	L3	Apply

Course Contents

Unit-I Introduction to WSN and IoT — 04 Hrs.

Introduction to WSN and its Technologies, Architecture and characteristics of WSN, Scalability issues and challenges of a Wireless Sensor Network, Introduction to Internet of Things, Characteristics and applications of IoT, IoT Reference Model, Security issues in the IoT, Disambiguation of IoT vs IoE vs M2M vs others.

Unit-II Transducers, Sensors and Actuators — 05 Hrs.

Introduction and classification of Transducers, Sensors and Actuators, Types of Sensors: Motion Detectors, Occupancy Detectors, Force Sensors, Strain Sensors, Tactile sensors, Pressure sensors, Chemical sensors, Temperature Sensors etc. Types of Actuators, Solenoid, Voice Coil, DC Motor, AC Motor and Stepper motor, Embedded systems: Characteristics of Embedded Systems.

Unit-III Introduction to Arduino and Raspberry Pi — 08 Hrs.

Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types, Introduction to Embedded C and Arduino platform.

Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi.

Unit-IV IoT Model and Protocols — 10 Hrs.

IoT Levels & Deployment Templates, IoT Level 1, IoT Level 2, IoT Level 3, IoT Level 4, IoT Level 5, IoT Level 6, M2M, Various operating systems, TinyOS, Contiki OS, MANTIS, Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, IPv6, 6LoWPAN, Comparison of protocols.

IoT Routing Protocols, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC (Energy Conserve), SPIN BC, Hierarchical Protocols, LEACH, QoS-Based Protocols.

Unit-V IoT applications — 08 Hrs.

IoT for Entertainment and wearables: Bluetooth Headset, Fitness, Smart Watch, location and Tracking – Personal navigation Device.

IoT for Manufacturing: Flow Optimization, Real Time Inventory, Asset Tracking Process, Analytics (pH, Gas, Concentration, Force& Humidity)- portable data terminal.

IoT for Employee safety: Fire and safety detector, Predictive Maintenance, Firmware Updates.

IoT for Healthcare: Remote Monitoring-ECG, Ambulance Telemetry, Drug Tracking, Hospital Asset Tracking, Access Control, Predictive Maintenance.

IoT for Logistics & Supply chain: Retail Supply chain control, NFC Payment, Intelligent shopping application, Smart product management, Case studies on Smart cities, Smart Home, Smart Environment, Smart Agriculture.

Unit-VI IoT in Cloud, Fog and Edge Computing 05 Hrs.

Overview of Cloud and Fog Computing, Definition, Difference between Fog and Cloud, Related Paradigms and Technologies like MCC, MEC, Edge Computing, Taxonomy of Fog Computing, Different dimensions of Fog computing Advantages and Applications. Edge Computing: Architecture of Edge Computing, Benefits, Applications, Cloud, Fog and Edge Computing Use Case Scenarios for IoT.

Unit-VII Artificial Intelligence in IoT 05 Hrs.

Applications of Artificial Intelligence in Internet of Things: Real world examples: Tesla Motors – Self Driving Cars, WildTrack – Endangered Species Preservation, Nest Labs – Smart thermostat, Automated vacuum cleaner – iRobot Roomba.

IoT companies and vendors: Commercially available IoT devices from vendors, Google Home Voice Controller, Amazon Echo Plus Voice Controller, August Doorbell Cam, August Smart Lock.

