Academic Program: PG

Academic Year 2025-26

Department of Computer Science & Engineering

M.Tech in Computer Science & Engineering

I & II Semester

Syllabus

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,
DHARWAD – 580 002

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

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

S D M College of Engineering & Technology, Dharwad
Department of Computer Science & 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 competent professionals in the field of Computer Science and Engineering with human values.

Mission:

1. To have contextually relevant curricula in line with industry trends and body of knowledge stated by IEEE /ACM.
2. To promote OBE based effective Teaching Learning Practices supported by modern educational tools and techniques.
3. To enhance research.
4. To involve the industrial expertise for connecting classroom contents to real-life situations.
5. To inculcate ethics and soft-skills leading to overall personality development.

S D M College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for I & II semester M.Tech in Computer Science & Engineering is recommended by the Board of Studies of Computer Science & 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 2024-25 till further revision.

Chairman BoS & HoD **Principal**

Program Educational Objectives (PEOs):

I. Contribute to the profession as an excellent employee or as an entrepreneur

II. Enhance their knowledge informally or by pursuing research work leading to new innovations and products

III. Work effectively in heterogeneous environment and be responsible member and leader of their communities

IV. Contribute positively to the needs of individuals and society at large by understanding the human, social and environmental context of their profession

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 current knowledge and technological trends in the field of Computer Science & Engineering.

PO4: Demonstrate the knowledge and understanding of the Computer Science & Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage a project in a multidisciplinary environment in terms of identifying requirements, conceptualizing the new and innovate system, modelling and designing the system / process, transforming the system model to working system and verify and validate the correctness of the system

PO5: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

PO6: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological change.

Scheme of Teaching and Examinations – 2024-25
M.Tech, Computer Science and Engineering
I Semester M.Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
24PCSC100	Applied Mathematics	3-0-0	3	50	100	3	-	-
24PCSC101	Advanced Algorithms	3-0-0	3	50	100	3	-	-
24PCSC102	Artificial Intelligence and Machine Learning	3-0-0	3	50	100	3	-	-
24PCSC103	Software Project Management	3-0-0	3	50	100	3	-	-
24PCSC104	Advances in Computer Networks	3-0-0	3	50	100	3	-	-
24PRMC105	Research Methodology and IPR	2-0-0	2	50	100	3	-	-
24PCSL101	Artificial Intelligence and Machine Learning lab	0-0-2	1	50	-	-	50	3
Total		**17-0-2**	**18**	**350**	**600**		**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.

Scheme of Teaching and Examinations – 2024-25
M.Tech, in Computer Science and Engineering
II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
24PCSC201	Cryptography and Network Security	3-0-2	4	50	100	3	-	-
24PCSC202	Data Science and Engineering	4-0-0	4	50	100	3	-	-
24PCSEXXX	Elective 1	4-0-0	4	50	100	3	-	-
24PCSEXXX	Elective 2	4-0-0	4	50	100	3	-	-
24PCSEXXX	Elective 3	4-0-0	4	50	100	3	-	-
24PCSL201	Data Science Engineering Laboratory	0-0-2	1	50	-	-	50	3
24PCSL202	Seminar	0-0-2	1	50	-	-	-	-
Total		**19-0-6**	**22**	**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 2 faculty members having specialization in respective program and allied areas.

Elective List:

Sl No	Course Code	Course title
1	24PCSE225	Block chain technology
2	24PCSE226	Image and Video Analytics
3	24PCSE227	Deep learning & Applications
4	24PCSE228	Soft and Evolutionary computing
5	24PCSE229	Agile Technologies
6	24PCSE230	Human Computer Interface

I – Semester

24PCSC100 Applied Mathematics (3-0-0) 3

Contact Hours:39

Course Learning Objectives (CLOs):

- Ability to analyze the solution and examine its stability in operator theory.
- Ability to optimize and solve real life problems.
- Ability to solve image processing and signal processing problems

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Use** statistical technique and use appropriate method to analyze multivariate data.	3,6	-	-
CO-2	**Understand** the probabilistic concepts required to test the hypothesis and take the decision using Analysis of variance. Apply the concept of optimization to solve linear and nonlinear programming problems.	-	-	3,6
CO-3	**Understand** vector spaces and related topics arising in magnification and rotation of images.	-	-	3,6
CO-4	**Apply** the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.	-	3,6	-
CO-5	**Compute** orthogonal and orthonormal basis vectors required to analyze image and signal processing problems.	-	3,6	-

Mapping Level:

POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
Mapping Level	-	-	1.8	-	-	1.8

Pre requisites:

1. Statistical Averages
2. Basic probability theory.
3. Random variables (discrete and continuous).

Contents:

1. **Statistics** :Statistical Inference: Introduction to multivariate statistical models: Curve fitting (Linear and Non-linear), Weighted least square approximation (Linear & Non Linear) Regression analysis: (Linear, Non Linear)& multiple regression. Correlation analysis: Correlation, Correlation for bivariate frequency distribution. The problem of over fitting model assessment **07 Hrs**
2. **Sampling theory**: Introduction to sampling distribution, standard error, Type-I and Type –II errors. Testing of hypothesis by z test, student's t-distribution test. **04 Hrs**
3. **Linear and Nonlinear programming:** Introduction to optimization problem. Simplex Method. Non linear Programming constrained extremal problems: Lagrange's multiplier method, Kuhn-Tucker conditions and solutions. **06 Hrs**
4. **Vector Spaces:** Vector spaces; subspaces, Linearly independent and dependent Vectors, Basis and dimension, coordinate vectors-Illustrative examples. Linear transformations, Representation of transformations by matrices. **07 Hrs**
5. **Symmetric Matrices:** Introduction to Eigen values and eigen vectors, Diagonalization, The Singular value decomposition. Applications to image processing and statistics, Principal Component Analysis **07 Hrs**
6. **Orthogonality and least squares:** Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram-Schmidt orthogonalization process. QR factorizations of a matrices, least square problems. Applications to linear models (least square lines and least square fitting of other curves). **08 Hrs**

Reference Books:

1. David C. Lay, Steven R. Lay and J. J. McDonald, "Linear Algebra and its Applications", Pearson Education Ltd 5 th Edition 2015.
2. M K Jain, S.R.K Iyengar, R K. Jain, "Numerical methods for Scientific and Engg. Computation ", New Age 2014 International 6th Ed.
3. T. Veerarajan,"Probability, Statistics and Random Process"**,** Tata Mc-Graw Hill Co 3rd Edition 2016.

24PCSC101 Advanced Algorithms (3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course focuses on asymptotic performance of algorithms, familiarity with major algorithms and data Structures, apply important algorithmic design paradigms and design efficient algorithms in common engineering design situations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** time complexities of algorithms using asymptotic analysis and amortized analysis.	-	3	-
CO-2	**Establish** and solve recurrences using tree method, master method, and substitution method.	-	3	-
CO-3	**Design** and implement solutions to engineering problems using Graph algorithms.	3	2	4,6
CO-4	**Explain** and analyze number-theoretic algorithms.	-	2,3	4,6
CO-5	**Implement** and analyze string matching algorithms.	3	2	4,6
CO-6	**Explain** algorithms for solving geometric problems	-	3	6
CO-7	**Explain** and analyze randomized algorithms Multithreaded algorithms	-	3	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**2.0**	**2.3**	**1.0**	**-**	**1.0**

Pre requisites: Knowledge of Data Structures

Contents:

1. **Review of Analysis Techniques:** Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods **08Hrs**
2. **Graph Algorithms:** Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite Matching. **08Hrs**
3. **Number -Theoretic Algorithms:** GCD, Modular Arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, RSA cryptosystem, rimarily testing, Integer factorization. **08Hrs**
4. **String-Matching Algorithms:** Naïve string Matching, Rabin - Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm, Boyer – Moore algorithms **08Hrs**
5. **Probabilistic Analysis and Randomized Algorithms:** The hiring problem, Indicator random variables, Randomized algorithm.
   Multithreaded Algorithms: The basics of dynamic multithreading, multithreaded matrix multiplication. **07Hrs**

Reference Books:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein "Introduction to Algorithms", 3rd Edition, Prentice -Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul "Algorithms", Cengage Learning, 2002
3. Ellis Horowitz, SartajSahni, S.Rajasekharan "Fundamentals of computer Algorithms", 2nd Edition, Universities press, 2007

24PCSC102 Artificial Intelligence and Machine Learning (3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs)

Objective of this course is to make student knowledge-full enough to determine when an AI approach is appropriate for a given problem, identify the appropriate representation, reasoning mechanism, models, algorithms, implement and evaluate it.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the representation and usage of knowledge using First order logic.	-	3,4	-
CO-2	**Apply** the decision making process with incomplete, inconsistent and ever changing facts.	-	3,4	-
CO-3	**Explain** regression and classification problems using supervised learning algorithms.	-	3,4	-
CO-4	**Apply** unsupervised learning algorithms and neural networks training for classification problems on available standard dataset.	-	3,4	-
CO-5	**Explain** expert systems and develop recommendation system.	-	3,4,5	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**2.0**	**2.0**	**2.0**	**-**

Prerequisites: Knowledge of Logic, Discrete Mathematic, Programming fundamentals.

Contents:

1. **Introduction to Artificial Intelligence**: Introduction, Solving problems by searching, Informed and Uninformed search, Knowledge Representation, First order logic, inference in First order logic, Propositional logic and Resolution Graph. **10 Hrs**
2. **Introduction to Statistical Decision Theory:** Regression, Classification, LinearRegression, Multivariate, Classification, Decision Trees, Regression Trees, Probabilistic classifier: Naive Bayes classifier, k-nearest neighbors (KNN). **10 Hrs**
3. **Unsupervised learning and clustering** – k- means clustering, hierarchical clustering: Agglomerative Clustering Reinforcement learning. **Neural Network:** ANN, CNN, RNN, Activation Functions. **10 Hrs**
4. **Expert Systems** : Introduction, Areas of Artificial Intelligence, Basic Function of An Expert System, Advantages, General Concepts, Characteristics. The Development of Expert Systems Technology, Applications and Domains, Broad Classes of Expert Systems, Example of an Structured Problem, Languages, Shells, And Tools, Elements of An Expert System, Procedural and Nonprocedural Paradigms, Artificial Neural Systems, Connectionist Expert Systems and Inductive Learning, The State of The Art in Artificial Intelligence **09 Hrs**

