Academic Program: PG

Academic Year 2021-22

Department of Information Science and Engineering

Information Technology

I & II Semester M.Tech.

Syllabus

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution Approved by AICTE & Affiliated to VTU, Belagavi)

Ph: 0836-2447465Fax: 0836-2464638 Web: www.sdmcet.ac.in

SDM College of Engineering & Technology, Dharwad
Department of Information Science and Engineering

College Vision and Mission

Vision:

To develop competent professionals with human values.

Mission:

1. To have contextually relevant Curricula.
2. To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
3. To enhance Research Culture.
4. To involve Industrial Expertise for connecting classroom content to real life situations.
5. To inculcate Ethics and impart soft-skills leading to overall Personality Development.

SDMCET- Quality Policy

- In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stake holders.

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work and
- Trust

Department Vision and Mission

Vision:

To develop globally acceptable Information Technology Engineering professionals with human values.

Mission:

1. Adopting the state of the art curricula
2. Practicing effective and innovative teaching-learning methodologies
3. Initiating complementary learning activities to enhance competence
4. Inculcating positive attitude and commitment to society.

SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for I & II semester M.Tech in Information Technology is recommended by the Board of Studies of Information Science and Engineering Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2021-22 till further revision.

Chairman BoS & HoD **Principal**

Program Educational Objectives (PEOs):

The Program Educational Objectives (PEOs):

I. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms
II. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise
III. To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, research, design and implementation skills
IV. To prepare graduates who will thrive to pursue life-long reflective learning to fulfill their goals

Program Outcomes (POs):

PO1: An ability to independently carry out research / investigation and development work to solve practical problems.
PO2: An ability to write and present a substantial technical report / document.
PO3: Student should be able to demonstrate a degree of mastery over the area of Information Technology
PO4: An ability to analyze real life problems and design and implement software solution for them

Scheme of Teaching and Examination
I Semester

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PRMIC100	Research Methodology and IPR	2-0-0	2	50	50	2		
20PITC100	Data Analytics	4-0-0	4	50	100	3		
20PITC101	Distributed Computing Systems	4-0-0	4	50	100	3		
20PITC102	Artificial Intelligence	4-0-0	4	50	100	3		
20PITEXXX	Elective 1	4-0-0	4	50	100	3		
20PITL103	Data Analytics Lab	0-0-3	2	50			50	3
20PITL104	Seminar	0-0-2	1	50				
Total		**18-0-5**	**21**	**350**	**450**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
***** SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

Electives for I Semester:

Course Code	Elective 1 Courses
20PITE125	Agile Technology
20PITE126	Cloud Computing
20PITE127	Storage Technologies

Scheme of Teaching and Examination
II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITC200	Machine and Deep Learning	4-0-0	4	50	100	3		
20PITC201	Internet of Things	3-2-0	4	50	100	3		
20PITEXXX	Elective 2	3-0-2	4	50	100	3		
20PITEXXX	Elective 3	4-0-0	4	50	100	3		
20PITEXXX	Elective 4	3-0-2	4	50	100	3		
20PITL202	Machine Learning Lab	0-0-3	2	50			50	3
20PITL203	Seminar	0-0-2	1	50				
Total		**17-2-9**	**23**	**350**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
*SEE for theory courses is conducted for **100 marks** and reduced to **50 marks**.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

Electives for II Semester:

Course Code	Elective 2 Courses	Course Code	Elective 3 Courses	Course Code	Elective 4 Courses
20PITE225	Data Science	20PITE228	Virtual reality	20PITE231	Advanced Computer Graphics
20PITE226	Client-server Programming	20PITE229	Parallel Computing	20PITE232	User Interface Design
20PITE227	Network Engineering	20PITE230	Mobile Adhoc & sensor network	20PITE233	Pervasive computing

I Semester

20PRMIC100	Research Methodology and IPR	(2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs): The students are expected to learn about the need and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing. Further, the students shall know about the intellectual property rights, copy rights, trademarks, patents, patents filing procedure, infringement &remedies and information technology act etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** the research problem, carryout literature survey and decide the methodology.	-	1	-
CO-2	**Use** measurement and scaling and **carryout** data collection.	-	1	-
CO-3	**Test** the hypothesis, **interpret** & **analyze** the results and **write** the report.	2	3	-
CO-4	**Explain** the need of IPR, copy right, patents, trademarks,& the filing procedure and know about infringement, remedies and regulatory framework.	-	2	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	2	2.5	2	-

Prerequisites: 1) Branch specific course on problem analysis (Preferred)

Contents:

1) **Research Methodology:** 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 and problems encountered by researchers in India. **2 Hrs.**

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration. **1 Hrs.**

2) **Reviewing the literature:** Importance of the literature review in research, How to review the literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed. **2 Hrs.**

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, important experimental designs. **3 Hrs.**

3) **Measurement and Scaling:** Measurement in research, measurement scales, sources of error in measurement, scaling, meaning of scaling and important scaling techniques **2 Hrs.**

Data Collection: 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. **2 Hrs.**

4) **Testing of Hypotheses:** What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses. **2 Hrs.**

5) **Interpretation and Report Writing:** Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation and mechanics of writing a research report, precautions for writing research reports, plagiarism and its significance. **3 Hrs.**

6) **Introduction to Intellectual Property Rights:** Meaning and conception of IPR, competing, rationale for protection, international conventions, world court. **1 Hrs.**

Copy right: Historical evolution of the law on copy right, meaning, content, substance, ownership, primary, special rights, obligations, period, assignment and relinquishment of copy rights. License and application for registration of copy right.

