Teaching And Evaluation Scheme For First Year M.Tech Programme

Semester – I

Title of the Course: Research Methodology	L	T	P	Credit
Course Code: PCSE0161	2	-	-	-

Course: There are no Pre-Requisite for this course

Course Description: This course will provide an opportunity for participants to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches.

Course Objectives:

1. Defending the use of Research Methodology
2. Judging the reliability and validity of experiments
3. Perform exploratory data analysis
4. Draw conclusions from categorical data
5. Using computer-intensive methods for data analysis
6. compare statistical models

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Defend the use of Research Methodology	Affective domain	Defend
CO 2	Judge the reliability and validity of experiments	Psychomotor	Judge
CO 3	perform exploratory data analysis	Psychomotor	analysis
CO 4	draw conclusions from categorical data	Psychomotor	conclude
CO 5	Use computer-intensive methods for data analysis	Psychomotor	data analysis
CO 6	Drawing conclusions from statistical test results & compare statistical models	Psychomotor	compare

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	3	1	1
CO2	3	1	1
CO3	1	1	2
CO4	1	2	2
CO4	1	3	1
CO5	3	1	1
CO6	3	1	1

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

Assessment	Marks
ISE 1	-
MSE	-
ISE 2	-
ESE	50

ESE: Assessment is based on 100% course content

Course Contents:

Unit I: Introduction to Research An Introduction, Meaning of Research , Objectives of Research, Motivation in Research, Types of Research, Research Approaches , Significance of Research , Research Methods versus Methodology Research and Scientific Method , Importance of Knowing How Research is Done , Research Process Criteria of Good Research, Problems Encountered by Researchers	5 Hrs.
Unit III Research Design Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs	4 Hrs.
Unit IV Sampling Design Need for sampling, Population, Sample, Normal distribution, Steps in sampling, Systematic bias and Sampling error, Characteristics of good sample design, Probability sampling and Random sampling, Determination of sample size	4 Hrs.
Unit 4:--- Results and Analysis Importance and scientific methodology in recording results, importance of negative results, Different ways of recording, industrial requirement, artifacts versus true results, types ofanalysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc	4Hrs.

Unit V : Measurement and Scaling Techniques Introduction, Concept of measurement - Measurement of scale, Developing measurement scale, Criteria of good measurement tools, Error measurement. Concept of Scaling, Classification, Approaches of scale construction, Types of scales - Rating scale, Ranking scale, Arbitrary scale, Differential scale, Summated scale, Cumulative scale, Factor scale.	3 Hrs.
Unit VI: Data Collection and Analysis of Data Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Data Processing Operations, Problems in Processing, Elements/Types of Analysis	4 Hrs.

Textbooks:

1. Books: C. R. Kothari, "Research Methodology", New Age international, 2004.
2. Deepak Chopra and Neena Sondhi, "Research Methodology : Concepts and cases", Vikas Publishing House, New Delhi, 2008.
3. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", 2nd Edition, Sage Publisher, 2011.

1. Kothari C.K., Research Methodology- Methods and Techniques (New Age International, New Delhi), 2004..

Unit wise Measurable students Learning Outcomes:

1. Recall research terminology
2. Be aware of the ethical principles of research, ethical challenges and approval processes
3. Describe quantitative, qualitative and mixed methods approaches to research
4. Identify the components of a literature review process
5. Critically analyze published research
6. Discuss Research Methodology

Title of the Course: Design and Analysis of Algorithm	L	T	P	Credit
Course Code: PCSE0101	3	1	-	4

Course Pre-Requisite:

1. Familiarity with basic algorithms such as those for searching, and sorting
2. Familiarity with tree and graph data structures

Course Description: This course aims to introduce algorithm design strategies such as divide and conquer, dynamic programming, greedy algorithms. Computational complexity of sorting and searching algorithm. Introduction to Theory of NP problems. Asymptotic notations for complexity classes.

Course Objectives:

1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design)
2. Knowledge of algorithm design strategies
3. Ability to analyze time and space complexity

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	
CO1	Define the basic concepts of sequential algorithms and measure the efficiency of any algorithm.	1st, 5th	Define and measure
CO2	Demonstrate a number of standard algorithms for problems such as sorting, searching, and problems involving graphs.	2nd	Demonstrate
CO3	Make use of different algorithmic design strategies to tackle real time problems.	3rd	Make use of
CO4	Identify with NP completeness and different NP complete problems. .	3rd	Identify
CO5	Explain high level algorithms such as number theoretic algorithms, string matching algorithms, Approximation algorithms.	2nd	Explain

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	3	-	2
CO2	3	-	3
CO3	3	-	-
CO4	-	-	2
CO5	2	-	3

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content

(normally last three modules) covered after MSE.	
Course Contents:	
Unit 1:--- Introduction :Introduction to algorithm, Algorithm specification, Performance analysis, Recurrence relation.	4 Hrs.
Unit 2:--- Divide and conquer: Binary search, Mergesort, Quicksort, Selection sort and analysis of these algorithms.	6Hrs.
Unit 3:--- Greedy Algorithms: The general method, Knapsack problem, Job sequencing with deadlines, Minimum-cost spanning trees – Prim's and Kruskal's Algorithms, Optimal storage on tapes, Optimal merge patterns, Single source shortest paths.	7 Hrs.
Unit 4:---.Dynamic Programming: The general method, Multistage graphs, All pair shortest paths, Optimal binary search trees, 0/1 knapsack, Reliability design, Travelling Salesperson problem.	7 Hrs.
Unit 5:--- NP-Completeness :Polynomial time, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems.	4 Hrs.
Unit 6:--- Other Algorithms: Number theoretic algorithms: Elementary number-theoretic notions, Greatest common divisor, Modular arithmetic, Solving modular linear equations, String matching algorithms : The naive string-matching algorithm, The Rabin-Karp algorithm, Approximation algorithms: The vertex-cover problem, The traveling-salesman problem.	8 Hrs.
Textbooks: 1. Fundamentals of Computer Algorithms - Ellis Horowitz, SatrajSahani, SaguthevarRajasejaran, Universities Press, Second Edition. 2. Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press Cambridge, Massachusetts London, England, Third Edition	
References: 1. Fundamentals of Algorithmics–Gilles Brassard, Paul Bratley (Pearson Education). 2. Mastering Algorithms with C – Kyle Loudon (SPD O'Reilly). 3. Computer Algorithms- Introduction to Design and Analysis – Sara Baase, Allen Van Gelder (Pearson Education).	
Unit wise Measurable students Learning Outcomes: 1. Students will be able to understand the fundamental concepts in Algorithm design and analysis of an Algorithm. 2. Students will be able to study Divide and Conquer method and analyze the complexity of various algorithms 3. Students will be able to study Greedy method and analyze the complexity of various algorithms. 4. Students will be able to design efficient algorithms for various problems applying Dynamic programming method. 5. Students will be able to understand the NP-Problems. 6. Students will be able to understand number theoretic algorithms, string matching algorithms, Approximation algorithms.	
Term work: It should consist of 8 to 10 assignments based on the following guidelines – 1. A batch of students will be assigned different algorithms and expected to analyze the algorithms in terms of time and space complexity. 2. Solve different exercise problems in the textbook mentioned in the syllabus. 3. Solve more numerical problems for Greedy and Dynamic Programming methods.	

Tutorial List:

1. Performance Analysis of Algorithm.
2. Divide and Conquer Algorithms.
3. Solve Different Problems with Greedy Method.
4. Solve Different Problems with Dynamic Programming.
5. Polynomial and Non Polynomial Time .
6. Number theoretic algorithms.
7. String matching algorithms.
8. Approximation algorithms.

Title of the Course: Mathematical Foundations in Computer Science Course Code: PCSE0102	L	T	P	Credit
	3	1		4

Course Pre-Requisite: :1. Discrete Mathematical Structures
2. Automata Theory

Course Description: It covers mathematical foundations required in Computer Science.

Course Objectives:

1. Revise basic mathematical concepts required in Computer Science
2. Ability to solve decidability and computability problems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	construct different automata like FAs, PDAs and TMs for given problems	1	
CO 2	Decide whether a problem is decidable or not.	2	
CO 3	Solve different computing problem	4	

CO-PO Mapping:

CO	PO 1	PO 2	PO 3
CO1	2	3	-
CO2	3	-	-
CO3	2	3	-

Assessments :

Teacher Assessment:

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

Marks	Assessment
10	ISE 1
30	MSE
10	ISE 2

50	ESE

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Introduction : Mathematical notions and terminology of sets, sequences and tuples,functions and relations, graphs, strings and languages, Boolean logic – properties and representation, Definition, Theorems and Types of Proofs , Regular Languages : Finite automata, DFA, NFA, Equivalence of DFA & NFA. An application, Regular expressions and languages, applications.	5 Hrs.
Unit 2:--- :---Context – free languages : CFGs, Applications, Ambiguity removal, pushdown automata and Equivalence with CFGs.	4 Hrs.
Unit 3:--- Turing Machine : Turing machines, variants of TMs, programming techniques for Tms, Restricted TMs, TMs and Computers.	4 Hrs.
Unit 4:--- Decidability : Decidable languages, decidable problems concerning Context free languages, The halting problem – Diagonalization method, halting problem is undecidable.	4 Hrs.
Unit 5:--- Reducibility : Undecidable problems from language theory – Regular expressions, Turing machines, Reduction. A simple undecidable problem (PCP), mapping reducibility, and other undecidable problems.	5 Hrs.
Unit 6:--- Computability : Primitive recursive functions, computable functions, examples, the recursion theorem. Computational Complexity : Tractable and Intractable problems – Growth rates of function, time complexity of TM, tractable decision problems, theory of Optimization.	5 Hrs.

Textbooks:

1. Introduction to languages and theory of computation – John C. Martin (MGH)

2.Introduction to Theory of Computation – Michael Sipser (Thomson Nrools/Cole).

References:

1]Introduction to Automata Theory, Languages and Computations – J.E. Hopcroft, Rajeev Motwani& J.D. Ullman (Pearson Education Asia), 2nd Edition

2] Discrete Mathematical Structures - Rosen

Title of the Course: Advanced Distributed Systems Course Code: PCSE0103	L	T	P	Credit
	3	1		4

Course Pre-Requisite:

- Fundamentals of Distributed Systems

Course Description:

Course Objectives:

1. Present the principles underlying the function of distributed systems and their extension to cloud computing and virtualization techniques
2. Create an awareness of the fundamental technical challenges in advanced distributed systems design and implementation
3. Expose students to current technology used to build architectures to enhance distributed computing infrastructures with various computing principles and paradigms, including grid and cloud computing
4. Provide experience in analyzing a distributed computing model and implementing typical algorithms used in distributed systems and distributed applications in cloud infrastructure

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	List the principles underlying the functioning of distributed systems	1	
CO2	Describe the problems and challenges associated with these principles and Evaluate the effectiveness and shortcomings of their solutions	2	
CO3	Discuss how the principles are applied in contemporary distributed systems and specific distributed infrastructure such as cloud infrastructure and cloud platforms	2	
CO4	Analyze cloud service models and deploy computing resources and running services in the underlying cloud infrastructure	4	

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	2		3
CO2	3		2
CO3		2	2
CO4		2	3

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on Online objective test and quiz.

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

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

Course Contents:

Unit 1:---DISTRIBUTED FILE SYSTEMS Introduction , File service architecture , Case study: Sun Network File System , The Andrew File System	4 Hrs.
Unit 2:---COORDINATION AND AGREEMENT Introduction , Distributed mutual exclusion , Elections , Coordination and agreement in group communication , Consensus and related problems	6 Hrs.
Unit 3:---DISTRIBUTED TRANSACTIONS and REPLICATION Introduction, Flat and nested distributed transactions, Atomic commit protocols , Concurrency control in distributed transactions , Distributed deadlocks , Transaction recovery , System model and the role of group communication , Fault-tolerant services , Case studies of highly available services: The gossip architecture, Bayou and Coda , Transactions with replicated data	8 Hrs.
Unit 4:---Introduction and Migratingto Cloud Computing Cloud Computing in a Nutshell, Roots of Cloud Computing , Layers and Types of Clouds , Desired Features of a Cloud , Cloud Infrastructure Management , Infrastructure as a Service Providers , Platform as a Service Providers , Challenges and Risks, Broad Approaches to Migrating into the Cloud , The Seven-Step Model of Migration into a Cloud	6Hrs.
Unit 5:--- Enriching the 'Integration as a Service' Paradigm for the Cloud Era An Introduction ,The Onset of Knowledge Era , The Evolution of SaaS , The Challenges of SaaS Paradigm , Approaching the SaaS Integration Enigma , New Integration Scenarios, The Integration Methodologies ,SaaS Integration Products and Platforms , SaaS Integration Services , Businesses-to-Business Integration (B2Bi) Services , A Framework of Sensor—Cloud Integration , SaaS Integration Appliances	6 Hrs.
Unit 6:--- VM Provisioning and Migration Services Introduction and Inspiration , Background and Related Work , Virtual Machines Provisioning and Manageability , Virtual Machine Migration Services , VM Provisioning and Migration in Action , Provisioning in the Cloud Context	6Hrs.

Textbooks:

1) Distributed Systems: Concepts and Design(Third Edition) by George Coulouris, Jean Dollimore and Tim Kindberg
2) Cloud Computing: Principles and Paradigms by Buyya, R., Broberg , J., and Goscinski, A.M., Eds. 2011. John Wiley & Sons
3)

References:

1) Distributed Systems: Principles and Paradigms- Tanenbaum, Steen.