Reference Books:

1 Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2009

2 Elaine Rich and Kevin Knight ,“Artificial Intelligence”, 2nd Edition, Tata McGraw Hill, 2018

3 Trevor Hastie, Robert Tibshirani,” The Elements of Statistical Learning” , 2017

4 Christopher Bishop,”Pattern Recognition and Machine Learning”, (optional), 2009

5 Joseph Giarratano & Gary Riley, “Expert Systems Principles and Programming”, 3rd Edition, PWS Publishing company, A division of USA, ISBN 7-111-10844-2/TP-2586, 1998

6 Dr. S. B. Kulkarni, Dr. M. Laxminarayana, Prof. Raghavendrarao B, Benny, S,” Neural Networks and Deep Learning”, SIPH, 2022, ISBN : 975-93-5625-514-2

24PCSC103 Software Project Management (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course emphasis on the mastery on the various standards, procedures and industry relevant tools and techniques for software development and effective software project management. Students acquire knowledge through practices on various tools and techniques; to be ready for Industry expectations and trends.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** the requirement specifications and assess the quality.	3,4	-	-
CO-2	**Prepare** the design models/ Patterns and assess the quality.	3,4	-	-
CO-3	**Prepare** the test plan / procedures and explain the associated metrics.	3,4	-	-
CO-4	**Prepare** the appropriate charts to show the project schedule along with task dependencies and milestones.	3,4	-	-
CO-5	**Estimate** the cost of the project and prepare the report.	3,4	-	-
CO-6	**Identify** the risks and develop mitigation plan for the given project.	3,4	-	-
CO-7	**Use** the appropriate industry relevant tool.	3,4,6	-	-
CO-8	**Explain** the various standards and procedures to manage software reliability and quality	-	3,4	-

Mapping level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**2.9**	**2.9**	**-**	**3**

Prerequisites: Software Engineering principles and computer programming experience.

Contents:

1. **Overview:** Software product types/quality features/development phases, Requirement engineering, Process, Complexities, Design & Development of Models, Verifications and Validation strategies, Maintenance. **08Hrs**
2. **Software Project Management-Part-1:** Project Management Concepts, Process and Project Metrics, Project Scheduling: Activity Networks, CPM, PERT/GANTT charts, Cost estimation for Software Projects. **08Hrs**
3. **Software Project Management-Part-2:** Risk management, Software configuration management, Maintenance and Reengineering, Software Process Improvements. Software Reliability and Quality Management: ISO900 and SEI Capability maturity models, P-CMM, Software reuse. Over view of Metrics and Models in Software Quality Engineering **08Hrs**
4. **Software Design Patterns and Development Tools:** Design Patterns, Software tools for the design of: UI, UML Models and Test cases/ Scripts. (Ex: Adobe XD UI designer, Selenium, Rational Rose, Junit / Latest Trending tools are to be focused) **08Hrs**
5. **Software Project Management Tools:** Software configuration management tools and automation (Ex: Git /GitHub, Jira- Latest Trending tools are to be focused); Containerization through Self-contained Software Packages- Dockers/ Containers. **07Hrs**

Reference Books:

1. Ian Somerville, “Software Engineering”, 10/E, Person Education, 2016.
2. Pankaj Jalote, “An Integrated Approach to Software Engineering”,2nd Edition, Narosa Publishing House.
3. Roger Pressman, “Software Engineering, Practitioners approach”, 7/E, McGraw-Hill, 2010.
4. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI-2022.
5. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad & Michael Stal, “Pattern-Oriented Software Architecture, A System of Patterns”, Volume 1, John Wiley and Sons, 2006.
6. Stephan H. Kan, “Metrics and Models in Software Quality Engineering”, 2nd Edition, Pearson Education-2003

7. Watts Humphrey, “Managing the Software Process”, Pearson Education, 2000.
8. Pankaj Jalote, “Software Project Management in practice”, Pearson Education, 2002.

24PCSC104 Advances in Computer Networks (3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course focuses on advanced concepts of Computer Networks, protocols, internetworking and congestion algorithms.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** a systematic and critical understanding of the theories, principles and practices of computer networks.	-	3	-
CO-2	**Explain** and apply various switching and Internetworking mechanisms.	1	3	4
CO-3	**Explain** and apply various intra-network and internetwork routing algorithms.	1	3	4
CO-4	**Demonstrate** a systematic and critical understanding of end-to-end issues.	1	3	4
CO-5	**Explain** various congestion control techniques.	1	3	4

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**3**	**-**	**2**	**1**	**-**	**-**

Pre requisites: Basic Knowledge of Computer Networks.