Patents: Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions, publications and public use, priority date and its purpose, procedure for obtaining patent. Stages of procedure, refusal to grant patent

- consequence, protection period, drafting if claims, grant of patent and significance of date of patent and date of ceiling. Services available with patent office, jurisdiction, appellate authorities, powers and obligations of central government, patent agent and controller – not a civil court. **4 Hrs.**

Industrial design: Concepts &Significance **1 Hr.**

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trade marks, application for registration and procedure for registration, procedure and certification of Trademarks. **1 Hr.**

Infringement and Remedies: Meaning of infringement, acts of infringements, suit against infringement and defence against infringement, reliefs and certificate of validity. **1 Hr.**

The information Technology Act: Definitions, certifying authority, meaning of compromise of digital signature, offences and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, World Wide Web and domain names and cyber flying. Self Study. **1 Hr.**

Reference Books:

1) C.R. Kothari, GauravGarg, Research Methodology: Methods and Techniques, New Age International, 4th Edition, 2018.
2) Ranjit Kumar,Research Methodology a step-by-step guide for beginners, SAGEPublications, 3rd Edition, 2011.
3) Fink A, Conducting Research Literature Reviews: From the Internet to Paper, SagePublications, 2009.
4) N. K. Acharya, Text book on Intellectual Property Rights,4th Edition, Asia Law House, Hyderabad

20PITC100	Data Analytics	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's):

Students will learn to optimize business decisions and create competitive advantage with Big Data analytics and learn to explore the fundamental concepts of big data analytics and analyze the big data using intelligent techniques and understand the various search methods and visualization techniques. They also learn to use various techniques for mining data stream and understand the applications using Map Reduce Concepts.

Course Outcome (CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		Mapping to Pos(1-3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Demonstrate the big data platform and explore the big data analytics techniques business applications.	1		
CO-2	Design efficient algorithms for mining the data from large volumes.		1	
CO-3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics.			2
CO-4	Illustrate on Big Data applications using Pig and Hive.		2	
CO-5	Demonstrate the fundamentals of various big data analytics techniques.	3		

POs	PO-1	PO-2	PO-3
Mapping Level	2.5	1.5	3

Pre-requisites:

1. Knowledge of data structure, data bases and basic statistics.

2. Some programming experiences

Contents:

1) **Introduction to big data :** Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting **10 Hrs.**

2) **Mining data streams :** Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions. **10 Hrs.**

3) **Hadoop:** History of Hadoop- the Hadoop Distributed File System – Components of HadoopAnalysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features-Hadoop environment. **10 Hrs**

4) **Frameworks:** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams. **10 Hrs**

5) **Predictive Analytics-** Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications. **12 Hrs**

Reference Books:

1) Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

2) Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.

3) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.

4) AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012.

5) Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& sons, 2012.

6) Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.

7) Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

20PITC101	Distributed Computing Systems	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): The students are expected to learn about the design and properties distributed system, the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions, recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems, design a distributed system that fulfills requirements with regards to key distributed systems properties (such as scalability, transparency, etc.), be able to recognize when this is not possible, and explain why, build distributed system software using basic OS mechanisms as well as higher-level middleware and languages.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** distributed system and its properties **design** a system as a distributed system,	1	-	-
CO-2	**Describe** the problems and challenges associated with these principles, and **evaluate** the effectiveness and shortcomings of their solutions;	2	3	-
CO-3	**Recognize** the applied principles in contemporary distributed systems, and be able to identify features and design decisions that may cause problems;	1	3	-
CO-4	**Design** a distributed system that fulfills requirements with regards to key distributed systems properties (such as scalability, transparency, etc.)	1	2	4
CO-5	**Implement** distributed system software using basic OS mechanisms as well as higher-level middleware and languages.	1	-	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.5	2.0	1.0

Prerequisites: 1) Operating system

Contents:

1) **Characterization of Distributed Systems**-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models- Introduction, Architectural and Fundamental models, Networking and Internet-working, Inter process Communication. Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI **10 Hrs**

2) **Operating System Support**-Introduction, OS layer, Protection, Processes and Threads, Communication, and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems. Name Services-Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service. **10 Hrs**

3) **Peer to Peer Systems**-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement – Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems. **10 Hrs**

4) **Transactions and Concurrency control** –Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency controls. Distributed Transactions – Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data. **12 Hrs**

5) **Security and Authentication:** basic concepts, Kerberos. Resource sharing and load balancing. **Special topics:** distributed objects, distributed databases, directory services, web **10 Hrs**

services.

Reference Books:

1) Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2) Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor, & Francis Group, 2010.
3) Distributed Computing, S. Mahajan and S. Shah, Oxford University Press.
4) Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI.
5) Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, Tata McGraw-Hill Edition.
6) Reliable Distributed Systems, K. P. Birman, Springer.

20PITC102	Artificial Intelligence	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives(CLO's): The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning

Course Outcome(CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe concepts of AI and Intelligent agents.	1	2	-
CO-2	Apply searching techniques for AI systems	2	-	-
CO-3	Design the logic for knowledge representation and reasoning in AI based systems.	3	-	-
CO-4	Formalize a given problem in the language/framework of different AI methods.	3	-	-
CO-5	Analyze different learning algorithms in AI systems &Implement applications using different artificial intelligence concepts.	3	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3.0	2.5	3.0	-

Pre-requisites:
Statistics and Probability

Contents:

1) **Introduction:** What is AI? AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics,

Production system characteristics -Specialized productions system- Problem solving methods – Problem graphs, matching **10Hrs**

2) State space search:Depth first and Breath first, Indexing and Heuristic functions Heuristic Search- Best First Search, Hill Climbing, Beam Search, Randomized Search: Simulated Annealing, Genetic Algorithms, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms. **10Hrs**

3) Representation of Knowledge - Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge, Mini max Algorithm, AlphaBeta Algorithm **10Hrs**

4) Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Propositional Logic, First Order Logic, Soundness and Completeness Rule value approach, Bayesian Theory-Bayesian Network-Dempster – Shafer theory. **10Hrs**

5) Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation, Basic plan generation systems , Learning- Machine learning, adaptive Learning **12Hrs**

Reference Books:

1) Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.
2) Elaine Rich, Kevin Knight, Shiva Shankar B Nair, Artificial Intelligence, Tata McGraw Hill 3rd Edition, 2013.
3) Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications,MorganKaufmann, 2011.
4) Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition,Prentice Hall, 2009.
5) Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2nd Edition, 2004