Text Books:

1. K. G. Srinivasa, G. M. Siddesh, Raju R. Hanumantha, "Internet of Things", 1st Edition, CENGAGE Publication.

Reference Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st Edition, Universities Press.
2. Raj Kamal, "Internet of Things, Architecture and Design Principles", 1st Edition, Mc-Graw Hill Education.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B): Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Internet of Things Laboratory (PECO6042L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Provide an overview of concepts, trends and challenges of the Internet of Things.
2. Impart the knowledge of sensors and embedded systems.
3. Facilitate use of hardware and software technologies related to Internet of Things.
4. Develop skills to relate the IoT technologies for practical IoT applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge of sensors and embedded systems.	L2	Understand
CO2	Get hand-on exposure to different IoT processors and controllers.	L3	Apply
CO3	Design and develop small IoT applications to create smart objects.	L3	Apply

List of Laboratory Experiments

Suggested List of Experiments:

Arduino

1. LED glow
2. Traffic signal
3. Seven segment display
4. Piezo sensor
5. Light emission
6. PIR sensor
7. IR remote control sensor
8. Ultrasonic sensor
9. ESP8266 WiFi Module
10. ThingSpeak Platform
11. Blynk App
12. Working with Own Cloud Server (Hosting)
13. Creating a platform to control home appliances with own server

R-Pi

1. Varying the brightness of LED using R-pi.
2. Making a user interface to Turn Things On and Off.
3. Controlling GPIO Outputs using a Web Interface.
4. Create an user interface to control Servo motor.
5. Camera Interfacing and Programming.
6. Playing an Audio File.
7. GSM/GPS interfacing and programming.
8. Measuring distance.
9. Displaying sensor values.

10. Logging to a USB flash Drive.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6042T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Business Analytics (PECO6043T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Basic statistics and Database.

Course Objectives:

1. Business Analytics refers to skills, practices and techniques used in converting data into information and knowledge that aid business decision making.
2. Statistical learning including quantitative, qualitative analysis techniques.
3. The use of the above analysis and visualization to aid decision making.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Able to familiar with Base SAS programming.	L1	Remember
CO2	Understand and demonstrate visual analytics.	L2	Understand
CO3	Able to design the report using reporter.	L3	Apply
CO4	View various reports using different media devices.	L5	Evaluate

Course Contents

Unit-I Introduction to Base SAS — 08 Hrs.

SAS Program: Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax.

Accessing Data: Examining SAS Data sets, Accessing SAS Libraries.

Producing Detail Reports: Subsetting Report data, Sorting and Grouping Report data, Enhancing Reports.

Formatting Data Values: Using SAS Formats, User defined Formats.

Unit-II Reading SAS Dataset, Spreadsheet & Database Data 05 Hrs.

Reading SAS Dataset, Customize SAS Dataset, Router Reading Spreadsheet data, Reading database data.

Unit-III Visual Analytics — 04 Hrs.

Getting Stated with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page.

Administrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator.

Demonstrations and Exercises.

Unit-IV Using the Explorer — 08 Hrs.

Selecting Data and defining Data Item properties, Creating Visualisations, Enhancing Visualisations with Analytics, Interacting with Visualizations and Explorations.

Unit-V Designing Reports with Reporter — 08 Hrs.

Creating a Simple Report, Creating Data Items and Working with Graphs, Working with Filters and Report sections, Working with other objects, Demonstrations and Exercises.

Unit-VI Viewing SAS VA Reports and Case Study — 06 Hrs.

Creating Analyses and Reports, Viewing Reports on the Web, Viewing Reports on the Mobile Device/ Office Analytics, Case Study – Creating Analyses and Reports.

Text Books:

1. "SAS programming 1 – Essentials", 1st Edition, SAS Publisher, Jan 2006, ISBN-13.
2. "SAS Visual Analytics – Fast Track", SAS Publisher, Jan 2013, ISBN-13.
3. "SAS Support".

