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NH - 4, VatharTarfVadgaon, Tal: -Hatkanangale, Dist: - Kolhapur-416112

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Curriculum Structure and Evaluation Scheme for M. Tech. in Computer Science & Engineering and Multidisciplinary Minor

(To be implemented for 2025-2027 Batch)

Prof. S. S. Redekar
Head of Department

HOD

DEPT. OF COMPUTER SCIENCE & ENGINEERING
SHRI BALASAHEB MANE SHIKSHAN PRASARAK MANDAL'S
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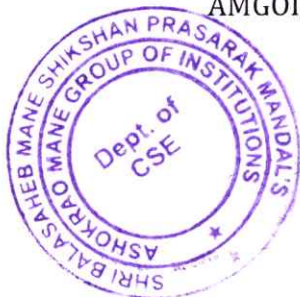
Dr. S. S. Patil
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Dr. S. R. Chougule
Director

Dr. Mrs. S. R. Chougule
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Shri Balasaheb Mane Shikshan Prasarak Mandal's
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ABBREVIATIONS

- **L:** Lecture
- **T:** Tutorial
- **P:** Practical
- **ISE-I-** In Semester Evaluation I
- **ISE-II-** In Semester Evaluation II
- **MSE:** Mid Semester Exam
- **ESE:** End Semester Exam
- **PCC:** Program Core Course
- **PEC:** Program Elective Course
- **OE:** Open Elective Course
- **AEC:** Ability Enhancement Course
- **AC:** Audit Course
- **RM:** Research Methodology
- **ELC:** Experiential Learning Course

**Department:**Computer Science & Engineering**Semester:** I

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min. For Passing	
PCC	P25CS101	Mathematical Foundations of Computer Science	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25CS102	Advanced Algorithms	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PCC	P25CS103	Machine Learning	3	1	-	4	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
PEC	P25CS104	Program Elective-I	3	-	-	3	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
RM	P25CS105	Research Methodology and IPR	2	-	-	2	ISE-I	10	20	40
							MSE	30		
							ISE-II	10		
							ESE	50		
ELC	P25CS106	Seminar	-	-	2	1	ISE	50	20	40
							ESE(OE)	50		
PCC	P25CS107	PG Lab- I	-	-	4	2	ISE	50	20	40
							ESE(POE)	50		
AC	P25CS108	Yoga and Meditation	1	-	-	-	-	-	-	-
	Total		15	03	06	20		700		
Total Contact Hours- 24			Total Credits- 20							



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Department: Computer Science & Engineering

Semester: II

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min. For Passing	
PCC	P25CS201	Advanced Database Management System	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25CS202	Advanced Software Architecture	3	1	-	4	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PCC	P25CS203	Big Data Analytics	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
PEC	P25CS204	Program Elective-II	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
OE	P25CS205	Open Elective-I	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
VEC	P25CS206	Technologies for Industrial	2	-	-	2	ISE-I	25	20	20
							ISE-II	25		
ELC	P25CS207	Mini Project	-	-	2	1	ISE-I	25		40
							ISE-II	25		
							ESE(POE)	50	20	
PCC	P25CS208	PG Lab- II	-	-	4	2	ISE	50		40
							ESE(POE)	50		
AC	P25CS209	Internship/Field Training	-	-	-	-	Will be Evaluated in Sem-III	-	-	
			17	02	06	22		750		
Total Contact Hours- 25			Total Credits- 22							



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Department:Computer Science & Engineering
Semester: III

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min. for Passing	
OE	P25CS301	Open Elective-II ^{\$}	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
MDM	P25CS302	Multi-Disciplinary Minor ^{\$}	3	-	-	3	ISE-I	10		40
							MSE	30		
							ISE-II	10		
							ESE	50	20	
ELC	P25CS303	Dissertation Phase- I*	-	-	20	10	ISE-I	25		40
							ISE-II	25		
							ESE(POE)	50	20	
ELC	P25CS209	Internship/Field Training [#]	-	-	-	2	ISE	50	20	--
	Total		06	00	20	18		350		
Total Contact Hours- 26			Total Credits- 18							

^{\$} It is mandatory to opt these courses certification from SWAYAM/NPTEL, MOOC platform.

* It is required to complete 30% work of Dissertation.

[#] It is required to do Four weeks domain specific industrial internship after completing first year of the program evaluated in Semester-III



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Department: Computer Science & Engineering

Semester: IV

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme			
			L	T	P	Cr	Components	Max	Min. For Passing	
ELC	P25CS401	Dissertation Phase- II*	-	-	40	20	ISE-I	50	40	80
							ISE-II	50		
							ESE(POE)	100	40	
	Total		-	-	40	20		200		
Total Contact Hours- 40						Total Credits- 20				

* It is required to publish/present two papers out of which at least one paper should be in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal before Thesis Submission.