20PITL103	Data Analytics Lab	(0-0-3) 2

Contact Hours:26

Course Learning Objectives (CLO's):

Students will learn to Optimize business decisions and create competitive advantage with Big Data analytics and Imparting the architectural concepts of Hadoop and introducing map reduce paradigm and Introducing Java concepts required for developing map reduce programs and Derive business benefit from unstructured data and Introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Preparing for data summarization, query, and analysis.	1	-	-
CO-2	Applying data modeling techniques to large data sets.	-	1	-
CO-3	Creating applications for Big Data analytics.	-	-	2
CO-4	Building a complete business data analytic solution.	-	2	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	2.5	1.5	3.0	-

Lab Exercises:

1) Perform setting up and Installing Hadoop in its two operating modes. **2Hrs**

2) Run a basic Word Count Map Reduc0e program to understand Map Reduce Paradigm. **2Hrs**

3) Stop word elimination problem **2Hrs**

4) Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores. **4Hrs**

5) Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data. **2Hrs**

6)	Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg).	**4Hrs**
7)	Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	**4Hrs**
8)	Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scale.	**2Hrs**
9)	Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.	**4Hrs**

20PITL104	Seminar	(0-0-2) 1

Contact Hours:26

Course Learning Objectives (CLO's): This course to enable the students to read technical articles, to know recent technology developments, to have research flavor, to promote and develop presentation skills.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explore new trends in various recent information technologies.	3	-	3
CO-2	Analyse the survey done on research paper.	2	3	2
CO-3	Analyse various techniques relevantto their topics, Study a new topic independently.	3	2	-
CO-4	Prepare the technical documents and publication.	3	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level		2.0	2.4	

Prerequisites: NIL

Guidelines:

1) In consultation with assigned guide the student has to select a topic for seminar purpose.

2) The student is required to study the research papers published (by Science Direct, IEEE transactions, Elsevier, ACM transactions, Springer publications, etc) in their respective fields for report preparation and presentation purposes.

3) The student has to present the work in any of the Conference/Workshop/Symposium/Journal on the selected topic.

4) Marks Distribution: Implementation + Presentation (PPT) + Report: 10 + 25 + 15=50.

20PITE125	Agile Technologies	(4-0-0)4

Contact Hours:52

Course Objectives: To understand how an iterative, incremental development process leads to faster delivery of more useful software To understand the essence of agile development methods To understand the principles and practices of extreme programming To understand the roles of prototyping in the software process, understand the concept of Mastering Agility

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyse** The XP Lifecycle, XP Concepts, Adopting XP	1	-	-
CO-2	Work on Pair Programming, Root-Cause **Analysis**, Retrospectives, **Planning**, Incremental Requirements, Customer Tests	1	-	-
CO-3	**Implement** Concepts to Eliminate Waste	-	2	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	-	-

Pre-requisites: Software Engineering.

Contents:

1) **Why Agile?**: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor

10Hrs

2) **Understanding XP:** The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility.

10Hrs

3) **Practicing XP:** Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings,

Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, TenMinute Build, Continuous Integration, Collective Code Ownership, Documentation, Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating, Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing.

12 Hrs

4) **Mastering Agility:** Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process**: Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People**: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste**: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10Hrs

5) **Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence**: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery.

10Hrs

Reference Books:

1. James shore, Chromatic, "The Art of Agile Development (Pragmatic guide to agile software development)", O'Reilly Media, Shroff Publishers & Distributors, 2013.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall; 1st edition, 2002
3. Craig Larman,"Agile and Iterative Development A Manger's Guide", Pearson Education, First Edition, India, 2004.

20PITE126	Cloud Computing	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's): Cloud computing helps organizations realize cost savings and efficiencies without spending capital resources up front, while modernizing and expanding their IT capabilities.

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Compare and Contrast the various cloud service models, cloud delivery models, key cloud characteristics, roles and boundaries and important terminology	1	-	-
CO-2	Explain how virtualization technology has enabled cloud computing.	-	2	-
CO-3	Demonstrate how various cloud providers such as AWS, Google Compute and Microsoft Azure implement and offer IaaS, PaaS and SaaS services.	-	3	-
CO-4	Develop, deploy, manage and scale applications running in platforms such as Java /Python Platform (PaaS).	-	3	-
CO-5	Describe how cloud can be used to perform Big Data Analytics using distributed computing technologies like Hadoop.	-	3	-

Course Outcomes (CO's):

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	2.0	-

Pre-requisites: Computer Networks

Contents:

1) **Introduction**: Cloud Infrastructure Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage

diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises Self learning component:-. User experience and software licensing **10Hrs**

2) **Cloud Computing**: Application Paradigms. Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep, The Web application, Cloud for science and engineering, High-performance computing on a cloud, SLC: Cloud computing for Biology research, Social computing **9Hrs**
3) **Cloud Resource Virtualization**: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and par a virtualization, Hardware support for virtualization, Case Study: Xen a VMM based para virtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, Exercises and problems **8Hrs**
4) **Cloud Resource Management and Scheduling**: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines **8Hrs**
5) **Python for Cloud**: Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for MapReduce, Python Packages of Interest, Python Web Application Framework - Django, Designing a RESTful Web API

   Cloud Application Development in Python: Design Approaches, Image Processing App, Document Storage App, MapReduce App, Social Media Analytics App **8Hrs**
6) **Comparing Cloud Platforms**: AWS (Amazon Web Services), GCP (Google Cloud Platform), IBM Cloud, Salesforce.

   Cloud Native and Emergent Cloud Trends: Hybrid Multicloud, Serverless, Microservices, Cloud Native, DevOps, Application Modernization **9Hrs**

Reference Books:

1) Arshdeep Bahga and Vijay Madisetti - "Cloud Computing: A Hands-On Approach", Universities Press India, 2014.
2) Dan C. Marinescu "Cloud Computing and Practice", 1/e, Elsevier (MK), 2013.
3) Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud".
4) Morgan Kaufmann - "Computing Foundations and Applications Programming", 2/e, 2013.
5) Anthony. Velte, "Cloud Computing A Practical Approach", 1/e, McGraw Hill, 2010.
6) Tom White, "Hadoop: The Definitive", 3/e, O'Reilly, 2013.