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Business Analytics Laboratory (PECO6043L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To learn how to use and apply SAS Studio and Excel to solve business problems.
2. To become familiar with the processes needed to develop, report, and analyze business data.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and use the fundamentals of the SAS programming language.	L2	Understand
CO2	Make use of SAS, Excel and CSV in business analytics.	L3	Apply
CO3	Understand new SAS data set by manipulating data from existing data sets using SAS expressions	L2	Understand
CO4	Analyze and report on data and export results to common formats (PDF, Excel).	L4	Analyze
CO5	Apply different types of data (SAS, Excel, or text), then explore and prepare the data.	L3	Apply
CO6	Apply SAS programming principles in practical examples.	L3	Apply

List of Laboratory Experiments

Suggested List of Experiments:

1. Importing data in SAS from Excel and CSV file.
2. Creating summary statistical data.
3. Exporting results to Excel and PDF.
4. Manipulating data with functions.
5. Using data with formats like charts and graphs.
6. Creating data by applying filters and performing data analysis on it.
7. Working with graph level display rules.
8. Analyzing a Text data source.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6043T with minimum 06 experiments along with a mini project to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Machine Learning (PECO6051T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Data Structures, Basic Probability and Statistics, Algorithms.

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression, classification and clustering tasks.
3. To become familiar with Dimensionality reduction Techniques.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge about basic concepts of Machine Learning.	L2	Understand
CO2	Identify machine learning techniques suitable for a given problem.	L3	Apply
CO3	Apply Dimensionality reduction techniques.	L3	Apply
CO4	Solve the problems using various machine learning techniques.	L4, L5	Analyze, Evaluate
CO5	Understand the basics of Reinforcement and deep learning.	L2	Understand
CO6	Design application using machine learning techniques	L6	Create

Course Contents

Unit-I Introduction to Machine Learning — 05 Hrs.

Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps involved in developing a Machine Learning Application.

Unit-II Learning with Regression and trees — 07 Hrs.

Learning with Regression: Linear Regression, Logistic Regression.

Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART).

Unit-III Dimensionality Reduction — 07 Hrs.

Dimensionality Reduction Techniques: Principal Component Analysis, Independent Component Analysis, Single value decomposition.

Unit-IV Learning with Classification and Clustering — 12 Hrs.

Learning with Classification Artificial Neural Networks: Backpropagation Algorithm, Self-Organizing Maps.

Non-parametric classification: K Nearest Neighbour Algorithm.

Support Vector Machine: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

Bayesian belief Networks: Markov Models, Markov Chain Monte Carlo Methods, , Markov Random Fields, Hidden Markov Models.

Learning with Clustering:K-means clustering, Hierarchical clustering, Expectation Maximization Algorithm.

Supervised learning after clustering, Radial Basis functions.

Unit-V Reinforcement and Deep Learning — 05 Hrs.

Reinforcement Learning: Introduction, Elements of Reinforcement Learning, Model based learning, Temporal Difference Learning, Generalization, Partially Observable States.

Deep Learning: Introduction to Deep Neural Network, Wide Vs. Deep Neural Network, Reasons to opt for deep neural network, Deep Neural networks for unsupervised learning.

Unit-VI Applications of Machine Learning — 04 Hrs.

Recommender Systems, Machine Learning for Image Recognition, Sentiment Analysis, Machine Learning for video surveillance.

Text Books:

1. Peter Harrington, "Machine Learning In Action", DreamTech Press.
2. Ethem Alpaydm, "Introduction to Machine Learning", 3rd Edition, MIT Press.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill.
4. Stephen Marsland, "Machine Learning An Algorithmic Perspective", CRC Press.
5. Kevin P. Murphy, "Machine Learning - A Probabilistic Perspective".
6. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'reilly.
7. François Chollet, "Deep Learning with Python", Manning.
8. J. S. R. Jang, "Neuro-Fuzzy and Soft Computing", PHI 2003.