Contents:

1. **Foundation:** Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay

X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. **08 Hrs.**

2. **Internetworking I:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. **08 Hrs.**
3. **Internetworking II:** Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP. **08 Hrs.**
4. **End-to-End Protocols:** Simple de-multiplexer (UDP), Reliable Byte Stream(TCP), End to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery. **08 Hrs.**
5. **Congestion Control and Resource Allocation** Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP, POP, IMAP, MIME), World Wide Web (HTTP), Network Management (SNMP) **07 Hrs.**

Reference Books:

1 Larry Peterson and Bruce S Davis, "Computer Networks: A System approach", 5th Edition, Elsevier 2014.

2 Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture", 6th Edition, PHI 2014.

3 Uyless Black, "Computer Networks, Protocols, Standards and Interfaces", 2nd Edition - PHI.2000.

4 Behrouz A Forouzan, "TCP /IP Protocol Suite" 4th Edition – Tata McGraw Hill, 2017.

24PRMC105 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: the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** their search 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	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**2.0**	**2.5**	**2.0**	**-**	**-**	**-**

Contents:

1. **Research Methodology:** Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, research process, criteria of good research and problems encountered by researchers in India.

Defining the Research Problem: Research problem, selecting the problem, technique involved in defining a problem, an illustration. **04 Hrs**

2. **Reviewing the literature:** How to review the literature, searching the existing literature, reviewing the selected literature.
   Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs **04 Hrs**
3. **Measurement and Scaling:** Measurement in research, measurement scales, sources of error in measurement
   Data Collection: Collection of primary data, collection of secondary data **04 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. **04 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, precautions for writing research reports, plagiarism and its significance. **03 Hrs**
6. **Introduction to Intellectual Property Rights:** Meaning and conception of IPR, competing, rationale for protection, international conventions, world Court.
   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.
   Industrial design: Concepts & Significance
   Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known, and well-known trademarks, application for registration and procedure for registration, procedure, and certification of Trademarks.
   Infringement and Remedies: Meaning of infringement, acts of infringement. **07 Hrs**

Self-Study- 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.

Reference Books:

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

24PCSL101 Artificial Intelligence and Machine Learning Lab (0-0-2) 1

Contact hours: 26

Course Learning Objectives (CLOs):

To provide hands on support to the students' study to determine when an AI approach is appropriate for a given problem, identify the appropriate representation and reasoning mechanism models, algorithms, implement and evaluate it.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the representation and usage of knowledge using First order logic.	-	3,4	-
CO-2	**Apply** the decision making process With incomplete, inconsistent and ever changing facts.	-	3,4	-
CO-3	**Explain** regression and classification problems using supervised learning algorithms.	-	3,4	-
CO-4	**Apply** unsupervised learning algorithms and neural networks training for classification problems on available standard dataset.	-	3,4	-
CO-5	**Explain** expert systems and develop recommendation system.	-	3,4,5	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**2.0**	**2.0**	**2.0**	**-**

Associated Lab Assignments (Sample):

1. Apply search techniques using informed and uninformed search.
2. Build a decision tree for the case of SDMCET students' performance based on the IA-1, IA-2, IA-3, CTA, Attendance, SEE marks (optional) and

classifying them into one of the Grade S, A, B, C, D, E & F. Study of precision of classification by including the 10^{th}, 12^{th} and CET/COMED-K into consideration.

3. Given the features of an email like , Sender's email ID, Number of typos in the email, Occurrence of words like "offer", "prize", "free Gift", classify the email as Spam or not. Use the feature vector to train a Logistic classifier which emits score in the range 0 to 1. If the score is more than 0.5, we label the email as spam. Otherwise, we don't label it as spam. (From https://magoosh.com/).
4. Apply regression technique to predict the salary of an employee.
5. Apply supervised learning algorithm to classify the known data.
6. Apply unsupervised learning algorithm to classify the unknown data.
7. Build recommendation system.

II – Semester

24PCSC201	Cryptography and Network Security	(3-0-2)4

Contact Hours: 52

Course Learning Objectives (CLOs):

This course focus on Principles of Cryptographic algorithms including secret key cryptography, hashing and message digests, and public key algorithms, Network security issues involving standalone computers, locally networked computers and remotely networked computers, Use of cryptographic techniques to establish security in modern information- and communication systems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Know** the various network securityattacks and knowledge on encryption techniques to achieve dataconfidentiality.	-	3	-
CO-2	**Apply** different security solutions for a given system using private and public key cryptography.	-	1, 3	4
CO-3	**Identify** the need for key management and message authentication services	1	3	4
CO-4	**Identify** and understand the requirement and usage of security services and hash functions	1	3	4
CO-5	**Recognize** various protocols for network security to protect against the threats in the networks.	1	3	4

Mapping Level:

POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
Mapping Level	2.75	-	2.0	1.0	-	-

Pre requisites: Computer Networks, Discrete Mathematical Structure, Data Structures

Contents:

1 **Introduction:** Security Attacks, Security Services, Security Mechanisms, and a Model for Network Security, Non cryptographic Protocol Vulnerabilities-DoS, DDoS, Session Hijacking and Spoofing, Software vulnerabilities- Phishing, Buffer Overflow, Format String Attacks, SQL Injection, Basics of Cryptography – Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers. Classical Encryption Techniques: Block Ciphers and the data encryption standard. **10Hrs**

2 **Secret Key Cryptography**: Data Encryption Standard(DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, International Data Encryption algorithm, Blowfish, CAST- 128, AES.