Unit wise Measurable students Learning Outcomes:

1 Explain different distributed file systems like Sun NFS and AFS
2 Illustrate various mutual exclusion, election and other algorithms related tocoordination and agreement in group communication
3 Discriminate various algorithms related to distributed transactions and replications
4 Explain layers and types of cloud computing
5 Classify different services in cloud
6 Demonstrate the use of virtualization technology in cloud computing

Title of the Course: Unix Network Programming Course Code: PCSE0121	L	T	P	Credit
	3			3

Course Pre-Requisite:

1. Basics concepts of Operating System.
2. Basics of Socket programing in C.
3. Basic knowledge of Unix.

Course Description: Designing a software in modular way, where modules communicated with each other to accomplish variety of tasks is one of the major advantages of UNIX system. To achieve the modular design the process executing in Unix System needs to communicate with each other. This results in the IPC -Inter Process Communication system. Unix has used messages passing pipes and System V queues for IPC. The course will cover IPC and Unix process in details.

Course Objectives: To expose students to:-

1. Architecture of Unix operating system.
2. How IPC works in Unix.
3. Security routines in Unix.
4. Remote Accessing features of Unix.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	List ways to achieve IPC in Unix.	1	List
CO2	Explain Interprocess Communication in Unix.	2	Explain
CO3	Make use of IPC mechanisms to communicate between programs.	3	Make use of

CO-PO Mapping:

CO	PO 1	PO 2	PO 3
CO1		2	
CO2		2	
CO3	2		2

Assessments :

Teacher Assessment:

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

Marks	Assessment
10	ISE 1
30	MSE

10	ISE 2
50	ESE

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---The Unix Model : Introduction, Basic Definitions, Input and Output, Signals Process Control, Daemon Processes, listing internet daemons and their service capabilities.	**4** Hrs.
Unit 2:---Interprocess Communication : Introduction, File and Record Locking, A simple Client-Server Example, Pipes, FIFOs, Streams and Messages, Name spaces, System V IPC, Message Queues, Semaphores. Shared Memory, Sockets and TLI, Differences between Unix & Windows IPC mechanisms.	**8**Hrs.
Unit 3:---Communications Protocols : Introduction, TCP/IP – the Internet Protocols, XNS – Xerox Network Systems, SNA – Systems Network Architecture, NetBIOS, OSI Protocols, UUCP – Unix-to-Unix Copy, Protocol Comparisons.	**6**Hrs.
Unit 4:--- Berkely Sockets & System V Transport Layer Interface: Unix Domain Protocols, socket system calls and socket structure, socket addresses, socket options – uses of ioctl and fctl system calls. synchronous I/O, Input /Output Multiplexing, Internet Superserver, Socket Implementation. Transport Endpoint Addresses, TLI Functions, Streams, TIJ Implementation, Stream Pipes.	**8**Hrs.
Unit 5:---Security & File Transfer Protocol: Introduction to security in Unix, 4.3 BSD Routines, Kerberos. Data Formats, Connections, Client User Interface, UDP Implementation, TCP Implementation.	**6** Hrs.
Unit 6:--- Device Drivers General devices and driver architecture, Ethernet as communication device, writing device drivers for communication interface.	**4** Hrs.

Textbooks:
1. Unix Network Programming – W. Rhichard Stevens Second Edition (PHI)

References:
2. Writing Unix device drivers – George Pajari (Pearson Education Asia)
3. Illustrated TCP/IP – D. Comer (Vol. II)
4. UNPv1:UNIX Network Programming, Stevens

Unit wise Measurable students Learning Outcomes:
1
2
3
4
5
6

Title of the Course: Program Flow Analysis Course Code:PCSE0127	L	T	P	Credit
	3			**3**

Course Pre-Requisite: Automata Theory, Compiler Design

Course Description: It covers advanced methods of code/data analysis

Course Objectives:

1. To study structure of compilers
2. To understand data flow and code optimization
3. To study garbage collectors and code synthesizers
4. To study pointer analysis and interprocedural analysis

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Construct control flow graphs	3	
CO2	Apply classical optimization techniques	4	
CO3	Analyse the life of variables and garbage collectors, code synthesizers process.	2	
CO4	Make use of testing and debugging tools	4	

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	1		3
CO2			
CO3	3		
CO4	1		2

Assessments:

Teacher Assessment:

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

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

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

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

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

Course Contents:

Topic No. 1:--- Introduction, Structure of a compiler, Programming Language Basics	**4** Hrs.
Topic No. 2:--- A Simple Syntax-Directed Translator -Syntax Definition, Syntax-Directed Translation, Parsing,A Translator for Simple Expressions, Lexical Analysis, Symbol Tables	**7** Hrs.

Topic No. 3:--- Intermediate-Code Generation - Control flow analysis, control-flow graphs, basic blocks, Dataflow analysis, SSA form	6 Hrs.
Topic No. 4:--- Code Generation Issues in the Design of a Code Generator,The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs,Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization,Register Allocation and Assignment	**5** Hrs. 6 Hrs.
Topic No. 5:--- Pointer and alias analysis, Interprocedural analysis	8 Hrs.
Topic No. 6:--- Garbage Collection, Program Synthesis, Program Testing and Debugging, Types and Programming	

Textbooks:

1. Aho, A., Lam, M., Sethi, R., Ullman, J., Compilers: Principles, Techniques, & Tools, Addison Wesley, 2007.

References:

1. Muchnick, S., Advanced Compiler Design and Implementation, Morgan Kaufmann, 1997.

2. Y. N. Srikant, Priti Shankar, The Compiler Design Handbook: Optimizations and Machine Code Generation, CRC Press, 2008

3. Muchnick, S., Advanced Compiler Design and Implementation, Morgan Kaufmann, 1997.

4. Uday P. Khedker, AmitabhaSanyal, and BageshriKarkare, Data Flow Analysis: Theory and Practice, CRC Press, USA (2009). Indian Edition is available, CRC Press, 2013.

Title of the Course: Digital Image Processing Course Code: PCSE0123	L	T	P	Credit
	3			3

Course Pre-Requisite:

1. Linear Algebra
2. Calculus
3. Programming in C

Course Description:

This course aims to introduce fundamental concepts of Digital Image processing. It will start with digital signal processing basics like Fourier analysis, and eventually go towards standard image processing tasks such as various image enhancements, edge detection, image compression, etc. It will also include some advanced topics such as Image segmentation, Face recognition and Morphological operations.

Course Objectives:

1. To explain basics of digital signal processing such as Fourier analysis
2. To expose students to different low level image processing tasks such as filtering, edge detection etc.
3. To impart knowledge of image compression as well as various image Segmentation techniques.
4. To introduce advanced image processing algorithms for face detection and recognition.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Explain basic image processing techniques for solving real problems	2	
CO2	Apply image processing techniques for solving problems in computer science	3	
CO3	Evaluate algorithms for higher level image processing.	4	
CO4	Develop an application using existing image processing algorithms	6	

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4
CO1	2			
CO2			2	
CO3			3	
CO4			3	

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: Fundamentals of Digital Signal Processing. Fourier Analysis. Fourier Transform. Discrete Fourier Transform. Discrete Cosine Transform. Convolution: 1D and 2D.	6 Hrs.
Unit 2: Image Enhancements. Filtering. Denoising. Contrast Enhancement. Blurring: Gaussian Blur, Motion Blur, Blur kernels. Histogram Equalization. Edge Detection. Bilateral filtering.	8 Hrs.
Unit 3: Image/Video Compression. Lossy and Lossless compressions. JPEG Standard. Application of DCT. Quantization. Huffman encoding. Wavelets. JPEG 2. Video compression standards. MPEG.	6 Hrs.
Unit 4: Color Image Processing. Color gamut, Color Spaces. RGB/CMY, HSV, YCbCr. Conversion among color spaces. Edge Detection in Color images.	4 Hrs.
Unit 5: Face Detection and Recognition. SVD. PCA, EigenFaces, Haar Wavelets. Viola-Jones framework for object detection. Filters for detecting parts of faces. Cascaded Architecture.	8 Hrs.
Unit 6: Advanced Image Processing. Morphological operations. Erosion. Dilation. Compound operations: opening, closing. Image Segmentation. Background subtraction. Environment mating: basic concepts.	6 Hrs.

Textbooks:
1. “Digital Image Processing" by Rafael C. Gonzalez and Richard Woods, 3rd edition

References:
1] “Fundamentals of Digital Image Processing”, by Anil K. Jain.

Unit wise Measurable students Learning Outcomes:
1 Student will be able to solve problems in fourier transforms of different functions.
2 Student will be able to explain different kernels used in image enhancement.
3 Student will be able to apply DCT for compressing image.
4 Students will be able to convert among color spaces.
5 Students will be able to explain how PCA is applied for face recognition.
6 Students will be able to differentiate between morphological operations.

Title of the Course: Network Core Protocols and Management Course Code:PCSE0124	L	T	P	Credit
	03	0		3

Course Pre-Requisite:

1. Basics of Data Communication.
2. Basic knowledge of Computer Networking.

Course Description: In this course the students will be revise to the concepts learned in Computer Networking and Data Communications. How packet delivery mechanism works in computer network. What are the standard services provided by TCP will be covered in this course. Network management tools such as Network Monitors, Remote Monitoring, Network applications will be introduced.

Course Objectives: To expose students to-

1. TCP/IP and OSI stacks.
2. How actual packet delivery works in network.
3. How to monitor and manage computer Network

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Explain TCP/IP protocol suite layers	2	Explain
CO2	Experiment with Network monitoring tools.	3	Experiment with
CO3	Select tools to solve networking problems.	3	Select

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1		2	
CO2	2		
CO3	2		2

Assessments :

Teacher Assessment:

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

Marks	Assessment
10	ISE 1
30	MSE

10	ISE 2
50	ESE

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents: Unit No. 1:Introduction to Network Protocols : Introduction to OSI, TCP/IP Architecture details, Physical & link layer protocols – overview & characteristics of WLAN, FWA, Components of Network.	4 hrs.
Unit No. 2: Internet Protocol : IP standard, datagrams, packets delivery datagram independence, housekeeping, fragmentation & reassembly, prioritization & service-based routing, IP header fields-overview.	6 hrs.
Unit No. 3 Transmission Control Protocol : TCP standard, services, Virtual circuits, Application I/o Management, Network I/O Management, Flow Control, Reliability, TCP header fields – overview, A complete session between HTTP client & server, opening & closing VCs, Bulk data transfer & errors recovery, troubleshooting TCP.	6 hrs
Unit No. 4: Specifying Network Protocols : Semantics syntax of protocol specifications – traditional & new, protocol examples – RR protocol, Manchester Encoding Protocol.	3 hrs
Unit No. 5: Data Communication & Network Management : Analogy of Telephone Network Management, Data & Telecom network, Effect of DCE, TCP/IP, Communication Protocols & standards on NM, NM challenges & goals, network & system management, current status of NM, Managed & unmanaged network devices, various configurations & connectors.	6 hrs
Unit No. 6: NM Standards & Tools : Various NM standards, characteristics, models, ASN.1, Encoding structure & Macros. RMON, RMON groups & functions, Common & Ethernet groups, NM Tools – functional role, resources & components managed, mechanisms, Basic software tools, protocol analyzer, NM systems, Commercial network & Enterprise Management System	8 hrs

Text Books:
1. Internet Core Protocols – The definitive guide by Eric A. Hall (O'Reilly, SPD)
2. Elements of network protocol design – M.G. Gouda (Wiley)
3. Network Management – Principles & Practice – Mani Subramanian (Pearson Education)

References :
1. Understanding TCP/IP by Libor D Ostalek, Alena Kabelova (SPD)
2. Network Management – Concepts & Practice : A Hands-on Approach by J. Richard
Burke (Pearson Education)
3. Network Management, MIBs & MPLS, Principles, Design & Implementation -/Stephen B. Morris (Pearson Eduction).
4. TCP/IP Protocol Suite – B.A. Forouzan (TMH Edition)

Title of the Course: Data Mining and Warehousing Course Code: PCSE0125	L	T	P	Credit
	3		-	3

Course Pre-Requisite:

1. Database Management Systems

Course Description:

Course Objectives:

1. Be familiar with the concepts of data warehouse and data mining
2. Be acquainted with the tools and techniques used for Knowledge Discovery in Databases

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	
CO1	Apply data mining techniques and methods to large data sets	3	Apply
CO2	Use data mining tools	3	Use
CO3	Compare and contrast the various classifiers	3	Compare

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	3	-	1
CO2	3	-	2
CO3	2	-	1

Assessments :

Teacher Assessment:

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

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

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

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

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

Course Contents:

Unit 1:--- Data Warehousing : Data warehousing Components- Building a Data arehouse- Mapping the Data Warehouse to a Multiprocessor Architecture- DBMS Schemes for Decesion Support – Data Extraction, Cleanup and Transformation Tools-Metadata.	6 Hrs.
Unit 2:--- Data Cube Technology: Reporting and Query tools and Applications-Tool Categories-The Need for Applications- Congos Impromptu- Online Analytical Processing(OLAP)- Need-Multidimensional Data Model-OLAP Guidelines-Multidimensional vesus Multirelational OLAP-Categories of Tools-OLAP Tools and the Internet.	6Hrs.
Unit 3:--- Data Mining: Introduction, Data, Types of data, Data Mining Functionalities, Interestingness of patterns, Classification of Data Mining	6 Hrs.

Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse, Issues, Data Preprocessing.	
Unit 4:---.Regression and Classification: Structure of regression model, single linear regression, and multiple linear regression. Classification and Prediction Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification	6 Hrs.
Unit 5:--- Association Rule Mining and Clustering: Mining frequent patterns, Associations and Correlations, Mining Methods, Mining various kinds of Association Rules, Correlation Analysis, Constraint Based Association Mining Clustering Cluster Analysis, Types of Data, Categorization of Major Clustering Methods, K-means-Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint based Cluster Analysis, Outlier Analysis, Data Mining Applications.	6 Hrs.
Unit 6:--- Data Mining Trends and Research Frontiers: Mining complex data types, other methodologies of data mining, data mining applications, data mining and society, data mining trends.	6 Hrs.
Textbooks: 1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, 13th Reprint 2008. 2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.	
References: - Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2007 - K. P. Soman, Shyam Diwakar and V. Aja, " Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006 - G. K. Gupta, "Introduction to Data Mining with Case Studies" , Eastern Economy Edition, Prentice Hall of India, 2006 - 4. Daniel T. Larose, " Data Mining Methods and Models", Wiley_Interscience, 2006	

Title of the Course: Business Intelligence Systems Course Code: PCSE0126	L	T	P	Credit
	3		-	3

Course Pre-Requisite:

3. DBMS
4. Object Oriented Concepts
5. Overview of Data Warehouse

Course Description:

Course Objectives:

4. Gain an awareness of the basic issues in BIS and Modeling techniques
5. Compare and contrast emerging architectures for BIS
6. Familiarize with the E-T-L techniques in BIS
7. Interpret BIS applications

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	
CO 1	Define and explain the overall technical aspects of BI system	1	Define
CO 2	Apply dimensional modeling for the business problem	3	Apply
CO 3	Design Dimensional modeling for the given problem	6	Design
CO 4	Define ETL and its components	1	Define
CO 5	Explain applications of Business intelligence	2	Explain

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	2	-	1
CO2	3	-	2
CO3	2	-	1
CO4	2	-	1
CO5	2	-	2

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Unit 1:--- Introducing the Technical Architecture The Value of ArchitectureTechnical Architecture Overview , Back Room Architecture, Presentation Server Architecture, Front Room Architecture, Infrastructure, Metadata, Security	7 Hrs.
Unit 2:--- Introducing Dimensional Modeling: Making the Case for Dimensional Modeling, Dimensional Modeling Primer, Enterprise Data Warehouse Bus Architecture, More on Dimensions and facts	6Hrs.
Unit 3:--- Designing the Dimensional Model: Modeling Process Overview, Getting Organized, Four-Step Modeling Process, Design the Dimensional Model	5 Hrs.
Unit 4:---.Introducing Extract, Transformation, and Load: Round Up the Requirements, The 34 Subsystems of ETL, Extracting Data, Cleaning and Conforming Data	6 Hrs.
Unit 5:--- Introducing Business Intelligence Applications: Importance of Business Intelligence Applications, Analytic Cycle for Business Intelligence, Types of Business Intelligence Applications, Navigating Applications via the BI Portal	6 Hrs.
Unit 6:--- Designing and Developing B.I.Applications: Business Intelligence Application Resource Planning, Business Intelligence Application Specification, Business Intelligence Application Development, Business Intelligence Application Maintenance	6 Hrs.
Textbooks: 1 The Data Warehouse Lifecycle Toolkit By Raiph Kimball, Ross, 2nd edition, Wiley Publication	
References: 1. Data Warehousing in Real World- Anahory& Murray, Pearson Edt. 2. Data Warehousing Fundamentals- Ponniah, Wiley Publication	

Title of the Course: Programming Lab-I Course Code:PCSE0131	L	T	P	Credit
	0	0	2	1

Course Pre-Requisite:
Database Management Systems, Computer Algorithms, Automata Theroy

Course Description:

Course Objectives:

1. Study software and hardware components of distributed computing systems.
2. learn how to analyze a problem & design the solution for the problem.
3. Acquainted with wide variety of mathematical concepts that are used in the Computer Science discipline, which may include concepts drawn from the areas of Number Theory, Graph Theory, Combinatorics, and Probability.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Implement the concepts in distributed system that fulfills requirements with regards to desired properties Apply database functions and packages suitable for enterprise database development and database management	3	Implement
CO 2	Synthesize efficient algorithms in common engineering design situations.	3	Synthesize
CO 3	Apply and design elementary deterministic and randomized algorithms to solve computational problem	3	Apply and design

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1			3
CO2	1		
CO3		2	

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

Assessment	Marks
ISE	50
ESE	50

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

Course Contents: Students will perform minimum 10-12 assignment based on followig	
Experiment No. 1:--- Implement Network File System (NFS) Aim and Objectives: Implementation of Clustering using MPI_CH2. Outcomes: Theoretical Background: Experimentation: • Set up Network File System (NFS) • Set up Secure Shell (SSH) • Set up Message Passing Interface (MPI) Results and Discussions: Server directory will be mounted on client machine Conclusion:	2 Hrs.
Experiment No. 2:--- To Simulate the Distributed Mutual exclusion algorithm Aim and Objectives: Implement Distributed Mutual Exclusion algorithm Outcomes: Theoretical Background: Experimentation: Write a program to simulate the Distributed Mutual Exclusion in 'C' or 'Java' Results and Discussions: Conclusion:	2 Hrs.
Experiment No. 3:--- To Simulate the Distributed Deadlock Detection algorithm Aim and Objectives: Implement distributed deadlock detection algorithm Outcomes: Theoretical Background: Experimentation: Write a program in Java/C to implement deadlock detection algorithm Results and Discussions: Conclusion:	2 Hrs.
Experiment No. 4:--- To create a private cloud. Aim and Objectives: Installation of Ubuntu Eucalyptus Cloud based platform. Configuration of Node controller, Storage Controller, Cluster Controller. Outcomes: Theoretical Background: Experimentation: • Install & Configure Ubuntu Enterprise Cloud Server • Ubuntu Linux Node Installation • Cloud provisioning from Ubuntu Results and Discussions: Conclusion:	4 Hrs.
Experiment No. 5:--- Installation of VM image in cloud environment. Aim and Objectives: To create a VM image in existing cloud Outcomes:	4 Hrs.

Theoretical Background: Experimentation: • Installing VMware • Create VM image in VMware • Configure VM image Results and Discussions: Conclusion:	
Experiment No. 6:--- Installation of KVM, Virt-Manager, libvirt library and VM- images in cloud environment Aim and Objectives:. To learn different virtualization technologies Outcomes: Theoretical Background: Experimentation: Following are installation steps of KVM on Ubuntu: • Install kvm. ... • Verify kvm installation. ... • Configure bridged networking. ... • Create your first virtual machine. ... • Find the list of the accepted OS variants. ... • List a running vms/domains. ... • Shutodwn a vm/domain called openbsd Following are installation steps of Virt-Manager: • Open virt-manager. Start virt-manager . ... • Optional: Open a remote hypervisor. Select the hypervisor and click the Connect button to connect to the remote hypervisor. • Create a new virtual machine. ... • Specify name and installation type. ... • Configure installation. ... • Configure CPU and memory. ... • Configure storage. ... • Final configuration. Results and Discussions: Conclusion:	4 Hrs.
Experiment No. 7:--- A program to construct FA Aim and Objectives: To design a program to construct from given specifications of a FA Outcomes: Table of FA Theoretical Background: Finite Automata Experimentation: Results and Discussions: Tabular FA Conclusion: FA can be constructed from given specifications	2 Hrs
Experiment No. 8:--- A program to construct PDA Aim and Objectives: To design a program to construct from given specifications of a PDA Outcomes: Table of PDA Theoretical Background: PushDown Automata Experimentation:	4 Hrs

Results and Discussions: Tabular PDA Conclusion: PDA can be constructed from given specifications	
Experiment No.9:--- A program to construct TMs Aim and Objectives: To design a program to construct from given specifications of a TM Outcomes: Table of TM Theoretical Background: FA,PDA & TM Experimentation: Results and Discussions: Tabular TM Conclusion: TM can be constructed from given specifications	4 Hrs
Experiment No. 10: Implementation of Mergesort with Divide and Conquer Method. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java/C++how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.	2 Hrs
Experiment No. 11: Implementation of Quicksort with Divide and Conquer Method. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java/C++ how the divide -and-conquer method works along with its time complexity analysis: worst case, average case and best case.	2 Hrs
Experiment No. 12: Implementation of 0/1 Knapsack with greedy and dynamic programming method. Implement in Java/C++, the 0/1 Knapsack problem using (a) Dynamic Programming method (b)Greedy method.	2 Hrs
Textbooks: 1. 2.	
References: 1] 2]	
Experiment wise Measurable students Learning Outcomes: 1 2	

Title of the Course: Professional Elective Lab-I	L	T	P	Credit
Course Code:PCSE0132	0	0	4	2

Course Pre-Requisite:
Computer Networks, Computer Graphics

Course Description:

Course Objectives:

1. To understand and use advanced socket system calls and APIs.
2. To develop skills of using recent machine learning software for solving practical problems.
3. Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.
4. Be acquainted with the tools and techniques used for Knowledge Discovery in Databases

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Implement next generation network protocols required for emerging distributed applications.	3	Implement
CO 2	Understand how to apply and evaluate variety of learning algorithms and model selection.	3	Understand
CO 3	Apply image processing techniques to real world problems	3	Apply
CO 4	Use data mining tools and techniques	2	Use

CO-PO Mapping:

CO	PO1	PO2	PO3
CO 1			3
CO 2	1		
CO 3		2	

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

Assessment	Marks

ISE	50
ESE	50

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

Course Contents:

UNIX NETWORK PROGRAMMING

Experiment No. 1:---Develop simple 'C' program to create pipe in Unix. Aim and Objectives: Understanding and using pipes to pass data between two process. Outcomes:Students will be able to use Pipes for IPC Theoretical Background:A pipe is a form of redirection that is used in Linux and other Unix-like operating systems to send the output of one program to another program for further processing Experimentation: To create a simple pipe with C, we make use of the pipe() system call. It takes a single argument, which is an array of two integers, and if successful, the array will contain two new file descriptors to be used for the pipeline. After creating a pipe, the process typically spawns a new process . Results and Discussions: Pipes will allow IPC, developers can queue output of one process as input to the second process, which will enable chaining between processes. Conclusion: Pipes can be used to achieve IPC	2 Hrs
Experiment No. 2:---Implementing non-blocking I/O in Unix Aim and Objective: Developing non-blocking I/O operation, which will allow server to execute without waiting for I/O process to finish. Theoretical Background: In computer science, asynchronous I/O, or Non-sequential I/O is a form of input/output processing that permits other processing to continue before the transmission has finished.	2 Hrs
Experiment No. 3:---Use of Socket programming for echo client and server. Aim and Objectives: Understanding socket programming and writing program to make us of socket Outcomes: Students will be able to make use of socket for writing service programs. Theoretical Background: The client reads a line of text from its standard input and writes the line to the server. The server reads the line from its network input and echoes the line back to the client. The client reads the echoed line and prints it on its standard output. Experimentation: Create socket, bind server's well-known port. Wait ISBN: for client connection to complete. Read a buffer and echo the buffer. Results and Discussions: Successful Client and server connection will allow data transfer between server and client. Conclusion: Sockets can be used to have IPC between process running on same as well as running on different computers.	2 Hrs
Experiment No. 4:---Implementing two tier architecture using berkeley sockets. Aim and Objectives: Develop client server application which follows two tier architecture. Outcomes: Students will understand the functionality of two tier architecture.	2 Hrs

Theoretical Background: A two-tier architecture is a software architecture in which a presentation layer or interface runs on a client, and a data layer or data structure gets stored on a server. Separating these two components into different locations represents a two-tier architecture, as opposed to a single-tier architecture. Experimentation: Create Server Socket program, which provides a service, Develop client program which request the service to server socket. Server socket will reply to request from client program. Results and Discussions: Many standard service runs on two tier architecture. Students will understand the key concepts of two tier architecture. Conclusion: Berkeley sockets can be used to to develop applications which follow two tier architecture.	
Experiment No. 5:--- Implementing three tier architecture using berkeley sockets. Aim and Objectives: Implementing Presentation tier, Application Tier and Data Tier using berkeley sockets. Outcomes: Students will be able to implement three tier architecture applications using berkeley sockets. Theoretical Background: Three-tier architecture is a client–server software architecture pattern in which the user interface,functional process logic, computer data storage and data access are developed and maintained as independent modules, most often on separate platforms. Experimentation: Results and Discussions: Data transfer occurs between tier adjacent to each other. Each time may run on separate computers. Conclusion: Three tier architecture separates interface, application and data into independent sevices	2 Hrs
Experiment No. 6:---Developing client programs for standard services in Unix. Aim and Objectives: Writing FTP client program using sockets, which will connect to FTP server running in Unix OS. Outcomes: Students will learn to develop client application to connect to standard services provided by operating system. Theoretical Background: Unix operating system provide different services based on client server architectures. These services run on standard ports and wait for incoming request. Students should be able to develop client application which can connect to these services provided by Unix and use them. Experimentation: Configure VsFTP in Unix, develop 'c' program using socket which will connect to FTP service and perform data transfer between server and client. Results and Discussions: Standard FTP service will communicate with the developed FTP client socket and allows data transfer. Conclusion: We can write our own customised socket program to connect to different services running in Unix.	2 Hrs
MACHINE LERANING	
Experiment No. 1:Creation of Decision Tree	2 Hrs
Experiment No. 2: Logistic Regression Experiment No. 3: Using SVM for classification	2 Hrs
Experiment No. 4: Creation of Backpropagation Network	2 Hrs