Reference Books:

1. Han Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Morgann Kaufmann Publishers.
2. Margaret H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Machine Learning Laboratory (PECO6051L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To implement linear and logistic regression model.
2. To implement supervised learning algorithm.
3. To Apply Exploratory Data Analysis

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To Build and Analyze regression model.	L3, L4	Apply, Analyze
CO2	To Build and Analyze supervised machine learning algorithm.	L3, L4	Apply, Analyze
CO3	Apply Dimensionality reduction techniques.	L3	Apply
CO4	Make use of Exploratory Data Analysis.	L3, L4	Apply, Analyze

List of Laboratory Experiments

Suggested List of Experiments:

1. To implement Linear Regression.
2. To implement Logistic Regression.
3. To implement CART decision tree algorithm.
4. To implement Support Vector Machine.
5. To implement Bayesian Classification.
6. To implement PCA.
7. To implement K-Nearest Neighbour.
8. To implement Radial basis functions.
9. Mini project based on any machine learning application.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6051T with minimum 06 experiments along with a mini project to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Compiler Design (PECO6052T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Data Structures and Algorithms, Theory of Computation.

Course Objectives:

1. To initiate an understanding of compilers in general and in brief about phases of compiler.
2. To provide a theoretical framework for optimizing the code.
3. To familiarize and encourage the students to use various compiler construction tools.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basics of compilation steps.	L2	Understand
CO2	Apply knowledge of automata theory and formal languages.	L3	Apply
CO3	Understand and Implement a Parser.	L2	Understand
CO4	Describe techniques for intermediate code and machine code optimization.	L2	Understand
CO5	Apply various Error Recovery mechanisms.	L3	Apply

Course Contents

Unit-I Introduction — 04 Hrs.

Introduction to compilers: Compilers Analysis of source Program, the tasks of a compiler, Analysis of the Source Program, Phases and Passes in compilers, The Grouping of phases, Cousins of the compiler, Compiler - construction tools.

Introduction to Interpreters: Phases of interpreter, Types of interpreter, Compiler vs. Interpreter.

Unit-II Lexical Analysis — 04 Hrs.

Role of a Lexical analyser, Input buffering, specification and recognition of tokens, Designing a lexical analyser generator, Pattern matching based on NFA's.

Unit-III Syntax Analysis — 10 Hrs.

Role of Parser, Top-down parsing, Predictive parsers -(LL), Bottom-Up parsing, Operator precedence parsing, SLR, CLR and LALR parsers.

Unit-IV Syntax directed Translation — 04 Hrs.

Syntax directed definitions, Inherited and Synthesized attributes, Evaluation order for SDDs,S - attributed Definitions, L- attributed Definitions

Unit-V Intermediate code generation — 06 Hrs.

Intermediate Code types: Postfix, Parse tree and syntax tree, Three address code.

Types of Three address code: Quadruples, Triples and Indirect triples.

Translation of Assignment statements, Boolean expression, case statements, array references and procedure calls.

Unit-VI Code generation — 04 Hrs.

Issues in the design of Code Generator, Basic Blocks and Flow graphs, Code generation algorithm, DAG representation of Basic Block.

Unit-VII Code optimization — 04 Hrs.

Principal sources of Optimization, Optimization of Basic Blocks, Loops in Flow graph, Peephole Optimization.

Unit-VIII Run-time storage management — 06 Hrs.

Data Structures for symbol table, representing scope information, Error detection and recovery, Error handling, Storage allocation strategies, parameter passing, introduction to garbage collection and

compaction.

Text Books:

1. A. V. Aho, R. Shethi, Monica Lam, J. D. Ulman, "Compilers Principles, Techniques and Tools", 2nd Edition, Pearson Education.

Reference Books:

1. John R. Levine, Tony Mason & Doug Brown, "Lex & yacc", 2nd Edition, O'Reilly.
2. Kenneth C. Louden, "Compiler Construction: Principles and Practice", 1st Edition, Cengage Learning.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Compiler Design Laboratory (PECO6052L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To design & implement a front end of the compiler.
2. To develop program for solving parser problems.
3. To create program for intermediate code generation.
4. To learn the new code optimization techniques and apply it to improve the performance of a program in terms of speed & space.
5. To learn & use the new tools and technologies used for designing a compiler.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the practical approaches of how a compiler works.	L2	Understand
CO2	Understand and analyze the role of syntax and semantics of Programming languages in compiler construction.	L2	Understand
CO3	Apply the techniques and algorithms used in Compiler Construction in compiler component design.	L3	Apply