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, the Chinese Remainder Theorem, Discrete Logarithms.

Public-Key Cryptography: RSA, Diffie-hellman key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp. **10Hrs**

3 **Key Management and Distribution**: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution,secret key distribution with confidentiality and authentication,

User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5. **12Hrs**

4 **Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Authentication Protocols, Digital Signature Standards.

Authentication Applications: Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME. **10Hrs**

5 **IP Security:** Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange, Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Electronic Payment.

System Security: Intruders, Intrusion Detection, Password Management, Malicious Software – Types, Viruses, Virus Countermeasures, Worms, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted systems.

Web security - SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access control, firewalls and host/network intrusion detection. Network/host intelligence gathering and reconnaissance methods. **10Hrs**

Reference Books:

1. William Stallings “Cryptography and Network Security: Principles and Practice”, 7th edition, Pearson Education, 2016.
2. Behrouz A. Fourouzan and Debdeep Mukhopadhyay ”Cryptography and Network”, 2nd edition, , McGraw-Hill, 2010”
3. Eric Maiwald “Fundamentals of Network Security” , Dreamtech press
4. Whitman, Thomson “Principles of Information Security”,
5. Buchmann “Introduction to Cryptography”, Springer.
6. Bruce Schneier, “Applied Cryptography” Johnwiley & Co 2nd Edition

24PCSC202	Data Science and Engineering	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

This course focus on the concepts of Data Science and Engineering and working principles of industry relevant tools and applications developed in different domain.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of Big Data in business and technology landscapes.	3,4,6	-	-
CO-2	**Explain** the architecture and working principles industry relevant technology to manage Big data.	3,4,6	-	-
CO-3	**Extract** meaningful insights from the data and transform the data using dimensionality reduction techniques	3,4,6	-	-
CO-4	**Solve** the Engineering problem using statistical tools	3,4,6	-	-
CO-5	**Develop** the application using appropriate programming environment and tools.	3,4,6	-	-
CO-6	**Project** the result in appropriate format using industry relevant visualization techniques and tools	3,4,6	-	-
CO-7	**Explain** the importance of social networks and their graph representations.	3,4,6	-	-

Mapping Level:

POs	**1**	**2**	**3**	**4**	**5**	**6**
Mapping Level	**-**	**-**	**3**	**3**	**-**	**3**

Pre-requisites: Knowledge of Statistics

Contents:

1 **Big Data and Analytics:** Big Data and its importance, Characteristics of Big data: Four Vs, Drivers for Big data, NoSQL, Big data analytics, Big data applications, Algorithms using map reduce.
Hadoop and its architecture: Distributed File system, Hadoop Architecture, Hadoop Distributed File System. (HDFS), Apache Hadoop and Ecosystem, Moving data in and out of Hadoop, Understanding inputs and outputs of Map Reduce, Apache Hive and Apache Spark **10Hrs**

2 **Python Programming for Data Science:** Data Structures in Python - Lists, tuples, and dictionaries, Working with arrays (NumPy), Introduction to pandas for data manipulation, Data Visualization- Introduction to data visualization libraries (Matplotlib, Seaborn), Creating basic plots , Customizing plots and adding annotations, Data Analysis with pandas - Data loading and manipulation with pandas, Data cleaning and preprocessing, Exploratory data analysis (EDA), Grouping and aggregating data, Introduction to Machine Learning with scikit-learn- Introduction to scikit-learn library for machine learning, Basic machine learning workflow: data preprocessing, model training, evaluation **10Hrs**

3 **Introduction to Data Science:** Definition, Applications, Data Science life cycle, Components of Data Science, 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: Real Direct (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (KNN), k-means clustering **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 **12Hrs**

5 **Mining of Social Network Graphs:** Social networks as graphs, Clustering of social network graphs, Direct Discovery of Communities, Partitioning of Graphs, Finding overlapping communities, Simrank, Neighborhood properties of graphs **10Hrs**

Reference Books:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman “Mining of Massive DatasetsV2.1”, Cambridge University Press, 2nd Edition 2014
2. Richord Cotton “Learning R”, O’Reilly Publications, 2013.
3. Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020
4. Jiawei Han, MichelineKamber and Jian Pei Morgan Kauffman “Data Mining: Concepts and Techniques, Third Edition, 2012
5. Cathy O’Neil and Rachel Schutt “Doing Data Science” Straight Talk from The Frontline O’Reilly 2014

24PCSE225	Blockchain Technology	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

This course focuses on understanding emerging abstract models for Blockchain Technology and familiarizes the functional/operational aspects of the crypto currency ecosystem. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the role of Block chain Technology in the real world.	-	3, 4, 5	1
CO-2	**Analyze** and understand the role of cryptography in block chain technology.	-	3, 5	-
CO-3	**Understand** the architecture and Evaluate the usage of Block chain implementation / features using different cryptocurrencies.	-	1, 3, 4	-
CO-4	**Exemplify** the usage of bitcoins and its impact on the economy.	3	-	-
CO-5	**Setting** Up a Private Ethereum Network and building smart contracts using decentralized applications.	3	2	6

POs	**1**	**2**	**3**	**4**	**5**	**6**
Mapping Level	**1.5**	**2.0**	**2.4**	**2.0**	**2.0**	**1.0**

Prerequisites: Programming and Data Structures, Cryptography, Computer Networks

Contents:

1. **Introduction to Blockchain**: Centralized vs. Decentralized Systems, Layers of Blockchain, Why is Blockchain Important, Blockchain Uses and Use Cases.