Experiment No. 5: Clustering using SOM	2 Hrs
Experiment No. 6: Clustering using GMM	2 Hrs
DIGITAL IMAGE PROCESSING	
Experiment No. 1: DFT of an image Aim and Objectives: Outcomes: Theoretical Background: DSP, Fourier Transforms Experimentation: 1. Calculate DFT of an image. 2. Separate Magnitude and Phase component. Show, scale invariance. 3.Reconstruct image from the DFT. Results and Discussions: Conclusion:	2 Hrs
Experiment No. 2: Study of GIMP Experimentation: Use GIMP for performing image enhancements: Contrast Enhancement, Sharpening etc.	2 Hrs
Experiment No. 3: Edge Detection Experimentation: 1. Using Canny edge detector for image processing application.	2 Hrs
Experiment No. 4: Image Compression Experimentation: 1.Compress image using JPEG standard 2. Evaluate the amount of loss while reconstruction.	2 Hrs
Experiment No. 5: Color Image conversion Experimentation: Convert image from one color space to another color space.	2 Hrs
Experiment No. 6: Face Recognition Experimentation: 1.Store faces in EIGENFACE format 2. Recognize a given input face as one of the stored faces.	2 Hrs
Network Core Protocols and Management	
Experiment No. 1:---TCP Client Server Application Aim and Objectives: Understanding Transmission Control Protocol and its working. Outcomes: Students will understand how tcp client and server communicate. Theoretical Background: TCP and UDP are transport layer protocols used by TCP/IP protocol stack. Variety of applications use TCP or UDP protocol as communication medium at transport layer. Experimentation: Develop TCP server socket program, Server program will provide chatting room. TCP client program will connect to server program. The client should be able to communicated with all other client connected to same server.	2 Hrs

Results and Discussions: The successful completion of the program will result in multithreaded TCP server, who can handle more than two client at single time. The sessions will be managed by server program for every client. Conclusion:TCP client server provides reliable communication medium.	
Experiment No. 2:---Error checking standards. Aim and Objectives: The students should learn how to detect transmission error and try to recover from it. Outcome: Students will be able to practically handle transmission error in network. Theoretical background: Network communication is error prone. Packets sent and received using networking devices may have transmission error, resulting in changed polarity of bits in data. To identify whether frame is received correctly or not schemes like hamming distance, CRC check are available. Experimentation: The assignment will focus on passing data with error from Machine A to Machine B. Machine B will detect errors in received data. Result and Discussion: When error detection and correction scheme is used, the transmission error can be detected and either corrected at the receiver end or, transmission could start from first place. Conclusion: Data sent over network may get altered to nosise and other network parameters. Students will be able to deal with this situation.	2 Hrs
Experiment No. 3:-ARP scan utility Aim and Objectives: Finding devices active in the network to deal with IP related problems. Outcome:Students will be able to track Duplicate IP addresses in the network with respective MAC address. Theoretical background: Duplicate IP address results in the network failure. It is a serious issue if large number of computers are connected to same LAN. This may lead to failure of enter subnet in network. So, it is important to trace duplicate IP address in the network Experimentation: Configure the Computer Lab with variety of devices; eg- smart phone, wifi router, computers connected to a common switch. Assign IP address to devices in lab. Use ARP utility to list all IP address and the associated MAC address. Identify duplicate IP address and the devices having it. Results and Discussion: Duplicate IP address result in the failure of LAN. Tackling the devices and removing duplicate entry can restore network connectivity. Conclusion: It is easy to identify duplicate IP address which has resulted into failure point of LAN using ARP utility.	2 Hrs
Experiment No. 4:--- NMAP utility. Aim and Objective: Scanning computer network and server. Outcome: Students will be able to track different services running in the network. Theoretical background: Port scanning is required to identify open ports of computer system. Using this information, one can identify the services running on the target system. for example if scan result in the information that port number 21 is open- it is easy to figure out the computer is running ftp service. Experimentation: Computer Lab with few computer running ftp/telnet/dhcp services. Use NMAP utility to trace the server running particular service. Identifying open ports of computer system;	2 Hrs

Results and Discussion: NMAP can list open ports on target computer system;list of open ports may result in attacks on computer system, as hacker are always looking for backdoor entry in computers. Conclusion: NMAP can be used to identify service running on remote computer; It is also popular tool to track open ports.	
Experiment No. 5:---TCP Dump utility Aim and Objective: Tracking TCP/IP packets and finding useful information. Outcome: Students will be able to track all incoming and outgoing packets from/to IP address and port using TCP Dump. Theoretical Background:tcpdump is a common packet analyzer that runs under the command line. It allows the user to display TCP/IP and other packets being transmitted or received over a network to which the computer is attached. Experimentation: Computer Lab with multiple devices connected to network, these devices should be generating some network traffic. A computer on which tcpdump command is available; should generate detail report of communications of devices in Lab. Result and Discussion: tcpdump can be used to track IP to IP and port to port traffic generated/received by computer. Conclusion: You can track packets in LAN.	2 Hrs
Experiment No. 6:---Wireshark utility Aim and Objective: To learn Network Monitoring tool, so students and track activities in the network. Outcome: Wireshark will enable students to do packet sniffing in the network. Theoretical Background: Wireshark is a free and open source packet analyzer. It is used for network troubleshooting, analysis, software and communications protocol development, and education. Wireshark makes ethernet card to work in promiscuous mode. Experimentation: Computer Lab with variety of devices accessing different services in the network. A computer with setup of wireshark tool. Scan the network using wireshark- see the contents of packets. try to locate useID and password or any other useful text in the tracked packet data. Result and Discussion: Wireshark is application which can capture communications in the LAN. It can be used for packet sniffing attack; Conclusion: Network monitoring tools help administrator to control network gather useful information to protect network against attacker.	2 Hrs
Data Mining and Warehousing	
Experiment No. 1:--- Implement basic data preprocessing operations on sample dataset Aim and Objectives: illustrates some of the basic data preprocessing operations that can be performed using WEKA Outcomes: Theoretical Background: Experimentation: Steps involved in this experiment are: Step1: Loading the data. We can load the dataset into weka by clicking on open button in preprocessing interface and selecting the appropriate file.	2 Hrs

Step2: Once the data is loaded, weka will recognize the attributes and during the scan of the data weka will compute some basic strategies on each attribute. The left panel in the above figure shows the list of recognized attributes while the top panel indicates the names of the base relation or table and the current working relation (which are same initially). Step3: Clicking on an attribute in the left panel will show the basic statistics on the attributes for the categorical attributes the frequency of each attribute value is shown, while for continuous attributes we can obtain min, max, mean, standard deviation and deviation etc., Step4: The visualization in the right button panel in the form of cross-tabulation across two attributes. Step5: Selecting or filtering attributes Results and Discussions: Conclusion:	
Experiment No. 2:---Implement Association rule process on sample dataset using apriori algorithm Aim and Objectives : illustrate some of the basic elements of asscociation rule mining using WEKA Outcomes: Theoretical Background: Experimentation: Steps involved in this experiment are: Step1: Open the data file in Weka Explorer. It is presumed that the required data fields have been discretized.. Step2: Clicking on the associate tab will bring up the interface for association rule algorithm. Step3: We will use apriori algorithm. This is the default algorithm. Step4: In order to change the parameters for the run (example support, confidence etc) we click on the text box immediately to the right of the choose button.	2 Hrs
Experiment No. 3:--- Implement classification rule process on dataset using decision tree classification algorithm Aim and Objectives : illustrates the use of decision tree classifier in weka. Outcomes: Theoretical Background: Experimentation: Steps involved in this experiment are: Step-1: We begin the experiment by loading the data into weka. Step2: Next we select the “classify” tab and click “choose” button to select the classifier. Step3: Now we specify the various parameters. These can be specified by clicking in the text box to the right of the chose button. In this example, we accept the default	2 Hrs

values. The default version does perform some pruning but does not perform error pruning. Step4: Under the "text" options in the main panel. We select the 10-fold cross validation as our evaluation approach. Since we don't have separate evaluation data set, this is necessary to get a reasonable idea of accuracy of generated model. Step-5: We now click "start" to generate the model .the Ascii version of the tree as well as evaluation statistic will appear in the right panel when the model construction is complete. Step-6: Note that the classification accuracy of model is about 69%.this indicates that we may find more work. (Either in preprocessing or in selecting current parameters for the classification) Step-7: Now weka also lets us a view a graphical version of the classification tree. This can be done by right clicking the last result set and selecting "visualize tree" from the pop-up menu. Step-8: We will use our model to classify the new instances. Step-9: In the main panel under "text" options click the "supplied test set" radio button and then click the "set" button. This wills pop-up a window which will allow you to open the file containing test instances.	
Experiment No. 4:--- Implement classification rule process on dataset using Bayesian classification algorithm Aim and Objectives : illustrates the use of Bayesian classifier in weka. Outcomes: Theoretical Background: Experimentation: Steps involved in this experiment are: Step-1: We begin the experiment by loading the data into weka. Step2: Next we select the "classify" tab and click "choose" button to select the classifier. Step3: Now we specify the various parameters. These can be specified by clicking in the text box to the right of the chose button. In this example, we accept the default values. The default version does perform some pruning but does not perform error pruning. Step4: Under the "text" options in the main panel. We select the 10-fold cross validation as our evaluation approach. Since we don't have separate evaluation data set, this is necessary to get a reasonable idea of accuracy of generated model. Step-5: We now click "start" to generate the model .the Ascii version of the tree as well as evaluation statistic will appear in the right panel when the model construction is complete. Step-6: Note that the classification accuracy of model is about 69%.this indicates that we may find more work. (Either in preprocessing or in selecting current parameters for the classification)	2 Hrs

Step-7: Now weka also lets us a view a graphical version of the classification tree. This can be done by right clicking the last result set and selecting “visualize tree” from the pop-up menu. Step-8: We will use our model to classify the new instances. Step-9: In the main panel under “text” options click the “supplied test set” radio button and then click the “set” button. This wills pop-up a window which will allow you to open the file containing test instances	
Experiment No. 5:---Implement classification rule process on dataset using K-NN classification algorithm Aim and Objectives : illustrates the use of K-NN classifier in weka. Outcomes: Theoretical Background: Experimentation: Steps involved in this experiment are: Step-1: We begin the experiment by loading the data into weka. Step2: Next we select the “classify” tab and click “choose” button to select the classifier. Step3: Now we specify the various parameters. These can be specified by clicking in the text box to the right of the chose button. In this example, we accept the default values. The default version does perform some pruning but does not perform error pruning. Step4: Under the “text” options in the main panel. We select the 10-fold cross validation as our evaluation approach. Since we don’t have separate evaluation data set, this is necessary to get a reasonable idea of accuracy of generated model. Step-5: We now click ”start” to generate the model .the Ascii version of the tree as well as evaluation statistic will appear in the right panel when the model construction is complete. Step-6: Note that the classification accuracy of model is about 69%.this indicates that we may find more work. (Either in preprocessing or in selecting current parameters for the classification) Step-7: Now weka also lets us a view a graphical version of the classification tree. This can be done by right clicking the last result set and selecting “visualize tree” from the pop-up menu. Step-8: We will use our model to classify the new instances. Step-9: In the main panel under “text” options click the “supplied test set” radio button and then click the “set” button. This wills pop-up a window which will allow you to open the file containing test instances	2 Hrs
Experiment No. 6:---Implement clustering rule process on sample dataset using simple k-means algorithm Aim and Objectives : illustrates the use of simple k-mean clustering with Weka explorer	

Outcomes:

Theoretical Background:

Experimentation: Steps involved in this Experiment are:

Step 1: Run the Weka explorer and load the data file in preprocessing interface.

Step 2: In order to perform clustering select the ‘cluster’ tab in the explorer and click on the choose button. This step results in a dropdown list of available clustering algorithms.

Step 3 : In this case we select ‘simple k-means’.

Step 4: Next click in text button to the right of the choose button to get popup window shown in the screenshots. In this window we enter six on the number of clusters and we leave the value of the seed on as it is. The seed value is used in generating a random number which is used for making the internal assignments of instances of clusters.

Step 5 : Once of the option have been specified. We run the clustering algorithm there we must make sure that they are in the ‘cluster mode’ panel. The use of training set option is selected and then we click ‘start’ button. This process and resulting window are shown in the following screenshots.

Step 6 : The result window shows the centroid of each cluster as well as statistics on the number and the percent of instances assigned to different clusters. Here clusters centroid are means vectors for each clusters. This clusters can be used to characterized the cluster.

Step 7: Another way of understanding characterstics of each cluster through visualization ,we can do this, try right clicking the result set on the result. List panel and selecting the visualize cluster assignments.

Textbooks:

1.

2.

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References:

1]

2]

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Experiment wise Measurable students Learning Outcomes:

1

2

Title of the Course: Seminar-I	L	T	P	Credit
Course Code:PCSE0141			4	2

Course Pre-Requisite:

Course Description: Students are trained for research and presentation skills in this course.

Course Objectives:

1. To promote and develop presentation skills
2. Learn how to evaluate research papers
3. Identify and use variety of academic resources available
4. Learn fundamental principles, concepts or theories

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Demonstrate ability to use technical resources available	2	Demonstrate
CO2	Write technical documents and give oral presentations related to the work completed	5	Write
CO3	Explain some specific skills, competences and points of view needed by computing professionals	6	Explain

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	3	2	3
CO2	2	3	2
CO3	1	3	2

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE)

Assessment	Marks
ISE-I	50
ISE-II	50

ISE are based on Presentation/ Internal oral etc.