List of Laboratory Experiments

Suggested List of Experiments:

1. Develop a lexical analyzer to recognize a few patterns in c. (ex. Identifiers, constants, comments, operators etc.)
2. Implementation of lexical analyzer using lex tool.
3. Derive First and Follow of a variable.
4. Design LL (1) Parser.
5. Implementation of Intermediate code generation.
   (a) Assignment statement
   (b) Boolean statement
   (c) Loop
6. Implementation of code generator algorithm.
7. Implementation of code optimization techniques (constant folding etc.)
8. Case study: LLVM

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6052T with minimum 10 experiments to be incorporated including 07 from the above suggested list. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Human Machine Interaction (PECO6053T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisites: Web Technologies; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc.

Course Objectives:

1. Learn the foundation of human machine interaction.
2. Understand the importance of human psychology in designing good interfaces.
3. Be aware of mobile interaction design and its usage in day – to – day activities.
4. Understand various design technologies to meet user requirements.
5. Encourage to indulge into research in Machine Interaction Design.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify User Interface (UI) design principles.	L2	Understand
CO2	Analysis of effective user friendly interfaces.	L4	Analyze
CO3	Apply Interactive Design process in real world applications.	L3	Apply
CO4	Evaluate UI design and justify.	L5	Evaluate
CO5	Create application for social and technical task.	L6	Create

Course Contents

Unit-I Foundations of HMI — 07 Hrs.

The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving.

The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.

Unit-II Design & Software Process — 08 Hrs.

Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics, human consideration, Human interaction speeds. Interactive Design basics, process, scenarios, navigation, Iteration and prototyping.

HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale.

Design rules: Principles, standards, guidelines, rules. Recognize the goals, Goal directed design process.

Evaluation Techniques: Universal Design.

Unit-III Graphical User Interface — 06 Hrs.

The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics.

Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.

Unit-IV Screen Designing — 07 Hrs.

Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

Unit-V Interface Design for Mobile Devices — 06 Hrs.

Mobile Ecosystem: Platforms, Application frameworks.

Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0.

Mobile Design: Elements of Mobile Design, Tools.

Unit-VI Interaction Styles and Communication 06 Hrs.

Windows: Characteristics, Components, Presentation styles, Types of Windows, Management, operations.

Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.
2. Wilbert O. Galitz, "The Essential Guide to User Interface Design", 2nd Edition, Wiley Publication.
3. Alan Cooper, Robert Reimann, David Cronin, "About Face3: Essentials of Interaction design", 3rd Edition, Wiley publication.
4. Jeff Johnson, "Designing with the Mind in Mind", 3rd Edition, Morgan Kaufmann Publication.
5. Donald A. Normann, "Design of Everyday Things", Basic Books Reprint Edition, 2002.
6. Brian Fling, "Mobile Design and Development", 1st Edition, O'Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece, "Interaction Design:Beyond Human Computer Interaction", 3rd Edition, Wiley.
2. Guy A. Boy, "The Handbook of Human Machine Interaction", 1st Edition, Ashgate Publishing Ltd.
3. Kalbnde, Kanade, Iyer, "Galitz's Human Machine Interaction", Wiley Publications.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Human Machine Interaction Laboratory (PECO6053L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Design and implement useful, usable, and engaging graphical computer interfaces.
2. Describe special considerations in designing user interfaces for wellness.
3. Discuss and critique research in the field of HCI.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To Understand the Computer and Human-Computer Interaction.	L2, L3	Understand, Apply
CO2	To Have an insight to Human Capabilities.	L3	Apply
CO3	Interactive Systems Design.	L6	Create
CO4	Windows Concepts and Interfaces.	L1	Remember

List of Laboratory Experiments

Suggested List of Experiments:

1. Design a Mobile app/ Website that can teach mathematics to children of 4-5 years age in schools in Rural /Urban Sector.
2. Design a Mobile App/Website that can help people to sell their handmade products in metro cities.
3. ATM machine/KIOSK screen design for rural people.
4. Design a Mobile App/Website to get an experience for passengers whose flight /train is delayed.
5. Design an UI application for Institute event management.
6. Design of User interface for the system using various interaction styles.
7. Statistical Graphics and its use in visualization.
8. Design appropriate icons pertaining to a given domain.(Eg. Greeting cards)
9. Design UI for Motor paralysis for disabled people.
10. KIOSK design for Hospital/School/Educational Campus/National Institute.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PECO6053T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Project Stage-I (PJCO6060L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To understand the basic concepts and principles of project development.
- To formulate/identify the problem statement.
- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To identify the problem statement and produce solution of the problem considering cultural, social, environmental and economic factors using appropriate tool and method.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage to conduct the project development activity.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the project development in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:

Database Management System, Networking and Internet of Things, Embedded Systems, Data science and Big data, Web and Application Development, Robotics, AI and Machine Learning, etc.

The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines: The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

- Each student shall work on project stage-I approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the departmental committee) shall be allotted for each Project stage-I. The departmental committee shall include Head of Department, project coordinator and guide(s).
- Each group shall submit at least 3 topics for the Project stage-I. The departmental committee shall finalize one topic for every group.
- Each group is required to maintain separate log book for documenting various activities of the project stage-I (Refer Table 4).
- Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
- In the first review of this semester, each group is expected to complete 30% of project stage-I.
- In the second review of this semester, each group is expected to complete 50% of project stage-I.
- Interaction with alumni mentor will also be appreciated for the improvement of project stage-I.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee.
- Assessment of the project (at the end of the semester) will be done by the departmental committee.
- Oral examination shall be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project stage-I.

Prescribed project report guidelines:

Size of report shall be of minimum 30 pages (excluding cover and front pages). Project stage-I report should include appropriate content for:

- **Abstract**
- **Introduction**
  - Background
  - Motivation
  - Problem Statement
  - Objectives
  - Scope
- **Literature Survey**
  - Review of Existing System(s)
  - Limitations of Existing System(s)
- **Proposed System**
  - Analysis/Framework/ Algorithm
  - Details of H/W and S/W required
  - Design details
  - Methodology (your approach to solve problem)
- **Implementation Plan for Project Stage-II**
- **Conclusion**
- **References**

Assessment criteria for the departmental committee for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 5.

Assessment criteria for the departmental committee for End Semester Exam:

Departmental committee will evaluate project as per Table 6.

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 5: Continuous Assessment Sheet

Sr	P.R.N.	Name of Student	Student Attendance (5)	Log Book Maintenance (5)	Literature Review (5)	Depth of Understanding (5)	Report (5)	Total (25)
			5	5	5	5	5	25

Table 6: Evaluation Sheet

Sr	P.R.N.	Name of Student	Project Stage - I Selection (5)	Design/ Simulation/ Logic (5)	PCB/ Hardware/ Programming (5)	Result Verification (5)	Presentation (5)	Total (25)
			5	5	5	5	5	25

Environmental Studies (MCCO6070T)

Teaching Scheme
Lecture : 01 Hr/week

Audit Course

Prerequisite: Interest in Environment and its impact on Human.

Course Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarise environment related legislation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand how human activities affect environment.	L2	Understand
CO2	Understand the various technology options that can make a difference.	L2	Understand

Course Contents

Unit-I Social Issues and Environment 04 Hrs.

Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.

Unit-II Technological Growth for Sustainable Development 04 Hrs.

Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.

Unit-III Green Technology 05 Hrs.

History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.

Text Books:

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure", 2012.
2. Erach Bharucha, "Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education".
3. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, "Green Information Technology: A Sustainable Approach", Elsevier, 2015.

Reference Books:

1. Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, "Information Technologies in Environmental Engineering: New Trends and Challenges", Springer, 2011.

Evaluation Scheme:

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.