08Hrs

2. **Basics of Cryptography:** Symmetric Key Cryptography, Asymmetric Key Cryptography, Cryptographic Hash Functions, Diffie-Hellman Key Exchange, case study. **08Hrs**
3. **Blockchain Architecture:** versions, variants, use cases, Life use cases of Blockchain, Blockchain vs. shared Database, Introduction to crypto currencies, Types, Applications. Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks. **12Hrs**
4. **How Bitcoin Works:** The Bitcoin Blockchain, The Bitcoin Network, Bitcoin Scripts, Bitcoin Wallets, Blockchain vs. Bitcoin, Practical applications. Interacting with the Bitcoin Blockchain. **12Hrs**
5. **How Ethereum Works:** From Bitcoin to Ethereum, Enter the Ethereum Blockchain, Ethereum Smart Contracts, Ethereum Virtual Machine and Code Execution, Interacting Programmatically with Ethereum- Sending Transactions **12Hrs**

.

Reference Books:

1. Arshdeep Bikramaditya Signal, Gautam Dhameja (Priyanshu Sekhar Panda., APress.) "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions"
2. Bahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach"
3. Melanie Swan, OReilly "Block chain".
4. Aravind Narayan. Joseph Bonneau, princeton "Bitcoin and Cryptocurrency Technologies"
5. Arthur.T Books "Bitcoin and Blockchain Basics: A non-technical introduction for beginners"
6. https://www.guru99.com/blockchain-tutorial.html
7. https://developer.ibm.com/technologies/blockchain/gettingstarted/

24PCSE226	Image and Video Analytics	(4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLOs):

This course is designed for post graduate level as an elective course, focuses on the principles, concepts, and representations in image and video analytics.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** preprocessing techniques for better understanding of images	-	3,4	-
CO-2	**Apply** spatial filtering to images for the preprocessing purposes	-	3,4	-
CO-3	**Apply** color transformations to image and video data	-	3,4	-
CO-4	**Apply** detection and classification methods for image and video data analytics	-	3,4	-
CO-5	**Apply** and analyze the techniques through case studies	-	3,4,5	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**2.0**	**2.0**	**2.0**	**-**

Pre-requisites: Knowledge of: Basics of statistics, Linear Algebra, computer graphics

Contents:

1. Digital image representation - Visual Perception- Sampling and Quantization- Basic Relations between Pixels- Mathematical Tools Used in Digital Image

Processing: Fundamental Operations –Vector and Matrix Operations- Image Transforms (DFT, DCT, DWT, Hadamard). **11Hrs**

2. Fundamentals of spatial filtering: spatial correlation and convolution-smoothing blurring- sharpening- edge detection - Basics of filtering in the frequency domain: smoothing-blurring- sharpening--Histograms and basic statistical models of image **11Hrs**

3. Detection of Objects of Interest, Tracking of Objects of Interest in a Sequence of Images, Tracking Objects of Interest Through a Camera Network. **10Hrs**

4. Biometric Techniques Applied to Video Surveillance, Vehicle Recognition in Video Surveillance, Activity Recognition **10Hrs**

5. Unsupervised Methods for Activity Analysis and Detection of Abnormal Events, Analysis of Crowded Scenes in Video, Detection of Visual Context, Example of an Operational Evaluation Platform: PPSL **10Hrs**

Reference Books:

1. R.C. Gonzalez, R.E. Woods, “Digital Image Processing”, Pearson, 2009.

2. Jean-Yves Dufour, “Intelligent Video Surveillance Systems”, Wiley, 2013.

3. Rick Szelisk, “Computer Vision: Algorithms and Applications”, Springer, 2011.

4. Härdle W, Müller M, Sperlich S, Werwatz, A, “Nonparametric and Semi parametric Models”, Springer, 2004.

24PCSE227 Deep Learning and Applications (4-0-0)4

Contact Hours: 52

Course Learning Objectives

This course focuses on the concepts of Deep Learning and its applications in solving real life problems.

Course Outcomes:

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Elucidate** and Apply the basic principles of Neural Network.	3	1	6
CO-2	**Explain** regularization strategies and optimization techniques for Deep Models.	-	1	6
CO-3	**Interpret** and Apply CNN functions and algorithms for the given problem scenario.	3	1,2	5,6
CO-4	**Expound** sequence models and its applications.	-	1,2	5.6
CO-5	**Explain** Linear Factor Models and Auto encoders.	-	-	6

Mapping Level

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**2**	**2**	**3**	**-**	**1**	**1**

Pre-requisites: Knowledge of Linear Algebra, probability and Machine Learning.