Course Contents/Guidelines:

- Attendance at each seminar is mandatory for all students enrolled
- Abstract should be concise(<250 words), well written and free of grammatical and typographical errors
- Each student will give 30- minute presentation
- Your seminar should cover several(5 or more) related papers
- The topic should be in an area closely related to your research.
- You should strive to organize your seminar into a cohesive presentation, and be selective about what you present
- Final grade will be determined by several factors: the quality and content of your seminars, presentation and the ability to meet scheduled deadlines.

Teaching And Evaluation Scheme For First Year M.Tech.Programme

Semester - II

Title of the Course: Software Systems Course Code: PCSE0261	L	T	P	Credit
	1	1		--

Course Pre-Requisite: :

Course Description: InSoftware Systems students will learn necessary tools and techniques required for report writing and project management. This course will empower students with knowledge and practices that will help student in versioning project, testing authenticity of work, generating reports and developing build for deployment of project.

Course Objectives: To give exposure to students

1. Various research project report writing tools.
2. Checking research work for genuinity and authenticity.
3. Different project management tools which can be used to track and manage progress of project.

Course Learning Outcomes: Students will be able to.

1. Select research project report writing tools.
2. Make use of plagiarism testing tools for checking research work for genuinity and authenticity.
3. Use project management tools to track and manage progress of project.

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Select research project report writing tools.	1st	Select
CO 2	Make use of plagiarism testing tools for checking research work for genuinity and authenticity.	3rd	Make use of
CO 3	Make use project management tools to track and manage progress of project.	3rd	Make use of

CO-PO Mapping:

CO	PO 1	PO 2	PO 3
CO1		2	
CO2		2	
CO3		2	

Assessments :

Teacher Assessment:

Marks	Assessment
50	ESE

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1:--Effective Report Writing: LateX- using document classes. Inserting graphics, tables, references, TikZ- creating diagrams- flowcharts, workflow etc.	6 Hrs.
Unit 2:-- Language Checking Tools: Language Checking - grammar correction in document, proper use of verbs according to subject, Proper use of articles. Use of active and passive voice.use of tools like grammarly.	2 Hrs.
Unit 3:---Plagiarism Detection-what is plagiarism, how to test article for plagiarism, avoiding self plagiarism, use of tools like viper, turnitin, ithenticate etc.	3 Hrs.
Unit 4:---Project Management Tools: Maintaining project versions using branching technique. use of tools like git, svnetc to manage project progress.Project Tracking Techniques- such as Agile, SCRUM	5 Hrs.
Unit 5:--Data Visualization and Analysis Techniques: Use of R and python for data analysis, use of PyPlot, GNUPlot for data visualisation and analysis technique.	4 Hrs.
Unit 6:--Build Management Systems: Study of various build management systems- such as make, make install, WAF, configure etc.	4 Hrs.

Textbooks:

1. LaTeX: A Document Preparation System (2nd Edition)by Leslie Lamport
2. Learning Agile by Andrew Stellman& Jennifer Greene
3. Learning Python: Powerful Object-Oriented Programming 4th Edition by Mark Lutz
4. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition by Hadley Wickham, Garrett Grolemund

References:

1. Git online documentation. https://git-scm.com/docs/git-help
2. Pyplot online documentation https://matplotlib.org/api/pyplot_api.html

Unit wise Measurable students Learning Outcomes:

1
2
3
4
5
6

Title of the Course: Optimization Techniques Course Code: PCSE0201	L	T	P	Credit
	3	1		4

Course Pre-Requisite: Linear Algebra, Probability, Calculus, Graph Theory

Course Description: This course introduces the principal algorithms for linear, network, discrete, dynamic optimization and nonlinear optimization. Emphasis is on methodology and the underlying mathematical structures. Topics include the simplex method, network flow methods, branch and bound and cutting plane methods for discrete optimization, interior point methods for convex optimization, Newton's method, heuristic methods, dynamic programmingand brief introduction to nonlinear optimization.

Course Objectives:

1. To introduce the fundamental concepts of Optimization Techniques;
2. To make the learners aware of the importance of optimizations in real scenarios
3. To provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Explain types of optimization techniques	2	Explain
CO 2	Apply optimization techniques to problems in computer science	3	Apply
CO 3	Evaluate complexity of optimization problems	5	Evaluate
CO 4	Model computer science problems as optimization problems	6	Model

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4
CO1	2		-	-
CO2	3	-	-	
CO3		-	2	-
CO4		-	-	3

Assessments :

Teacher Assessment:

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

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

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

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

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

Course Contents:

Unit 1:- Mathematical Preliminaries Vector Spaces: bases, echelon forms, rank and determinants. Gauss elimination and its complexity, Inner products, Gram- Schmidt orthogonalization. Linear transformations.	**4**Hrs
Unit 2:--- Introduction to Linear programming Modeling and formulation of optimization problems. Linear costs and convex domains. Mean-square (distance) minimizations. Linear programming and the Simplex algorithm. Duality and the primal dual method.	**8**Hrs.
Unit 3:--Robust optimization and Network Flows Introduction, Large scale optimization, Introduction to Network flows, Max flow, Min-flow, Algorithms for optimization of network flows	**4**Hrs.
Unit 4: Convex Optimization Convex Sets, Convex Functions, Convex optimization problems, Lagrange Duality, Saddle-point interpretation, KKT Conditions, Applications of Convex Optimization: Approximation and fitting	8 Hrs.
Unit 5:--- Non-Linear optimization Brief introduction, Line searches, Newton's methods, Modification of Newton's Methods, Quasi-Newton Method, Levenberg-Marquardt, Conjugate and Stochastic Gradient Descent, Applications in Computer Vision, Natural Language Processing(NLP)	8 Hrs.
Unit 6:---Discrete optimization Integer Programming, Constraint Programming, Branch and bound and cutting planes	6Hrs.

Textbooks:

1. Linear Algebra and its Applications By Gilbert Strang,,
2. Introduction to linear optimization by Dimitris Bertsimas, Athena Scientific Series
3. Linear Programming and Applications By V. Chvatal

References:

1. Convex Optimization by Stephen Boyd
2. Nonlinear Programming: Theory and Algorithms by Mokhtar Bazaraa, HanifSherali and C. M. Shetty
3. https://ocw.mit.edu/courses/sloan-school-of-management/15-093j-optimization-methods-fall-2009/readings/

Unit wise Measurable students Learning Outcomes:

1
2
3
4
5
6

Title of the Course: Advanced Database Systems	L	T	P	Credit
Course Code: PCSE0202	3	1		4

Course Pre-Requisite: Database Management Systems

Course Description: This course is devoted to new database technology with emphasis on object orientation. The focus is mainly on the data modelling aspect. Other aspects handled are Database administration, Advanced SQL and NOSQL Data management.

Course Objectives:

1. Explain different database design methodologies.
2. Implement object-oriented concepts.
3. Administering Database System.
4. Concepts of data model for advanced applications..

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Explain object oriented database concepts.	2nd	Explain
CO 2	Distinguish Parallel Databases and Distributed Object Databases	4th	Distinguish
CO 3	Develop their skill as database administrator	3rd	Develop
CO 4	Build complex SQL queries to retrieve information for business decision making from databases .	3rd	Build
CO 5	Find out various NoSQL systems and their features	1st	Find

CO-PO Mapping:

CO	PO1	PO2	PO3
CO 1	-	-	2
CO 2	-	-	3
CO 3	-	-	2
CO 4	3	-	-
CO 5	2	-	3

Assessments :

Teacher Assessment:

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

Assessment	Marks
ISE 1	10
MSE	30

ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:-Object Oriented and Object Relational Databases Overview of Object Oriented Concepts, Object Entity, Object Structure and Type constructions, Encapsulation of operations, methods and persistence, type hierarchies and inheritance, type extents and queries, complex objects: Database schema design for OODBMS; OQL, persistent programming Language; OODBMS architecture and storage issues; transactions and concurrency control, Example of ODBMS; Database design for an ORDBMS, Nested Relations and collections, Storage and access methods, Systems comparison of RDBMS,OODBMS,ORDBMS	**7** Hrs.
Unit 2:--Parallel and Distributed Databases and Client-Server Architecture Architecture of Parallel Databases,Parallel Query evaluation; parallelizing individual operations, sorting, joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; query processing in distributed databases; concurrency control and recovery in distributed databases. An overview of Client server architecture.	6 Hrs.
Unit 3:---Advanced SQL PL SQL- A Basic introduction, Functions and Procedure, Packages, Synonyms, Database Links, Embedded SQL and Dynamic SQL. Database Design: systems development life cycle, database life cycle, DBMS Software Selection, top-down versus bottom-up design, centralized versus decentralized design.	**6** Hrs.
Unit 4:---Enhanced Data Models for advanced Applications: Active database concepts, temporal database concepts, spatial databases, concepts and architecture, Deductive databases and query processing, Mobile databases, geographic information systems	**4** Hrs.
Unit 5:---Database administration Managing database instance, maintaining online Redo Log files, managing tablespace and data files, managing undo data, managing users and privileges, managing roles and auditing	7 Hrs.
Unit 6:--- NOSQL Data management Introduction to NoSQL , aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models.	6 Hrs.

Textbooks:
1. ElmasriNavathe, Fundamentals of Database systems, 4th Edition, Addison Wesley

2. Oracle Database Online Documentation 11g Release 2 (11.2).

References:

- Stefano ceri and giuseppepelagatti, Distributed Databases principles and systems, McGraw-Hill, 1985
- R. RamaKrishnan Database management systems, Mc Graw Hill
- Database System Concepts – Silberschatz, Korth, Sudarshan – 5th Edi (MGH International edition).
- Advanced Database Management System – RiniChakrabarti -ShilbhadraDasgupta

Unit wise Measurable students Learning Outcomes:

1. Differentiate RDBMS, OODBMS and ORDBMS
2. Understand parallel and distributed databases
3. Use Advanced SQL functions
4. Explain the use of advanced data models
5. Learn administrator functions
6. Explain the use of NOSQL

Title of the Course: Machine Learning Course Code: **PCSE0204**	L	T	P	Credit
	3	1		4

Course Pre-Requisite: : Linear Algebra, Probability Theory, Calculus

Course Description: This course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (probabilistic classifiers, decision trees) , neural networks, support vector machines; unsupervised learning (clustering, dimensionality reduction, kernel methods), Graphical models (Bayesian networks, HMM)

Course Objectives:

1. To provide students with an in-depth introduction to Machine Learning
2. To provide understanding of the strengths and weaknesses of popular machine learning approaches.
3. To explain underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and unsupervised learning.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Understand a wide variety of learning algorithms	2	
CO2	Apply a variety of learning algorithms to data	3	
CO3	Evaluate learning algorithms and model selection.	4	
CO4	Develop machine learning algorithms for various applications	6	

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4
CO1	2		-	-
CO2	2		-	-
CO3			2	
CO4		-		3

Assessments :

Teacher Assessment:

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

Marks	Assessment
10	ISE 1

	30	MSE
	10	ISE 2
	50	ESE

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:- Introduction. Mathematical foundation of machine learning: Probability, Statistics, optimization. Classification: Supervised, Unsupervised. KNN Classifier, Decision Trees, Random Forests, Pruning Trees.	7 Hrs.
Unit 2:- Probabilistic Generative and Discriminative Classifiers Discriminant Functions, Probabilistic Generative Models, Bayes Classifier, Maximum Likelihood Classifier, Probabilistic Discriminative Model, Logistic Regression	6 Hrs.
Unit 3: Support Vector Machine Constrained optimization, Lagrangian Methods, Hinge Loss, SVM kernels, Training SVM, Feature Selection.	6 Hrs.
Unit 4: Neural Networks: Simple Perceptron, Linear Separability, Backpropagation Networks, Kohonen's Self Organizing maps, Reinforcement learning, Introduction to Deep Neural Networks	7 Hrs.
Unit 5: Mixture Models and EM K-means clustering, Mixture of gaussians, Mixture Models, EM Algorithm,	5 Hrs.
Unit 6: Introduction to Graphical Models Bayesian Networks, Markov Random Field (MRF), Hidden Markov Model, Training HMM: Viterbi, Baum-welch algorithm	7 Hrs.

Textbooks:

1. Pattern recognition and Machine Learning by Christopher M. Bishop
2. Pattern Classification by Duda and Hart
3. Neural Network by Simon Haykin

References:

1. http://neuralnetworksanddeeplearning.com/

Title of the Course: Internet of Things Course Code: PCSE0221	L	T	P	Credit
	3	1		4

Course Pre-Requisite:

- Fundamentals of Computer Networks
- Fundamentals of Embedded Systems

Course Description: The course is designed to learn the importance of IoT in society, the current components of typical IoT devices, IoT design considerations, constraints and interfacing between the physical world and your device. Students will also learn how to connect their device to the Internet.