20PITE127	Storage Technologies	(4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLO's): To help the students: To outline basic terminology and components in information storage and retrieval systems, to compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Model, to describe current trends in information retrieval such as information visualization. To understand a backup process and securing and managing storage infrastructure

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the role and use of technology in business systems and operations	1	-	-
CO-2	**Identify** and describe organizational structure and business processes within these.	1	-	-
CO-3	**Develop** an understanding of network engineering principles for network, system and service management.	-	2	-
CO-4	**Implement** information systems in industry	-	2	-
CO-5	**Discuss the** method and replication methods.	2	-	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	1.3		1

Pre-requisites: Computer Network

Contents:

1. **Introduction to Information Storage:** Information Storage, Evolution of Storage Architecture, Data center Infrastructure, Virtualization and cloud computing. **Data Center Environment:** Application, Database Management System(DBMS), Host(compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, Disk Native Command Queuing, Introduction to Flash Drives, Concept in Practice: VMware ESXi. **Data Protection: RAID:** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares, **Case Study**. **10 Hrs.**
2. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Storage Provisioning, Types of intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX. **Fibre Channel Storage AreaNetworks:** Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity,Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, Concepts in Practice: EMC Connectrix and EMC VPLEX.**IP SAN and FcoE:** iSCSI, FCIP, FcoE. **10 Hrs.**
3. **Network-Attached Storage:** General-purpose Servers versus NAS Devices, benefits of NAS, File Systems andnetwork File Sharing. Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, factors Affecting NAS Performance, File-Level Virtualization, Concepts in Practice: EMC Isilon and EMC VNX gateway. **10 Hrs.**
4. **Backup and Archive: B**ackup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operation, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Dedupulication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture, Concepts in Practice: EMC Networker, EMC Avamar, and EMC Data domain. **Local Relication:** Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in Virtualized Environment, Concepts in Practice: EMC TimeFinder.

10 Hrs

5. **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage SecurityDomains, Security implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Concepts in practice: RSA and VMware Security Products. Case Study.

12 Hrs

Reference Books:

1) EMC^2: Information Storage and Management, Willey India 2013.
2) EMC Corporation, Information Storage and Management, Wiley, India. ISBN-13: 978-8126537501, August 2012.
3) Robert Spalding, “Storage Networks: The Complete Reference“, Tata McGraw Hill, Osborne, 2003.
4) Marc Farley, “Building Storage Networks”, Tata M cGraw Hill, Osborne, 2001.
5) Additional resource material on www.emc.com/resource-library/resource-library.esp.

II Semester

20PITC200	Machine and Deep Learning	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course will enable students to Explain basic concepts of learning and decision trees, Compare and contrast neural networks and genetic algorithms , Apply the Bayesian techniques and instant based learning and Examine analytical learning and reinforced learning

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Choose the learning techniques with this basic knowledge.	-	-	1
CO-2	Apply effectively neural networks and genetic algorithms for appropriate applications.	-	1	-
CO-3	Derive effectively learning rules.	-	3	-
CO-4	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains	-	2	-
CO-5	Implement deep learning algorithms and solve real-world problems.	-	-	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	1.5	2.0	2.0	1.0

Prerequisites: 1) Database Management Systems

Contents:

1) INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search

12Hrs

2) NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.**10Hrs**
3) INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **10Hrs**
4) Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout. **10Hrs**
5) How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features. **10Hrs**

Reference Books:

1) Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.
2) Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3) T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.
4) Deep Learning Lan Good fellow and Yoshua Bengio and Aaron Courville MIT Press 2016.
5) Neural Networks: Asystematic Introduction Raúl Rojas 1996.
6) Pattern Recognition and machine Learning Chirstopher Bishop 2007.

20PITC201	Internet of Things	(3-2-0) 4

Contact Hours: 39

Course Learning Objectives: This course considers at the Internet of Things (IoT) as the general theme of real-world things becoming increasingly visible and actionable via Internet and Web technologies. The goal of the course is to take a top-down as well as a bottom-up approach, thereby providing students with a comprehensive Analysis of the IoT: from a technical viewpoint as well as considering the societal and economic impact of the IoT.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** portable IoT applications using Arduino/ Raspberry Pi.	2	-	-
CO-2	**Develop** web services to access and control IoT devices.	3	-	-
CO-3	**Deploy** an IoT application and connect to the cloud.	-	3	-
CO-4	**Analyze** IoT applications data.	2	-	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	-	3.0	2.5	-

Pre-requisites: Computer Networks

Contents:

1. **Introduction:** Introduction to Internet of Things (IoT): IoT overview, Physical and Logical design of IoT, IoT Enabling Technologies, IoT levels, Domain Specific IoTs: Home Automation, Smart Cities, Smart Environment, Smart Energy, Smart Retail, Smart Logistics, Smart Agriculture, Smart Industry, Smart Health.