Contents:

1. **Deep Feed forward Networks** : Introduction to Neural Network, Multilayer Perceptron, Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes **10Hrs**
2. **Regularization for Deep Learning and Optimization for Training Deep Models.** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under- Constrained Problem, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi- Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier. How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms. **10Hrs**
3. **Convolution Neural 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, The Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning. **10Hrs**
4. **Sequence Models: Recurrent and Recursive Nets (RNN) :** Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long- Term Dependencies, Explicit Memory. **10Hrs**
5. **Deep Learning Research :** Linear Factor Models, Autoencoders; Probabilistic PCA and Factor Analysis, Independent Component Analysis (ICA), Sparse Coding, Undercomplete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders, Learning Manifolds with Autoencoders, Contractive Autoencoders, Predictive Sparse Decomposition, Applications of Autoencoders. **12Hrs**

Reference Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, An MIT Press book, 2016
2. Francois Chollet, “Deep Learning with Python”, Manning Publications,2017, ISBN-10, 9781617294433
3. Dr. S. B. Kulkarni, Dr. M. Laxminarayan, Raghavendrarao B., Binny S, “Neural Networks and Deep Learning”, SIPH, 2022, ISBN: 9789356255142
4. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, “Dive into Deep Learning Release 0.8.0” 2020.

24PCSE228 Soft and Evolutionary Computing (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs):

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial level(3)	**Moderate level(2)**	**Slight Level (1)**
CO-1	Explain the philosophy of soft computing and architecture of neural network.	1	2, 3	-
CO-2	Demonstrate the working of supervised learning in neural networks.	1	2, 3	-
CO-3	Demonstrate the working of unsupervised learning in neural networks.	1	2, 3	-
CO-4	Explore the concepts, operations, properties of fuzzy logic, classical sets and fuzzification process.	-	1, 2	3
CO-5	Comprehend the principle and concepts of Defuzzification, Fuzzy arithmetic and measures.	-	1	2, 3

Mapping level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**2.0**	**1.8**	**1.6**	**-**	**-**	**-**

Pre-requisites: Knowledge of computer programming, engineering mathematics

Contents:

1. **Introduction to Soft Computing and Artificial Neural Network :**
   Neural networks, Application scope of neural networks, Fuzzy Logic, Genetic algorithm, hybrid systems, fundamental concepts of neural networks, evolution and basic model of artificial neural network, important terminologies of ANNs, McCulloch Pitts neuron, linear separability, Hebb network. **10Hrs**
2. **Supervised Learning Networks :**
   Perceptron networks, Adaptive linear neuron, Multiple Adaptive linear neuron, Back – Propogation networks, Radial basis function networks, time delay neural networks, functional link networks, tree neural networks. **10Hrs**
3. **Unsupervised learning networks :**
   Fixed weight competitive nets, Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network **10Hrs**
4. **Introduction to Fuzzy Logic, Classical relations and Fuzzy relations and Membership functions:** Classical sets, fuzzy sets, Cartesian product of relations, classical relation, fuzzy relation, tolerance and equivalence relation, non-interactive fuzzy sets, features of membership functions, fuzzification, methods of membership value assignments **12Hrs**
5. **Defuzzification, Fuzzy Arithmetic and Fuzzy measures:** Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods, Fuzzy Arithmetic, extension principles, fuzzy measure, measure of fuzziness **10Hrs**

Reference Books:

1. S.N. Sivanandam and S.N. “Deepa, Principles of Soft Computing”, 2nd Edition, Wiley, 2016.
2. Diliip Kumar Pratihar, “Soft Computing: Fundamentals and Application”, 2nd Edition, Alpha Science International Limitied, 2015.
3. Simon Haykin, “Neural Networks and Learning Machines 3rd Edition”, Pearson, 2016.
4. S, Rajasekaran and G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and applications”, PHI Publication, 1st Edition, 2019.

24PCSE229	Agile Technologies	(4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLOs):

This course emphasis on various practical aspects of agile development to build valuable software. This courses deals with how to adopt XP practices, describes each practice in detail.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the core principles of adopting agile Development and its benefits.	3,4,5,6	-	-
CO-2	**Explain** the core principles of pair programming and its benefits.	3,4,5,6	-	-
CO-3	**Explain** the importance of documentation.	3,4,5,6	-	-
CO-4	**Explain** the procedure to prepare product design and architecture from agile perspectives.	3,4,5,6	-	-
CO-5	**Explain** the core components of product road map.	3,4,5,6	-	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**3**	**3**	**3**	**3**

Pre requisites:

Software Engineering principles and computer programming experience

Contents:

1 **Need for 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? Challenge for change. **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, Ten-Minute 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. **10Hrs**

4 **Mastering Agility-1:** 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 **Mastering Agility-2:**

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 **12Hrs**

Reference Books:

1. James Shore and Shane Warden, "The Art of Agile Development"- O'Reilly Publications-2007
2. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices" Prentice Hall 1st edition, 2002

24PCSE230	Human Computer Interface	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

This course aims to provide students with a comprehensive understanding of Human-Computer Interaction principles, theories, and methodologies. The students will be able to analyze and evaluate interactive systems from various user perspectives and enhance the user experience