Course Objectives:

1. To understand the concepts and protocols related to Internet of Things.
2. To study the IoT standards and APIs for prototyping
3. To study the application areas of the Internet of Things.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Explain the concept of Internet of Things	2	
CO 2	Illustrate key technologies, protocols and standards in Internet of Things.	2	
CO 3	Analyse trade-offs in interconnected wireless embedded device networks.	4	
CO 4	Application of IoT in automation of Commercial and Real World examples	3	
CO 5	Design a simple IoT system comprising sensors, edge devices and wireless network connections involving prototyping, programming and data analysis.	6	

CO-PO Mapping:

CO	PO1	PO2	PO 3
CO1	1		
CO2	3		1
CO3	2		1
CO4	3		2
CO5	3		2

Assessments :

Teacher Assessment:

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

Assessment	Marks
ISE 1	10

MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on Online objective test and quiz.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---Introduction Overview and Motivations, IPv6 Role, IoT Definitions, IoT Frameworks.	4 Hrs.
Unit 2:--- Prototyping Embedded Devices Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, BeagleBone Black, Electric Imp, Other Notable Platforms	6 Hrs.
Unit 3:--- : IPv6 Technologies for the IoT Overview and Motivations, Address Capabilitie, IPv6 Protocol Overview , IPv6 Tunneling , IPsec in IPv6, Header Compression Schemes , Quality of Service in IPv6 , Migration Strategies to IPv6	8 Hrs.
Unit 4:---Evolving IoT Standards Overview and Approaches, IETF IPv6 Routing Protocol for RPL Roll , Constrained Application Protocol (CoAP) , Representational State Transfer (REST) , ETSI M2M , Third-Generation Partnership Project Service Requirements for Machine-Type Communications , CENELEC, IETF IPv6 Over Lowpower WPAN (6LoWPAN) , ZigBee IP (ZIP), IP in Smart Objects (IPSO)	8 Hrs.
Unit 5:--- Prototyping Online Components Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols: MQTT, Extensible Messaging and Presence Protocol	6 Hrs.
Unit 6:--- IoT Application Examples Overview, Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking (Following and Monitoring Mobile Objects),Over-The-Air-Passive Surveillance/Ring of Steel,Control Application Examples, Myriad Other Applications	4 Hrs.

Textbooks:

1) Building the Internet of Things with IPv6 AND MIPv6 by DANIEL MINOLI Published by John Wiley & Sons, Inc., Hoboken, New Jersey.(UNIT-I, III, V, VI)
2) Designing the Internet of Things by Adrian McEwen and Hakim Cassimally Published by John Wiley & Sons (UNIT-II, IV)

References:

1) Getting Started with the Internet of Things by CunoPfister Published by O'Reilly Media, Inc.
2) Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things" Key

Applications and Protocols, ISBN 978-1-119-99435-0, Wiley Publications.
Unit wise Measurable students Learning Outcomes: Student will be able to 1. Explain the concept of IoT 2. Describe different types of IoT devices 3. Illustrate IPv6 addressing 4. Analyze IoT protocols and Standards 5. Illustrate use of APIs for prototyping IoT components 6. Illustrate applications of IoT in real world

Title of the Course: Data Analytics Course Code: PCSE0222	L	T	P	Credit
	3	1		4

Course Pre-Requisite:
High-school level linear algebra and calculus. Knowledge of probability theory, statistics, and programming is desirable.

Course Description:
Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. While this is the broad and grand objective, the last 20 years has seen steeply decreasing costs to gather, store, and process data, creating an even stronger motivation for the use of empirical approaches to problem solving. This course seeks to present you with a wide range of data analytic techniques and is structured around the broad contours of the different types of data analytics, namely, descriptive, inferential, predictive, and prescriptive analytics.

Course Objectives:

1. Introducing to data analytics providing some basic data-science tools.
2. Statistical tools to individuate regularities discover patterns and laws in complex datasets will be introduced to students together with instruments to analyse, characterize, validate, parameterize and model complex data.
3. Practical issues on business data analysis and statistics will be covered with specific case studies also in collaboration with industrial partners.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Define and state the basics of Big Data and Analytics	1	Define, State
CO 2	Explain the data mining process and its fundamentals	2	Explain
CO 3	Use and apply the Hadoop ecosystem for Big data	3	Use , apply
CO 4	Explain and apply the role of map reduce in Hadoop ecosystem	3	apply
CO 5	Use and analyze R language for Big Data Analysis	4	Analyze
CO 6	Generate various data analysis on various case study	5	generate

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	2		
CO2	3		
CO3	3		1
CO4	3		
CO5	3		2
CO6	2		1

Assessments :

Teacher Assessment:

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

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

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

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

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

Course Contents:

Unit 1:--- Introduction of Big data and technologies: Big data definition, Elements of Big data, data analytics, Exploring Big Data Stack, Virtualization and Big data, virtualization approaches.	6 Hrs.
Unit 2:--- Business Problems and Data Science Solutions: Supervised versus unsupervised data mining. From Business Problems to Data Mining Tasks, Supervised Versus Unsupervised Methods, Data Mining and Its Results, The Data Mining Process.	6 Hrs.
Unit 3:--- Hadoop Ecosystem: Distributed and parallel computing for Big data, How Data models and computing models are different , Introducing Hadoop, Hadoop Distributed file system(HDFS, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig latin, Sqoop, ZooKeeper, Flume, Oozie.	8Hrs.
Unit 4:--- Introduction to Map Reduce Fundamentals: The Map Reduce frame work techniques to Optimize Map reduce Jobs Uses of Map reduce, Role of Hbase in Big Data Processing	6 Hrs.
Unit 5:--- Exploring R: Basic Features of R, Exploring RGui, Working with vectors, handling data in R workspace. Reading datasets and exporting data from R, Manipulating and processing data in R.	6 Hrs.
Unit 6:--- Case study: Exploring web pages categorization, computing the frequency of stock market change, predicting the sale price of blue book for bulldozers,	4 Hrs.

Textbooks:

1. Big Data (Black Book)- DT Editorial Services- Dream tech Press(Unit 1,3,4,5)

2. Data Science for Business What You Need to Know about Data Mining and Data-Analytic Thinking By Foster Provost, Tom Fawcett, Publisher O'Reilly ISBN:978-1-4493-6132-7 (Unit 2)
3. VigneshPrajapati, Big data analytics with R and Hadoop, SPD 2013. (Unit 6)
4. Data Mining and Analysis Fundamental Concepts and Algorithms-MOHAMMED J. ZAKI and WAGNER MEIRA JR.- Cambridge University Press

References:

1. "Big Data for dummies" ,by Judith Hurwitz, Alan Nugent, Dr. Fern Halper,and Marcia Kaufman, ISBN: 978-1-118-50422-2, Wiley Publication.
2. Big Data and Analytics by Seema Acharya, SubhashiniChellappan, Wiley Publication

Unit wise Measurable students Learning Outcomes:

1. Explain the necessity of big data analysis and its approaches
2. Describe the various data mining tasks
3. Explain Hadoop ecosystem and the tools used in the ecosystem
4. Explain the role of map reduce functions in Hadoop ecosystem
5. Use R programming for data analysis
6. Apply various data analysis on real time cases or applications

Title of the Course: Computer Vision Course Code: PCSE0223	L	T	P	Credit
	3	1		4

Course Pre-Requisite: Digital Image Processing

Course Description: This course provides an introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, multiview geometry including stereo, motion estimation and tracking, and object classification.

Course Objectives:

1. To introduce students the fundamentals of image formation;
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems
4. To provide the student with programming experience from implementing computer vision and object recognition applications

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Understand the foundations of modern computer vision theory, problem and state of the art solutions.	2	
CO 2	Apply fundamental computer vision algorithms for solving problems	3	
CO 3	Analyse and evaluate critically the building and integration of computer vision algorithms and systems	4	
CO 4	Design and demonstrate a working computer vision system	6	

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4
CO 1	2			
CO 2	3			
CO 3			3	
CO 4				2

Assessments :

Teacher Assessment:

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

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

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

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

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

Course Contents:

Unit 1: Camera Calibration Camera Model, Illumination model, Intrinsic Parameters, Extrinsic Parameters, Camera Distortion Models, Radial Distortion.	6 Hrs.
Unit 2: Stereo Stereo Camera Model, Essential Matrix, Fundamental Matrix, Epipolar lines, Image Rectification, Disparity calculation algorithms.	7 Hrs.
Unit 3: Feature Detection Harris Corners, FASTCorner Detection, SIFT, SURF, HOG. Feature Matching algorithms: Flann matcher. Calculation of Homography matrix, Warping: Perspective, Cylindrical, Spherical. Application to image stitching.	8 Hrs
Unit 4: Estimation of Geometric Model Line detection, Ellipse Detection, Plane Detection, RANSAC, multiRANSAC, J-linkage	5 Hrs.
Unit 5: Optical Flow and Object Tracking Point Correspondences, Calculation of Optical Flow, Lucas-Kanade Method, MaxFlow-MinCut method	5 Hrs.
Unit 6: Deep Learning Background,Introduction to convolutional neural network. Layers in CNN. Learning algorithms. Deep Learning Frameworks	7 Hrs.

Textbooks:

1. Multiple View Geometry in Computer Vision by Richard Heartley and Andrew Zisserman
2. Deep Learning by Ian Goodfellow and YoshuaBengio and Aaron Courvillehttp://www.deeplearningbook.org/

References:

1] Computer Vision, a Modern Approach by Fosyth and Ponce

Unit wise Measurable students Learning Outcomes:

1
2
3
4
5
6

Title of the Course: Wireless Ad Hoc Networks Course Code: PCSE0224	L	T	P	Credit
	3	1		4

Course Pre-Requisite:

-

Course Description:

Course Objectives:

1. Understand design issues of wireless ad hoc networks
2. Learn different types of MAC protocols
3. Be familiar with different types of ad hoc routing protocols
4. Students will be exposed to different issues in transport layer in ad hoc network situations
5. Learn different architecture of WSN

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Explain the concept and applications of wireless ad hoc networks	2	Explain
CO 2	Analyze different protocols and design issues of ad hoc networks	4	Analyze
CO 3	Design routing protocols for ad hoc networks and compare it with already existing routing protocols	6	Design

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1		2	
CO2	2	2	
CO3		2	2

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---INTRODUCTION Introduction to adhoc networks – definition, characteristics features, applications. Charectristics of Wireless channel, Ad hoc Mobility Models:- Indoor and outdoor models.	4 Hrs.
Unit 2:--- MEDIUM ACCESS PROTOCOLS MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN	8 Hrs.
Unit 3:--- :NETWORK PROTOCOLS Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing	**8** Hrs.
Unit 4:---END-END DELIVERY AND SECURITY Transport layer : Issues in desiging- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.	6 Hrs.
Unit 5:---CROSS LAYER DESIGN AND INTEGRATION OF ADHOCFOR 4G Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary prespective. Intergration of adhoc with Mobile IP networks.	**8** Hrs.
Unit 6:---WIRELESS SENSOR NETWORKS Applications of WSN, Comparison with ad hoc networks, issues and challenges, Sensor network architecture.	4 Hrs.

Textbooks:

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

References:

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network
4. Research," Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

Unit wise Measurable students Learning Outcomes:

1
2
3
4
5
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Title of the Course: Natural Language Processing Course Code:PCSE0225	L	T	P	Credit
	3	1		4

Course Pre-Requisite: Lexical Analysers and Parsers, Probability

Course Description: Processing of natural language text.

Course Objectives:

1. To understand different phases of natural language processing
2. To study word sense ambiguation
3. To study dimensionality reduction

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Define the basic concepts of NLP	1	
CO2	Explain parts of speech of a sentence	2	
CO3	Resolve word sense Ambiguation	2, 3	
CO4	Apply binding theory on sentences	5	

CO-PO Mapping:

CO	PO 1	PO2	PO3
CO1	2		
CO2	2		1
CO3	3		2
CO4	1		

Assessments :

Teacher Assessment:

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

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

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content

(normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Introduction, POS Tagging, HMM	04 Hrs.
Unit 2:--- Machine Translation, Parsing	06 Hrs.
Unit 3:--- Grammar- Constituencydependency, Parse Tree Construction	06 Hrs.
Unit 4:--- Word Sense Disambiguation(WSD), Knowledge Based and Supervised WSD, Unsupervised EM Based WSD, Multi-Lingual Constraint Based WSD	08 Hrs.
Unit 5:--- Introduction to Machine Translation, Statistical Machine Translation Model, Derivations	06 Hrs.
Unit 6:--- Binding Theory, Merger, X-Bar Theory, Linear and Logistic Regression, Dimensionality Reduction, PCA	06 Hrs.

Textbooks:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
3. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999..

References:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993
2. Radford, Andrew et. al., Linguistics, An Introduction, Cambridge University Press, 1999

Unit wise Measurable students Learning Outcomes:

1

2

3

4

5

6

Title of the Course: High Performance Computing Course Code: PCSE0226	L	T	P	Credit
	3	1		4

Course Prerequisite: :

Course Description:

Course Objectives:

1. To introduce the current trends in parallel computer architectures and programming model.
2. To acquaint with parallel program design methodologies.
3. To devise various parallel algorithms for matrices and graphs.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain different parallel architectures and design methodologies.	2nd	Understanding
CO2	Choose parallel algorithms to optimize real world problems.	3rd	Applying
CO3	Study the parallel algorithms for matrices, graphs, sorting algorithm etc.	4th	Analyzing

CO-PO Mapping:

CO	PO 1	PO 2	PO 3
CO1		2	
CO2	2		
CO3		2	

Assessments :

Teacher Assessment:

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

Marks	Assessment
10	ISE 1
30	MSE
10	ISE 2

50	ESE

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--Introduction Introduction to parallel computing & its scope. Issues in parallel computing. Taxonomy of parallel architecture, Dynamic and static interconnection networks, Routing mechanism and communication cost in static interconnection network.	7 Hrs
Unit 2:-- Parallel programming models and paradigms. Introduction to cluster computer and its architecture, parallel applications and development, code granularity and level of parallelism, parallel programming models and tools, methodical design of parallel algorithm, parallel program paradigm, programming skeleton and templates.	7 Hrs
Unit 3:-- Performance and scalability of parallel systems Performance Metrics for parallel systems. The effect of Granularity and Data Mapping on Performance. The Scalability of parallel systems, Isoefficiency metric of scalability, sources of parallel overhead, Minimum execution time and minimum cost-optimal execution time.	6 Hrs
Unit 4:- Tools for parallel programming OpenMP, MPI, OpenCL, etc. , Basics of threading ,Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers, The MPI Programming Model, MPI Basics, Global Operations , Asynchronous Communication, Modularity, Other MPI Features, Performance Issues	6 Hrs
Unit 5:--Hybrid parallelism and accelerators. MPI + CUDA, Basic of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or OpenCL for GPGPU hardware, case study.	6 Hrs
Unit 6:--Designing parallel programs Automatic vs. Manual Parallelization,Understand the Problem and the Program, Partitioning, Communications, Synchronization,Data Dependencies, Load Balancing, Granularity, I/O, Debugging, Performance Analysis and Tuning	7 Hrs.

Textbooks:Textbooks:
1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Pearson Education, Second Edition.

2. Michel Quinn, Parallel Programming in C with MPI and Open MP, Tata McGraw Hill Publication

References:
1. David B. Kirk, Wen-mei W. Hwu, Massive parallel Programming with GPGPU Morgan Kaufmann Publication.

Unit wise Measurable students Learning Outcomes:
Unit 1: Understand basics of parallel computing platform.

Unit 2: Comprehension of parallel algorithm design methodology.
Unit 3: Computing performance of parallel algorithm.
Unit 4: Classify various programming tools.
Unit 5: Explain CUDA Memory model and Architecture.
Unit 6: Design of parallel algorithm for different data structures.

Title of the Course: Programming-Lab-II	L	T	P	Credit
Course Code: PCSE0231	-	-	2	1

Course Prerequisite:

1. Basic Programming Skills
2. Knowledge of ADS, Program Flow Analysis, Optimization Techniques

Course Description: In this course students are expected to implement the concepts they have studied in Advanced Database System, Program Flow Analysis, Optimization Techniques

Course Objectives: To expose students to:-

1. Implementation of algorithms in Advanced Database System.
2. Steps in program analysis.
3. Optimization of program code.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Apply optimization techniques to problems in computer science	III	Apply
CO2	Implement the concepts in distributed system that fulfills requirements with regards to desired properties	III	Implement
CO3	Build complex SQL queries to retrieve information for business decision making from databases .	III	Build

CO-PO Mapping:

CO	PO 1	PO 2	PO 3
CO 1	1		
CO 2			3
CO 3			2

Course Contents: Students will perform minimum 10-12 assignment based on followig	
Experiments:	
Experiment No. 1:--- Designing a compiler for a simple grammar Aim and Objectives: To revise phases of a compiler Outcomes: Intermediate code Theoretical Background: Design of compiler Experimentation: Results and Discussions: Conclusion: A simple compiler can be designed for a given grammar	2 Hrs.
Experiment No. 2:--- Identify Basic Blocks	2 Hrs.

Aim and Objectives: To identify Basic Blocks in termediate code Outcomes: Independant basic blocks of code Theoretical Background: Experimentation: Results and Discussions: Conclusion: Basic blocks of intermediate code can be identified by following algorithms	
Experiment No. 3:--- Data Flow Analysis Aim and Objectives: To analyse flow of data in a program Outcomes: Data Flow Graph Theoretical Background: Parsing Experimentation: Results and Discussions: Data Flow Diagram Conclusion: Data Flow can be analysed by following algorithms	2 Hrs.
Experiment No. 4:--- Classical Optimizations Aim and Objectives: To implement classical optimization techniques Outcomes: Optimized code Theoretical Background: Optimization techniques Experimentation: Results and Discussions: Code can be optimized by using classical techniques.	2 Hrs.
Experiment No. 5:--- Garbage Collection Aim and Objectives: To implement Garbage Collection algorithm Outcomes: Memory without garbage data Theoretical Background: Garbage collection methods Experimentation: Results and Discussions: Clean and free memory Conclusion: Garbage collection can be achieved by following different methods	2 Hrs.
Experiment No. 6:---Program Testing & Debugging Aim and Objectives: To Test & debug programs Outcomes: Bug free programs Theoretical Background: Program testing techniques Experimentation: Results and Discussions: Bug free programs Conclusion: Programs can be tested and debugged by using different tools	2 Hrs.
Experiment No. 7: Enhanced Entity Relationship (EER) Model Aim and Objectives:To design an Enhanced Entity Relationship (EER) Model for sample database.	2 Hrs.

Outcomes: Students will understand how to design EER model. Theoretical Background: Database design for an ORDBMS, Nested Relations and collections, Experimentation: A University wants to track persons associated with them. A person can be an Employee or Student. Employees are Faculty, Technicians and Project associates. Students are Full time students, Part time students and Teaching Assistants. a) Design an Enhanced Entity Relationship (EER) Model for university database. Write OQL for the following i. Insert details in each object. ii. Display the Employee details. iii. Display Student Details. iv. Modify person details. v. Delete person details. Conclusion: Thus an Enhanced Entity Relationship (EER) Model for university database has been created and successfully executed.	
Experiment No. 8: Parallel database Aim and Objectives: To develop an university counselling application for engineering colleges. Outcomes: Students will understand parallel Database. Theoretical Background: Architecture of Parallel Databases,Parallel Query evaluation; parallelizing individual operations, sorting, joins. Experimentation:Consider the application for University Counselling for Engineering Colleges. The college, department and vacancy details are maintained in 3 sites. Students are allocated colleges in these 3 sites simultaneously. Implement this application using parallel database [State any assumptions you have made] Two forms are created for viewing available seats and allocating seats. The first form will view only the available seats in each site. The second form is used to allocate seats for students. If a seat is allocated to a student, all the 3 sites are updated in parallel. Conclusion: This software provides an efficient way of managing university counselling application for engineering colleges.	2 Hrs.
Experiment No. 9: Parallel database -2 Aim and Objectives: To implement parallel join and parallel sort algorithms to get marks from different colleges of the university and publish 10 ranks for each discipline Theoretical Background: Architecture of Parallel Databases,Parallel Query evaluation; parallelizing individual operations, sorting, joins. Experimentation: There are 5 processors working in a parallel environment and producing output. The output record contains college details and students mark information. Implement parallel join and parallel sort algorithms to get the marks from different colleges of the university and publish 10 ranks for each discipline. Five tables are created in which each table represents a college. Each table contains various departments and its overall percentage. Query is written to extract the details from all the 5 tables in parallel and colleges are arranged based on their department overall percentage. Conclusion:This software provides an efficient way of managing university counselling application for engineering colleges	2 Hrs.
Experiment No. 10:Distributed Database - Aim and Objectives: Construct a distributed database for a bookstore with 4 sites called S1, S2, S3 and S4.	2 Hrs.

Title of the Course: Professional Elective Lab-II Course Code:PCSE0232	L	T	P	Credit
			4	2

Course Pre-Requisite:
Database Management System, Computer Graphics ,Computer Networks

Course Description:

Course Objectives:

5. To understand the concepts and protocols related to Internet of Things.
6. Introducing to data analytics providing some basic data-science tools.
7. Be familiar with both the theoretical and practical aspects of computing with images;
8. Be familiar with different types of ad hoc routing protocols
9. To understand different phases of natural language processing

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO 1	Organize embedded devices to form IOT	5	Organize
CO 2	Deploy a structured lifecycle approach to data science and big data analytics projects	3	Deploy
CO 3	Analyse and evaluate critically the building and integration of computer vision algorithms and systems.	3	Apply
CO 4	Design and implement routing protocols for ad hoc networks and compare it with already existing routing protocols	2	Use
CO 5	Resolve word sense Ambiguation and Apply binding theory on sentences	5	Resolve and Apply

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1			3
CO2	1		
CO3		2	

Assessments :

Teacher Assessment:

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

Assessment	Marks
ISE	50
ESE	50

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

ESE: Assessment is based on oral examination

Course Contents:

Internet of Things

Experiment No. 1:--- To familiarize with ARM mbed board and understand the procedure of creation and compilation of C++ source code. Aim and Objectives: To understand ARM mbed board and the procedure of creation and compilation of C++ source code. Outcomes: Theoretical Background: Experimentation: 1. Connect ARM mbed board with PC using proper USB cable 2. Click on html link and you will be redirected to mbed website 3. create the login to use online compiler 4. Click on Platform and select mbed LPC11U24 5. Read all the documents related to concerned platform 6. Study pin diagram showing mapping of LPC11U24 pins with mbed LPC11U24 board with all functions 7. Study how to create source codes for mbed board Results and Discussions: Compilation and programming of ARM mbed board is done and process understood Conclusion: Using online compiler and editor it is easy to program ARM board anywhere, with only mandatory requirement of internet access	2 Hrs
Experiment No. 2:--- Creating different LED patterns and use ARM mbed board, on-board LEDs for checking output. Aim and Objectives: To write C++ source code for creating different LED patterns and use ARM mbed board on-board LEDs for checking output Outcomes: Theoretical Background: Experimentation: 1. Write desired C++ source code 2. Compile using online compiler Results and Discussions: Output observed at LEDs, as per compiled C++ source code.	2 Hrs

Conclusion: Small changes in source code may result in saving memory space and programmers efforts tremendously.	
Experiment No. 3:--- Interfacing LEDs and push to on switch with ARM mbed board at different GPIO pins. Aim and Objectives: To write C++ source code for interfacing LEDs and push to on switch with ARM mbed board at different GPIO pins. Outcomes: Theoretical Background: Experimentation: 1. Connect LEDs as per connections 2. Write the desired C++ program and compile using online compiler 3. Connect switch as per connections 4. Write the desired C++ source code and compile using online compiler Results and Discussions: Output observed at GPIO pins. LEDs and switch interfacing achieved at GPIOs as per compiled C++ source code. Conclusion: LCD is interfaced with ARM mbed board and is showing messages	2 Hrs
Experiment No. 4:--- Interfacing 16x2 LCD with ARM mbed board at different GPIO pins. Aim and Objectives: To write C++ source code for interfacing 16x2 LCD with ARM mbed board at different GPIO pins. Outcomes: Theoretical Background: Experimentation: 1. Connect 16x2 LCDs as per connections given in Figure 4.1 2. Write the desired C++ source code 3. Compile using online compiler Results and Discussions: Output "Hello World" observed at 16x2 LCD as per C++ source code written. Conclusion: LCD is interfaced with ARM mbed board and is showing messages	2 Hrs
Experiment No. 5:--- Using analog input at GPIO pin with ARM mbed board. Aim and Objectives: To write C++ source code for using analog input at GPIO pin with ARM mbed board. Outcomes: Theoretical Background: Experimentation: 1. Connect input as per connections 2. Write the desired C++ program and compile using online compiler Results and Discussions Output is observed at all 4 on board LEDs as per variations in analog input voltage	2 Hrs

Conclusion: Analog voltage inputs are taken by ARM mbed board and corresponding Digital data is stored into internal registers.	
Experiment No. 6:--- Creating a Bluemix Application Aim and Objectives: Build your Internet of Things application Outcomes: Theoretical Background: Experimentation: 1. In your browser go to the Bluemix URL http://bluemix.net and login if necessary 2. click on the Dashboard link 3. click on CREATE AN APP 4. For the template choose Web 5. choose Browse samples and clik Browse samples 6. select the boiler plate Internet Of the Things Results and Discussions : IoT application will be created Conclusion:	2 Hrs
Data Analytics	
Experiment No. 1: Installation of Hadoop Aim and Objectives: How to install hadoop Outcomes: Students will able to know installation of hadoop and its file system. Theoretical Background: Hadoop is an Apache open source framework written in java that allows distributed processing of large datasets across clusters of computers using simple programming models. A Hadoop frame-worked application works in an environment that provides distributed storage and computation across clusters of computers. Hadoop is designed to scale up from single server to thousands of machines, each offering local computation and storage. Experimentation: A user/application can submit a job to the Hadoop (a hadoop job client) for required process by specifying the following items: 1. The location of the input and output files in the distributed file system. 2. The java classes in the form of jar file containing the implementation of map and reduce functions. 3. The job configuration by setting different parameters specific to the job. Conclusion: Hadoop on Linux operating system is installed successfully.	2 Hrs
Experiment No. 2 Installation of R Aim and Objectives: To know installation procedure of R tool Outcomes: Students will able to know installation of R and execution of different commands Theoretical Background: The package provides various statistical methods for designing and analyzing randomized experiments.	2 Hrs