   7 Hrs.

2. **Data-Link Layer and Networking Layer Protocols for Internet of Things:** Recent Protocols for IoT, L2 Protocols for IoT, Power Line Communication (PLC), Broadband Over Power Lines (BPL), OFDM, Home Plug, Connected Home, Convergent Digital Home Network, IEEE 1905.1, Netricity, Field bus, Industrial Ethernet, IEEE 1451, Smart Cards, IoT Ecosystem, IEEE 802.15.4,EUI64 Addresses, 6LowPAN, IP+UDP Header Compression: Stateless, Context Based

Compression, Routing Protocol for Low-Power and Lossy Networks (RPL), IPv6 Technologies for the IoT, MQTT, 6LoWPAN. **10 Hrs.**

3. **IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, Introduction to Software Defined Networking (SDN), SDN for IoT and Network Function Virtualization (NFV) for IoT, Cloud Computing, Sensor-Cloud, Fog Computing, **7 Hrs.**
4. **IoT Systems - Logical Design using Python:** Introduction, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Classes, Python Packages of Interest for IoT **5 Hrs.**
5. **Tools for IoT and case studies:** Introduction, NETCONF, YANG, YIN and BEEP, Case Studies illustrating IoT Design-Introduction, Home and Agriculture Automation **4 Hrs.**
6. **Data Analytics for IoT:** Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Data Handling and Analytics **7 Hrs.**
7. **Semester Project using Arduino and Raspberry Pi: 20Hrs**
    a) Project Design Meeting.
    b) Project Plan (timeline, assignment of tasks, etc.)
    c) Introduction & Overview of Projects
    d) Project Implementation Strategy Meeting
    e) User Interfaces and Application Examples
    f) Project Progress Demo -1, 2, 3, 4, 5
    g) Final Project Demo

Beyond the Syllabus Coverage (Suggestive):

1. Students' Survey papers related to IoT
2. Laboratory Experiments
3. Seminar

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015
2. Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 2017 CRC Press)
4. Michael Miller,” The Internet of Things”, First Edition, Pearson, 2015.
5. Claire Rowland, Elizabeth Goodman et.al.,” Designing Connected Products”, First Edition, O’Reilly, 2015

6. Samuel Greengard, The Internet of Things, MIT Press, 2015
7. H. Zhou, "The Internet of Things in the Cloud: A Middleware Perspective," CRC Press, 2012, ISBN:1439892997
8. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
9. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
10. Internet of Things courses from www.edx.orgwww.coursera.orgwww.nptel.ac.in

20PITL202	Machine Learning Lab	(0-0-3) 2

Contact Hours: 26

Course Objectives (CLO's): This course will enable students to explain basic concepts of learning and decision trees. Compare and contrast neural networks and genetic algorithms. Apply the Bayesian techniques and instant based learning. Examine analytical learning and reinforced learning.

Course Outcome(CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Understand the implementation procedures for the machine learning algorithms.	-	1,4	-
CO-2	Design Java/Python programs for various Learning algorithms.	1	4	-
CO-3	Apply appropriate data sets to the Machine Learning algorithms.	-	1,4	-
CO-4	Identify and apply Machine Learning algorithms to solve real world problems.	1	4	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	2.5	-	-	2

Contents:

Description (If any):

The programs can be implemented in either JAVA or Python.

1. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

20PITL203	Seminar	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives(CLO's): This course to enable the students to read technical articles, to know recent technology developments, to have research flavor, to promote and develop presentation skills.

Course Outcome(CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explorenew trends in various recent information technologies.	3	-	4
CO-2	Analyse the survey done on research paper.	2	3	4
CO-3	Analyse various techniques relevant to their topics, Study a new topic independently.	3	2	4
CO-4	Prepare the technical documents and publication.	3	-	4

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	-	2.5	2.75	1

Prerequisites: NIL

Guidelines:

1) In consultation with assigned guide the student has to select a topic for seminar purpose.

2) The student is required to study the research papers published (by Science Direct, IEEE transactions, Elsevier, ACM transactions, Springer publications, etc) in their respective fields for report preparation and presentation purposes.

3) The student has to present the work in any of the Conference/Workshop/Symposium/Journal on the selected topic.

4) Marks Distribution: Implementation + Presentation (PPT) + Report: 10 + 25 + 15=50.

20PITE225	Data Science	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course will enable students to Define data science and its fundamentals , Demonstrate the process in data science, Explain machine learning algorithms necessary for data sciences , Illustrate the process of feature selection and analysis of data analysis algorithms and Visualize the data and follow of ethics

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Define data science and its fundamentals	-	-	4
CO-2	Demonstrate the process in data science	-	3	-
CO-3	Explain machine learning algorithms necessary for data sciences	-	-	-
CO-4	Illustrate the process of feature selection and analysis of data analysis algorithms	-	2	-
CO-5	Visualize the data and follow of ethics	1	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3	2	2	1

Prerequisites: 1) Database Management Systems

Contents:

1) Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. NeededStatistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, - Introduction to R

12Hrs

2) Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, kNearest Neighbors (k-NN), k-means

10Hrs

3) One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web **10Hrs**
4) Feature Generation and Feature Selection (Extracting Meaning From Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system **10Hrs**
5) Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists **10Hrs**

Reference Books:

1. Doing Data Science Cathy O'Neil and Rachel Schutt Straight Talk From The Frontline.O'Reilly 2014.
2. Mining of Massive Datasets. v2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press 2014 .
3. Machine Learning: A Probabilistic Perspective Kevin P. Murphy 2013.
4. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.

20PITE226	Client-Server Programming	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives: This subject will provide students with the principles and practical programming skills of developing Internet and Web applications. It enables students to master the development skill for both client-side and server-side programming, especially for database applications. Students will have opportunity to put into practice the concepts through programming exercises based on various components of client/server web programming.

Course Outcomes:

Description of the Course Outcome:		**Mapping to POs(1,11)**		
At the end of the course the student will be able to:		**Substantial Level (3)**	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Analyze basic I/O Functions available in UNIX, Context Switching and Protocol Software.	-	2	-
CO-2	Design Programming System Calls, Basic I/O Functions available in UNIX	3	-	-
CO-3	Demonstrate use of Client Server Applications	-	1	-
CO-4	Compare the pros and cons of various clients – server applications and their issues.	-	-	2

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	2	1.5	3	-

Pre-requisites: Computer Communications, Operating Systems.