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course, the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the principles of Human Computer Interaction	-	2,3	-
CO-2	**Design** interactive systems using relevant frameworks	3	4,2	-
CO-3	**Demonstrate the understanding** of HCI design principles and apply user-centered design processes, tools & techniques to create intuitive user-friendly interfaces	3,4	2	-
CO-4	**Design** user interface management systems through expert analysis and user participation by integrating universal design principles to ensure inclusive user support	3,2	4	-
CO-5	**Develop** HCI using appropriate architectural structures	3,2	4	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**2.4**	**2.8**	**1.8**	**-**	**-**

Pre requisites: Knowledge of user interface design

Contents:

1. **HCI - Foundations:** Introduction, Input–output channels, Human memory, thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning. **09Hrs.**
2. **Designing - Programming Interactive systems:** Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, The context of the interaction, Experience, engagement and fun, Paradigms for interaction. **10Hrs.**
3. **Centered design and testing:** Interaction design basics-The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping, Design for non-Mouse interfaces, HCI in the software process, Iterative design and prototyping, Design rules, Principles to support usability, Standards and Guidelines, Golden rules and heuristics, HCI patterns. **11Hrs.**
4. **Implementation support:** Elements of windowing systems, Programming the application, Using toolkits, User interface management systems, Evaluation techniques, Evaluation through expert analysis, Evaluation through user participation, Universal design, User support **11Hrs.**
5. **Models and Theories:** Cognitive models, Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures

   Collaboration & communication: Face-to-face communication, Conversation, Text-based communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design. **11Hrs.**

Reference Books:

1. A Dix, Janet Finlay, G D Abowd, R Beale, “Human-Computer Interaction”, 3rd Edition, Pearson Publishers, 2008.
2. Shneiderman, Plaisant, Cohen and Jacobs, “Designing the User Interface: Strategies for Effective Human Computer Interaction”, 5th Edition, Pearson Publishers, 2010.
3. Jonathan Lazar et al "Research Methods in Human Computer Interaction", 2nd Edition, Morgan Kaufmann Publication 2017

24PCSL201 Data Science and Engineering Laboratory (0-0-2)

Contact Hours: 26

Course Learning Objectives (CLOs):

This course at postgraduate level focusing on practical approaches of Data Science architecture and working principles of industry relevant tools and applications developed in different domain.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Extract** meaningful insights from the data and transform the data using dimensionality reduction techniques	3,4,6	-	-
CO-2	**Solve** the Engineering problem using statistical tools	3,4,6	-	-
CO-3	**Develop** the application using appropriate programming environment and tools.	3,4,6	-	-
CO-4	**Project** the result in appropriate format using industry relevant visualization techniques and tools	3,4,6	-	-

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**-**	**-**	**3**	**3**	**-**	**3**

Pre requisites: Knowledge of Statistics

Laboratory Experiment:

1. Install and configure industry relevant tools related to Big data applications
2. Write a program using Map Reduce on Big data
3. Write a program using Apache-Hive on Big data

4. Write a program using Apache –PIG on Big data
5. Write a program using R to model Big data
6. Project the result in appropriate format using industry relevant visualization techniques and tools

Reference Books:

1. Jure Leskovek, AnandRajaraman and Jeffrey Ullman “Mining of Massive DatasetsV2.1”, Cambridge University Press, 2nd Edition 2014

2. Richord Cotton “Learning R”, O’Reilly Publications, 2013.

3. Chirag Shah, “A Hands on Introduction to Data Science”, Cambridge University Press, 2020

4. Jiawei Han, MichelineKamber and Jian Pei Morgan Kauffman “Data Mining: Concepts and Techniques, , Third Edition, 2012

5. Cathy O’Neil and Rachel Schutt “Doing Data Science” Straight Talk from The Frontline O’Reilly 2014

24PCSL202	Seminar	(0-0-2)1

Contact Hours: 26

Course Learning Objectives (CLOs):

The objective of the seminar is to inculcate **self-learning**, enhance communication skills, be **motivated** to reach **high standards** and become **self-confident**, be involved in group discussions, and present ideas before the expert committee.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to 6)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Communicate** effectively on a technical topic	1,3	2	1
CO-2	**Prepare** presentation slides and Reports using industry standard tools.	1,3	2	1
CO-3	**Effectively** manage discussions	1,3	2	1

Mapping Level:

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
Mapping Level	**3.0**	**2.0**	**3.0**	**1.0**	**-**	**-**

Seminar Guidelines:

Students, under the guidance of a faculty, are required to:

i) Choose a topic of his/her interest relevant to the Course of Specialization.

ii) Carry out a literature survey, and organize the subject topics systematically.

iii) Prepare the report using the LATEX tool.

iv) The student has to either present their work/study in front of the expert committee.

v) Submit two duly signed copies of the seminar report.

vi) Preferably, the seminar contents should not be studied in their regular courses.

vii) Participation in the seminar by all postgraduate students of the same program shall be mandatory.

viii) The internal assessment marks shall be awarded by a committee consisting of at least two staff members (including a guide) and shall be based on the evaluation of the

- Presentation
- Question/Answer session
- Implementation/prototype mode