Experimentation: The package provides various statistical methods for designing and analyzing randomized experiments. One main functionality of the package is 3the implementation of randomized-block and matched-pair designs based on possibly multivariate pre-treatment covariates. The package also provides the tools to analyze various randomized experiments including cluster randomized experiments, randomized experiments with noncompliance, and randomized experiments with missing data. Conclusion: The package also provides the tools to analyze various randomized experiments including cluster randomized experiments, randomized experiments with noncompliance, and randomized experiments with missing data	
Experiment No. 3: Building Hadoop Map Reduce application for counting frequency of word/phrase in simple text file Aim and Objectives: To demonstrate the workings of map reduce in hadoop. Theoretical Background: Word count is a typical example where Hadoop map reduce developers start their hands on with. This sample map reduce is intended to count the no of occurrences of each word in the provided input files. Experimentation: There are 5 processors working in a parallel environment and producing output. The output record contains college details and students mark information. Implement parallel join and parallel sort algorithms to get the marks from different colleges of the university and publish 10 ranks for each discipline. Five tables are created in which each table represents a college. Each table contains various departments and its overall percentage. Query is written to extract the details from all the 5 tables in parallel and colleges are arranged based on their department overall percentage. Conclusion: This Demonstrates how map reduce works	2 Hrs
Experiment No. 4: Study of Hadoop Hive DDL commands, like create database, viewing database, dropping database, altering database, creating tables, dropping and altering tables. Aim and Objectives: Student will learn how these commands work. Experimentation: HiveQL DDL a statement includes: CREATE DATABASE/SCHEMA, TABLE, VIEW, FUNCTION, INDEX DROP DATABASE/SCHEMA, TABLE, VIEW, INDEX TRUNCATE TABLE ALTER DATABASE/SCHEMA, TABLE, VIEW MSCK REPAIR TABLE (or ALTER TABLE RECOVER PARTITIONS) SHOW DATABASES/SCHEMAS, TABLES, TBLPROPERTIES, VIEWS, PARTITIONS, FUNCTIONS, INDEX [ES], COLUMNS, CREATE TABLE	2 Hrs

DESCRIBE DATABASE/SCHEMA, table_name, view_name PARTITION statements are usually options of TABLE statements, except for SHOW PARTITIONS.	
Experiment No. 5: Study of Hadoop Hive DML commands like Insert, delete, update, data retrieval queries and Join-inner and outer Aim and Objectives: Student will learn how these commands work Experimentation: DML (Data Manipulation Language) commands in Hive are used for inserting and querying the data from hive tables once the structure and architecture of the database has been defined using the DDL commands listed above. Data can be loaded into Hive tables using – -LOAD command -Insert command	2 Hrs
Experiment No. 6: Manipulating and processing data in R- merging datasets, sorting data, putting data into shape, managing data using matrices managing data using data frames. Aim and Objectives: To learn how processing of data in R using data frames. Outcomes: Students will be able to execute different views on data frames. Theoretical Background: PL SQL- A Basic introduction, Functions and Procedure, Packages, Synonyms, Database Links, Embedded SQL and Dynamic SQL. Experimentation: 1. Merge – adds variables to a dataset. This document will use –merge– function. Merging two datasets require that both have at least one variable in common (either string or numeric). If string makes sure the categories have the same spelling (i.e. country names, etc.). Explore each dataset separately before merging. Make sure to use all possible common variables (for example, if merging two panel datasets you will need country and years). Append – adds cases/observations to a dataset. This document will use the –rbind– function. Appending two datasets require that both have variables with exactly the same name. If using categorical data make sure the categories on both datasets refer to exactly the same thing (i.e. 1 “Agree”, 2”Disagree”, 3 “DK” on both). Conclusion: Thus the merge and Append command executed and verified successfully	

Computer Vision	
Experiment No. 1: Finding camera intrinsic and extrinsic matrix Aim and Objectives: Outcomes: Theoretical Background: Experimentation: Given an input image of chessboard and physical co-oordinates of some points, find the dimensions of chessboard. Results and Discussions: Conclusion:	2 Hrs
Experiment No. 2: Disparity calculation	2 Hrs
Experiment No. 3: Ellipse Fitting	2 Hrs
Experiment No. 4: Multiple Plane fitting using J-linkage	2 Hrs
Experiment No. 5: Mosaicing of Images to create a cylindrical panorama	2 Hrs
Experiment No. 6: Find out optical flow between successive frames in a video to track motion of an object	2 Hrs
Wireless Adhoc Networks	
Experiment No. 1:--- Installation of NS 2 Aim and Objectives: Creating Simulation Environment for Ad hoc Network Outcomes:- Students will be able to test protocols in simulated environment. Theoretical Background: Creating physical ad hoc network could be a tedious job. It will be costly too. Providing well accepted standard for testing protocols is a good alternative. NS 2 is accepted and recognized by many professional institutions as a Networking Simulation tool for projects. Experimentation: Install NS 2 in Linux operating system. Test its working. Results and Discussions: NS2 should run, user should be able to execute simple programs in NS2 Conclusion: Students can develop and test protocols for ad hoc network in NS2	2 Hrs
Experiment No. 2:--- Testing Back-off algorithm Aim and Objectives: Back off algorithm is used by MAC layer of Ad hoc network for traffic scheduling on physical media. Testing this algorithm will explain students how to use back off variable in NS 2 Outcome: Students will understand the Back-off mechanism of MAC layer. Theoretical background: To handle collusion in network and resend the collided packet by gaining the access is one of the key tasks of MAC layer. binary exponential back-off period is used by MACA, MACAW family. Experimentation: use back-off variable of NS 2 to test the algorithm. Result and Discussion: The node detecting collusion goes into sleep state for back-off time period, avoiding loss of data. Conclusion: back-off period is useful to avoid repeated collusion in network.	2 Hrs
Experiment No. 3:- Use of Bellman-ford algorithm to detect nodes in network. Aim and Objective: Detective live nodes in the network using beacon based approach to build basic routing information. Outcome: Students will understand, how the beacon signals are used to detects neighbour nodes in network. Theoretical Background:The Bellman–Ford algorithm is an algorithm that computes shortest paths from a single source vertex to all of the other vertices in a	2 Hrs

weighted digraph. Network use beacons to detect neighbours, it then collect information about neighbours of neighbours. Experimentation: Create NS 2 network with 4-5 nodes randomly having direct links to each other. Pick any node as first node and run bellman ford algorithm on it. Results and Discussion: The successful completion of program will generate shortest path to all other nodes from start node. This experiment will demonstrate the use of beacons to find path from source to destination. Conclusion: Bellman ford algorithm can be extended to Ad Hoc wireless network.	
Experiment No. 4:- Simulate Table Drive Protocol Aim and Objectives: To study Proactive routing protocol of Ad Hoc network. So students can understand its working. Outcome: Students will learn Proactive routing strategy for Ad Hoc Wireless N/w. Theoretical background: For routing Ad Hoc network uses proactive, reactive and hybrid approach. Table drive protocols use proactiv strategy. They maintain all routes to the all nodes from every node in network. Experimentation: Simulate DSDV protocol in NS 2 Results and Discussion: DSDV performance when network size is small is excellent, but as we keep on increasing the network it start generating heavy control traffic and hence not adequate for huge network. Conclusion: DSDV have best routes available at all time at the cost of poor bandwidth utilization.	2 Hrs
Experiment No. 5:-- Reactive routing protocol Aim and Objective: To study behaviour of reactive routing approach in Ad Hoc network. Students should be able to use reactive protocols or proactive protocols depending on situation. Outcome: Students will learn the best and worst scenario for reactive strategy. Theoretical background: Reactive strategy finds the route as and when required by a node in Ad Hoc network. Due to this it generates very less network traffic and uses most of bandwidth for data transfer. But, it also comes with the delay of finding routes between nodes as it is reactive strategy. Experimentation: Simulation of DSR/ABR/SSA any one of these protocols. Results and Discussion: Reactive strategy generates less control traffic, but it need to find route between nodes and have the initial delay, broken links are also concern for reactive protocols as they do not maintain path. Conclusion: Reactive strategy generates very low control traffic, but routes are of no guarantee. Node may suffer from data loss by using stale link, it also may have to find new route to destination.	2 Hrs
Experiment No. 6:--- Simulating LOR based Protocol Aim and Objective: Simulating specific resource based protocols, to experiment with Ad Hoc network ability to take advantage of hardware resources Theoretical Background: Ad Hoc network supports protocols which uses specific hardware resource to optimally find the path. LOR - Location Aided Routing Protocol is one example of it. It uses GPS signal to find the best route for destination. It comes in two flavours LOR1 and LOR2. LOR 1 uses requested zone and expected zone, whereas LOR2 uses distance calculation method to find route. Experimentation: Simulating LOR protocol with NS2.	2 Hrs

Result and Discussion: Reactive strategy flood the network with route finding request messages, it is also a time consuming process. To answer these drawbacks LOR uses GPS, Using GPS LOR send Route finding messages in specific network area and do not flood it in entire network	
Natural Language Processing	
Experiment No. 1:--- Parts of speech Aim and Objectives: To identify parts of speech Outcomes: Separated parts of speech of a sentence Theoretical Background: Experimentation: Results and Discussions: Conclusion: Parts of speech of a natural language (English) can be identified.	2 Hrs
Experiment No. 2:--- Parsing Aim and Objectives: To parse a natural language sentence Outcomes: Parsed sentence Theoretical Background: Parsing Experimentation: Results and Discussions: Conclusion: NL sentences can be parsed by using parsing algorithms	2 Hrs
Experiment No. 3:--- Parse tree construction Aim and Objectives: To construct parse tree of a sentence Outcomes: Parse tree Theoretical Background: Parsing Experimentation: Results and Discussions: Parse tree Conclusion: Using grammar of a language parse tree of a sentence can be constructed	2 Hrs
Experiment No. 4:--- Word Sense Disambiguation Aim and Objectives: To implement an algorithm for WSD Outcomes: Disambiguated words in sentences Theoretical Background: WSD algorithms Experimentation: Results and Discussions: words in sentences with disambiguated meaning Conclusion: Word sense disambiguation can be performed by using different algorithms.	2 Hrs
Experiment No. 5:--- Statistical Machine Translation Model Aim and Objectives: To implement machine translational model Outcomes: Translated sentences Theoretical Background: Machine translation Experimentation: Results and Discussions: Translated sentences Conclusion: Translation of natural language sentences can be achieved by following models	2 Hrs

Experiment No. 6:--- Linear regression Aim and Objectives: To achieve linear regression Outcomes: Regression coefficients of words Theoretical Background: Linear regression theory Experimentation: Results and Discussions: Regression coefficients of words are calculated. Conclusion: Linear regression is used to calculate coefficients of words.	2 Hrs
High Performance Computing	
Experiment No. 1:- To design and implement quick sort algorithm using openMP	2 Hrs
Experiment No. 2:- To study different profilers like GPROF, GCOV, VTUNE Amplifier	2 Hrs
Experiment No. 3:-To analyze the performance of developed algorithms using above profilers	2 Hrs
Experiment No. 4:-Implementation of dense matrix using MPI	2 Hrs
Experiment No. 5:-To design and implement algorithm for different communication operators	2 Hrs
Experiment No. 6:- Study of Pthread library	2 Hrs
Textbooks: 1. 2. . .	
References: 1] 2] .	
Experiment wise Measurable students Learning Outcomes: 1 2	

Title of the Course: Seminar Course Code:PCSE0241	L	T	P	Credit
			2	1

Course Pre-Requisite:

Course Description: Students are trained for research and presentation skills in this course.

Course Objectives:

1. To promote and develop presentation skills
2. Learn how to evaluate research papers
3. Identify and use variety of academic resources available
4. Learn fundamental principles, concepts or theories

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Demonstrate ability to use technical resources available	2	Demonstrate
CO2	Write technical documents and give oral presentations related to the work completed	5	Write
CO3	Explain some specific skills, competences and points of view needed by computing professionals	6	Explain

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1	3	2	3
CO2	2	3	2
CO3	1	3	2

Assessments :

Teacher Assessment:

Two component of In Semester Evaluation (ISE)

Assessment	Marks
ISE-I	50
ISE-I	50

ISE are based on Presentation/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents/Guidelines:

- Attendance at each seminar is mandatory for all students enrolled
- Abstract should be concise(<250 words), well written and free of grammatical and typographical errors
- Each student will give 30- minute presentation
- Your seminar should cover several(5 or more) related papers
- The topic should be in an area closely related to your research.
- You should strive to organize your seminar into a cohesive presentation, and be selective about what you present
- Final grade will be determined by several factors: the quality and content of your seminars, presentation and the ability to meet scheduled deadlines.

Title of the Course: Mini Project	L	T	P	Credit
Course Code:PCSE0251	0	0	2	1

Course Pre-Requisite:

Course Description: Students are required to carry out Mini Project work under the supervision of a Guide provided by Programme Coordinator.

Course Objectives:

1. To apply the acquired knowledge and techniques
2. Develop software solutions for real problems
3. Identify and use variety of academic resources available
4. Learn fundamental principles, concepts or theories

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Formulate a real world problem and develop a solution for a set of requirements	6	Formulate
CO2	Test and validate the conformance of the developed prototype against the original requirements of the problem	6	Test and
CO3	Analyze new tools, algorithms, and/or techniques that contribute to the software solution of the project	5	Analyze

CO-PO Mapping:

CO	PO1	PO2	PO3
CO1			3
CO2	2		
CO3			3

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE)

Assessment	Marks
ISE	50

ISE are based on Presentation/ Internal oral etc.

Course Contents/Guidelines:

- Every student is required to carry out Mini Project work under the supervision of a Guide provided by the Programme Coordinator.
- The Guide shall monitor progress of the student continuously.
- Mini Project proposal should be prepared in consultation with the Guide. It should clearly state the objectives and environment of the proposed Mini Project to be undertaken
- A student is required to present the progress of the Mini Project work during the semester as per the schedule provided
- Final grade will be determined by several factors: the quality and content of your presentation and the ability to meet scheduled deadlines.
- Each student is required to make a copy of Mini Project in CD and submit along with his/her Mini Project report.