Contents:

1) **The Client Server Model and Software Design:** Introduction, Motivation, Terminology and Concepts **Concurrent Processing in Client-Server software**: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols**: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX Using UNIX I/O with TCP/IP. **8 Hrs**

2) **The Socket API:** History of Sockets, Specifying a protocol interface, ,Socket abstraction, Specifying an endpoint address, A Generic address structure, Functions in the SOCKET API, Utility routines for integer conversion, Using Socket calls in a program, Symbolic constants **Algorithms and Issues in Client Software Design**: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **(8T+6P) Hrs**

3) **Example Client Software:** Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service. **(8T+8P) Hrs**

4) **Algorithms and Issues in Server Software Design:** Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, **(8T+6P) Hrs**

Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

5) **Iterative, Connectionless Servers (UDP):** Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes. **(8T+6P) Hrs**

Reference Books:

1. Douglas E. Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001.

20PITE227	Network Engineering	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLO's): Students are exposed to various concepts and design principle of networking.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the principles of network engineering.	1	-	-
CO-2	**Explain** advanced network engineering concepts and techniques	-	2	-
CO-3	**Develop** an understanding of network engineering principles for network, system and service management.	3	-	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	3.0	1.0

Pre-requisites: Computer Network

Contents:

1) **FOUNDATIONS OF NETWORKING: C**ommunication Networks Network Elements Switched Networks and Shared media Networks Probabilistic Model and Deterministic Model Datagrams and Virtual Circuits Multiplexing Switching Error and Flow Control Congestion Control Layered Architecture Network Externalities Service Integration**. 8T+2P=10Hrs**
2) **QUALITY OF SERVICE:**Traffic Characteristics and Descriptors Quality of Service and Metrics Best Effort model and Guaranteed Service Model Limitations of IP networks Scheduling and Dropping Policies for BE and GS models Traffic Shaping Algorithms End to End Solutions Laissez Faire Approach – Possible improvements in TCP – Significance of **UDP in Inelastic Traffic 8T+2P=10Hrs**
3) **HIGH PERFORMANCE NETWORKS:** Integrated Services Architecture Components and Services Differentiated Services NetworksPer Hop Behavior Admission Control – MPLS Networks – Principles and Mechanisms Label Stacking RSVP RTP/RTCP. **8T+2P=10Hrs**
4) **NETWORK DEVICE ARCHITECTURE**: Network Devices Switch Router

Hardware Components Software Configuration Routing ,Concepts Static Routing Dynamics Routing Routing Information Protocol Configuration Open Shortest Path First Protocol Configuration Access Control List Standard Extended Named. Multiplexers, Modems and Internet Access Devices Switching and Routing Devices-Router Structure- Configuring EGP RIP OSPF IS-IS Hub Bridges – Routers Link Virtualization Multicast Architecture.

10T+2P=12Hrs

5) **SOFTWARE DEFINED NETWORKING**: HistoryData Plane Support for SDN Software Routers Programmable Hardware Control Plane Support for SDN Modern SDN Stack Programming Languages Applications Data Centre Networking Software Defined Radio Campus Networks. **8T+2P=10Hrs**

Reference Books:

1) Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education/PHI, 2009.
2) Larry L Peterson and Bruce S Davie, 'Computer Networks: A Systems Approach', FifthEdition, Morgan Kaufman Publishers, 2012.
3) Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
4) James Macfarlane ," Network Routing Basics: Understanding IP Routing in Cisco Systems", Wiley edition 1 2006.
5) Wendell Odom and Rick McDonald, "Routers and Routing Basics CCNA 2 Companion Guide (Cisco Networking Academy)", Cisco press, 2006

20PITE228	Virtual Reality	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's): The objective of the course is to provide an understanding to the students the fundamentals of virtual reality systems. Aim is to summarize the 3D interaction techniques and its importance to provide design guidelines to develop and analyze the real world applications of virtual reality.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** fundamentals of virtual reality systems	1	2	-
CO-2	**Summarize** the hardware and software of the virtual reality.	1	2	-
CO-3	**Explain** the 3D Interaction Techniques design guidelines for a virtual reality system.	-	3	-
CO-4	**Summarize** the design guidelines for a virtual reality system	-	-	3
CO-5	**Analyze** the applications of virtual reality.	4	-	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	2.0	3.0

Contents

1) **VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS**: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for virtual reality, benefits of virtual reality. **10 Hrs**
2) **HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES-** Visual Displays, Auditory displays, choosing Output devices for 3D User Interfaces. **3D USER INTERFACE INPUT HARDWARE**: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Choosing Input Devices for 3D Interfaces.
   SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy,

Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occludes, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits.. **12 Hrs**

3) **3D INTERACTION TECHNIQUES**: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Way finding, User Centered Way finding Support, Environment Centered Way finding Support, Evaluating Way finding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands,Tools, Multi modal System Control Techniques, Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry. **10 Hrs**
4) **DESIGNING AND DEVELOPING 3D USER INTERFACES**: Strategies for Designing and Developing Guidelines and Evaluation. **ADVANCES IN 3D USER INTERFACES:** 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development,3D UI evaluation and other issues. **12 Hrs**
5) **VIRTUAL REALITY APPLICATIONS**: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training. **8 Hrs**

Reference Books:

1) Kelly S. Hale Kay, M. StanneyHandbook of Virtual Environment : Design , CRC Press, 2nd Edition, 2015.
2) Steven M. LaValle., Virtual reality – http://vr.cs.uiuc.edu/book.html,Cambridge, 2016
3) Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
4) Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
5) Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.
6) William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)”. Morgan Kaufmann Publishers, San Francisco, CA, 2002.
7) John Vince, “Virtual Reality Systems”, Addison Wesley, 1995.

20PITE229	Parallel Computing	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives: Parallel computing is pervasive. From embedded devices, laptops, to highend Super computer and large scale data centers, parallel computing is widely employed To achieve performance and efficiency targets. This course introduces the foundations of parallel computing, including parallel architectures, parallel programming methods and techniques, parallel algorithm designs, and parallel performance analysis.

Course Outcome:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	An ability to **apply** knowledge of computing and mathematics appropriate to the discipline.	1	2	
CO-2	An ability to **analyze** a problem and identify the computing requirements Appropriate for its solution; an ability to design, implement and evaluate a Computer based system, process, component or program to meet desired needs.	3	4	
CO-3	An ability to **apply** mathematical foundations, algorithmic principles and Computer science theory to the modeling and design of computer based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices	4	5	
CO-4	An ability to **apply** design and development principles in the construction of Software systems of varying complexity.	5		
CO-5	An ability to **function** effectively as a member of a team in order to accomplish a common goal..	4	3	

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3	2	2.5	2.66

Pre-requisites: Programming languages like C/C++/Java.

Exposure to multi core architectures

Contents:

1) Introduction to Parallel Computing: Need of Performance, Building Parallel Systems, Why to Write Parallel Programs? How to Write Parallel Programs? Approach: Concurrent, Parallel, Distributed. **Parallel Hardware and Parallel Software:** Background, Modifications to the von Neumann Model,Parallel Hardware, Parallel Software, Input and Output, Performance, Parallel Program Design and Writing and Running Parallel Programs. **10 Hrs.**

2) Distributed Memory Programming with MPI: Getting Started, The Trapezoidal Rule in MPI, Dealing with I/O, Collective Communication, MPI Derived Data types, A Parallel Sorting Algorithm **10 Hrs.**

3) Shared Memory Programming with Pthreads: Processes, Threads and Pthreads, Hello, World program ,Matrix-Vector Multiplication, Critical Sections Busy-Waiting, Mutexes, Producer-Consumer Synchronization and Semaphores, Barriers and Condition Variables, Read-Write Locks, Caches, Cache-Coherence, and False Sharing and Thread-Safety **11 Hrs.**

4) Shared Memory Programming with OpenMP: Introduction to OpenMP, TheTrapezoidalRulemScopeof Variables, The Reduction Clause, The Parallel For Directive, More About Loops in OpenMP: Sorting, Scheduling Loops, Producers and Consumers, Caches, Cache-Coherence, and False Sharing and Thread-Safety. **11 Hrs.**

5) Parallel Program Development and Parallel Algorithms: Two N-Body Solvers, Tree Search and Case Studies. **10 Hrs.**

Reference Books:

1) Peter s. Pacheco," An introduction to parallel programming",1/e, Morgan Kaufmann Publishers, 2011

2) Barbara Chapman, Gabriele Jost and Ruud van der Pas, "Using OpenMP: Portable Shared Memory Parallel Programming" , 3/e, The MIT Press, 2007

3) William Gropp and Ewing Lusk, "Using MPI: Portable Parallel Programming with the Message Passing Interface", 3/e, MIT Press, 201

20PITE230	Mobile Adhoc &Sensor Networks	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The student should be made to understand the different design issues, MAC protocols, routing protocols and its architecture in ad hoc and sensor networks

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks	1	-	-
CO-2	Analyze the MAC protocol design issues of ad hoc networks	-	2	-
CO-3	Analyze the MAC protocol design issues of sensor networks	-	2	-
CO-4	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues	-	2	3
CO-5	Evaluate the QoS related performance measurements of ad hoc and sensor networks	1	2,3	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	1.5	1

Pre-requisites: 1. Computer Networks

Contents:

1) **Introduction**: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks. **10 Hrs**
2) **MAC Protocols for Ad Hoc Wireless Networks**: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention

based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11 **9Hrs**

3) **Routing Protocols And Transport Layer In Ad Hoc Wireless Networks**: Issues in designing a routing and Transport Layer protocol for Ad hoc networks-proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks. **10 Hrs**
4) **Wireless Sensor Networks and MAC Protocols**: Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4. **12 Hrs**
5) **Wsn Routing, Localization & Qos :**Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues. 10 **Hrs**

Reference books:

1) C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, 2008.
2) Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
3) Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.
4) Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005
5) Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
6) Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

20PITE231	Advanced Computer Graphics	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLO's): The objective of this course is to Introduce various Graphics Applications in real world scenario and to be familiar with image fundamentals and animations. students will learn more about 2D, 3D and Curve applications , the basics and Fundamentals of Multimedia and Multimedia components and Tools.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate 2D and 3D graphics algorithms and Explain and compare various projections	3,4	-	-
CO-2	Explain and demonstrate fundamentals of graphics used in various real life applications	-	3,4	-
CO-3	Compare and explain the performance characteristics of graphics algorithms and different color models.	-	-	3
CO-4	Explain Different algorithms based on image based rendering	-	3	-
CO-5	Explain about different types of media format and their properties.	3	-	-
CO-6	Applying efficient graphics technique to solve engineering problems	3	4	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	-		2.33	1.33

Pre-requisites: Engineering Mathematics

Contents:

1) **Review of two-dimensional graphics :**Transformations Windowing Clipping **Three Dimensions :** 3D geometry, primitives and transformations, Rotation about an arbitrary axis, Parallel and perspective projection Viewing parameters 3D clipping and viewing transformation **8T+2P=10Hrs**
2) **Curves and Fractals Polygon Meshes Parametric Cubic curves:** B-spline, Bezier Hermite, Parametric Bicubic Surfaces Quadric surfaces **Solid Modeling** : Representing solids Regularized Boolean Set Operations Primitive Instancing Sweep and Boundary Representations Spatial-partitioning Representations Constructive Solid Geometry User Interface for Solid Modeling **10T+2P=12Hrs**
3) **Achromatic and Colored Light** Achromatic light, Gamma correction, Halftone approximation, Color models for Raster Graphics. Using Color in Computer Graphics **Hidden Lines and Surfaces** :Algorithms for Visible-Line and Surface determination: zbuffer, List priority, Scan line, Area Subdivision, Ray Tracing **8T+2P=10Hrs**
4) **Image based Rendering**: Introduction comparison with geometry based rendering applications **6T+2P=8Hrs**
5) **Multimedia:** Introduction to Multimedia- Concepts, uses of multimedia, hypertext and hypermedia, Image, video and audio standards. Audio- digital audio, MIDI, processing sound, sampling, compression. Video- MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation-types, techniques, key frame animation, utility, morphing, Virtual Reality concepts **10T+2P=12Hrs**

Reference Books:

1) Hearn, Baker, “Computer Graphics (C version)", 2/e, Pearson education.
2) Foley, Vandam, Feiner, Hughes, “Computer Graphics principles",2/e, Pearson Education.
3) D. F. Rogers, J. A. Adams, “Mathematical Elements for Computer Graphics” ,TMH.
4) Z. Xiang, R. Plastock,“ Schaum’s outlines Computer Graphics",2/e” ,TMH.
5) W. M. Newman, R. F. Sproull,“Principles of Interactive computer Graphics” ,TMH.

20PITE232	User Interface Design	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

User Interface design is a course offered as a elective subject at the post graduate level for II semester students. The objective of this course is for the students to learn the basic principles of user interface design and become familiar with the techniques of data collection and interpretation. On learning this they should be able to deploy the knowledge of UID principles, design concepts and related methodologies, be familiar with the design technologies for individuals, apply theories and concepts associated with effective work design to real-world application and understand the theory behind what they do.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the key principles of user interface design.	-	4	-
CO-2	**Design** interfaces for the specification.	4	2	-
CO-3	**Illustrate** the components of direct manipulation and virtual environments.	-	3	-
CO-4	**Demonstrate** the functionality of User's task for a real time application.	1	4	-
CO-5	**Summarize** the concepts of windows layout and visualization.	-	-	4

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3	2	3	2

Pre-requisites: Knowledge of Software Engineering

Contents:

1) **Introduction:** Importance of User interface design, Characteristics of Graphical and web interface, user centered design, user interface design process, UI design principles, user system interaction, interaction styles, information presentation, user documentation, evaluation. **Usability of Interactive Systems**: Introduction, Usability Requirements, Usability measures,

Usability Motivations, Universal Usability, Goals for our profession Guideline, principles, and Theories: Guidelines, Guidelines, principles, Theories**.**

(8T+2P) Hrs.

2) **Managing Design Processes and Evaluating Interface designs:** Introduction, Organizational Design to support Usability, The four pillars of design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Social Impact statement for Early Design Review, Expert Reviews, Usability testing Acceptance tests, evaluating during active use. **8 Hrs.**

3) **Direct Manipulation and Virtual Environments:** Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, 3D Interfaces, Tele operation, Virtual and Augmented Reality. Menu Selection, Form Filling, and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry with Menus: Form Filling, Dialog Boxes, and Alternatives, Audio Menus and Menus for small Displays. **(10T+2P) Hrs.**

4) **Command and Natural Languages:** Introduction, Functionality to Support User‘s Tasks, Command-Organization Strategies, The Benefits of Structure, Naming and Abbreviations, Natural Language in Computing. Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and auditory interfaces, display small and large printers. **(10T+2P) Hrs.**

5) **Quality of Service, User Manuals:** Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response Time, Frustrating Experiences. Balancing Function and Fashion: Introduction Error Messages, Display Design, Window Design Color, User Manuals, Online Help, and Tutorials- Paper versus Online Manuals, Reading from Paper Verses from Displays, Shaping the Content of the Manuals, Online Manuals and Help, Online Tutorials, online communities for user assistance. Information Search and Visualization: Introduction, Search in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interfaces, Information Visualization. **10 Hrs.**

Reference Books:

1) Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interfacell, 5/e, Pearson Education, 2010.

2) Jenifer Tidwell, ”Designing Interfaces Patterns for effective design”, 2/e, O‘Reilly Media, 2010.

3) Jesse James Garrett, “The Elements of User Experience: User – Centered Design for the Web and Beyond”, 2/e, New riders- Pearson Education, 2011.

4) Wilbert O. Galitz, “The Essential Guide to User Interface Design”, An Introduction to GUI Design Principles and Techniques”, 2/e, Wiley Dreamtech, 2011.

20PITE233	Pervasive Computing	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLO's): The course aims at providing a sound conceptual foundation in the area of Pervasive Computing aspects and developing a design thinking approach towards problem-solving in this domain. The course attempts to provide a balanced treatment of the mechanisms and environments of pervasive computing and initiates senior CSE and EE students to the state-of-the-art in the area. At the end of this course, students should be able to conceptualize, analyze and design select classes of pervasive computing systems.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the fundamental theoretical concepts in pervasive computing	1	-	-
CO-2	**Explain** the aspects of context awareness	1	2	-
CO-3	**Describe** the methods for efficient resource allocation and task migration	1	2	3
CO-4	**Analyze** the HCI Service Selection and HCI migration framework	1	3	4
CO-5	Design and implement pervasive application systems	4	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3.0	2.0	1.5	2.0

Pre-requisites: Computer Network

Contents:

1) **Pervasive Computing Concepts**: Perspectives of Pervasive Computing, Challenges, Technology; The Structure and Elements of Pervasive Computing Systems: Infrastructure and Devices, Middleware for Pervasive Computing Systems, Pervasive Computing Environments **12Hrs**

2) Context Collection, User Tracking, and Context Reasoning; Resource Management in Pervasive Computing: Efficient Resource Allocation in Pervasive Environments, Transparent Task Migration, Implementation and Illustrations.

10T+2P=12Hrs

3) HCI interface in Pervasive Environments: HCI Service and Interaction Migration, Context- Driven HCI Service Selection, Scenario Study: Video Calls at a Smart Office, A Web Service– Based HCI Migration Framework . **12T+2P=14Hrs**

4) Pervasive Mobile Transactions: Mobile Transaction Framework, Context-Aware Pervasive Transaction Model, Dynamic Transaction Management, Formal Transaction Verification, Evaluations

Case Studies: iCampus Prototype, IPSpace: An IPv6-Enabled Intelligent Space

12T+2P=14Hrs

Reference Books:

1) Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen,"Pervasive Computing: Concepts, Technologies and Applications",CRC Press, 2016.
2) Obaidat, Mohammad S., Mieso Denko, and Isaac Woungang, eds. Pervasive computing and networking. John Wiley & Sons, 2011.
3) Laurence T. Yang, Handbook On Mobile And Ubiquitous Computing Status And Perspective, 2012, CRC Press