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Exit Courses after Semester– II - P.G. Diploma

Type of Course	Course Code	Course Name	Teaching Scheme				Evaluation Scheme		
			L	T	P	Cr	Components	Max	Min. for Passing
ELC	P25CS209	Internship/Field Training Evaluation [#]	-	-	-	2	ISE	50	40
							ESE	50	
AEC	P25CS210	Employability Skill Development [*]	4		-	4	ISE	50	40
							ISE	50	
	Total		4	00	00	6		200	
Total Contact Hours- 4			Total Credits- 06						

*It is mandatory to opt this course certification from SWAYAM/NPTEL MOOC platform

Four weeks domain specific industrial internship after successfully completing first year of the program.



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PROGRAM ELECTIVE

(Students have to select any one Program Elective course out of 03, for each applicable semester, of their interest, offered by the PG Program from the table below)

Program Elective – I			
Sr. No.	Course Code	Course Name	Semester
1	P25CS104A	Artificial Neural Networks	I
2	P25CS104B	Digital Image Processing	
3	P25CS104C	Agile Project Management & Devops	

Program Elective – II			
Sr. No.	Course Code	Course Name	Semester
1	P25CS204A	Intrusion Detection System	II
2	P25CS204B	Pattern Recognition	
3	P25CS204C	Block Chain & Cyber Security	

MULTIDISCIPLINARY MINOR (MDM)

(Students have to select any one course of their interest (other than a courses offered by their program) for the award of Minor Degree from the table below)

Sr. No.	Course Code	Course Name (MDM)	Semester	Offered by the Department
1	P25CS303	Artificial Intelligence & Machine Learning	III	Computer Science & Engineering



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OPEN ELECTIVE COURSES

(Students have to select any one Open Elective course, for each applicable semester, of their interest from the basket below.)

Open Elective – I Semester II			Open Elective – II Semester III		
Sr.	Course Code	Course Name (OE)	Sr.	Course Code	Course Name (OE)
1	P25CS205A	Environment and Development	1	P25CS301A	Labour Welfare and Industrial Relations
2	P25CS205B	Engineering Economics	2	P25CS301B	Sustainable Technology
3	P25CS205C	Project Management	3	P25CS301C	Entrepreneurship Development
4	P25CS205D	Healthcare Engineering	4	P25CS301D	Industrial Automation



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Semester - I

P25CS101- Mathematical Foundations of Computer Science

Title of the Course Name: Mathematical Foundations of Computer Science Course Code: P25CS101	L	T	P	Credits
	3	1	--	4
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Basic Mathematics & Fundamentals of Probability

Course Objectives: The course aims:

1. Apply concepts of combinations, probability, and statistics to solve problems and analyze data.
2. Summarize and interpret data using statistical techniques.
3. Apply hypothesis testing and regression for data analysis.
4. Analyze data using modern intelligent tools.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Generate permutations/combinations for problem-solving
CO2	Analyze probabilities and solve linear equations.
CO3	Interpret statistical data using descriptive methods & Techniques
CO4	Analyze advanced tools for intelligent analytic.



Course Content		
Unit No.	Unit title and Content	Hrs
1	Permutations and Combinations Basics of Permutations and Combinations, Rule of sum and product, Algorithms for generation of Permutations and Combinations.	6
2	Probability Distributions and Linear Equations Random variable - Discrete and continuous, Discrete probability distributions, Joint Probability distributions, Mean of Random Variable, Maximum likelihood test, System of Linear Equations and Homogeneous system of Linear Equations.	6
3	Data Definition and Descriptive Statistics Data Elements and categorization, statistical learning, Measures of Central tendency, Measures of location of Dispersion's.	6
4	Inferential Statistical Techniques Basic inferential techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test, System of Linear Equations.	6
5	Trees Group-based Statistical Techniques Variance and Covariance of Random Variable, Analysis of variance, Regression, Correlation analysis.	6
6	Advance Analytic Tools Intelligent data analysis, Analytic Processes and Tools, Analysis v/s Reporting	6

Text books:

1. Ronald E. Walpole, Raymond H. Myers et al , “Probability and Statistics for Engineers and Scientists”, 9th Edition, Pearson Education, 2012
2. Dennis Wackerly, William Mendenhall, “Mathematical Statistics with Applications”, 7th Edition, Richard L. Scheaffer, Cengage Learning, 2008

Reference books:

1. Richard A. Johnson, Dean W. Wichern, “Applied Multivariate Statistical Analysis”, 6th Edition Pearson Education, 2007
2. Peter Bruce, Andrew Bruce, Peter Gedeck, “Practical Statistics for Data Scientists”, 2nd Edition, O'Reilly Media, 2020



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P25CS102 - Advanced Algorithms

Title of the Course Name: Advanced Algorithms	L	T	P	Credits
Course Code: P25CS102	3	1	--	4
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Data Structures & Basics of Algorithm

Course Objectives: The course aims:

1. To Analyze algorithm complexity using asymptotic notations and recurrence methods.
2. To Design efficient data structures and graph algorithms.
3. To Use matrix computations for algorithm optimization.
4. Apply linear programming, NP-completeness, and randomized algorithms to solve computational problems.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Analyze algorithm growth, recurrence relations, and techniques for polynomial and matrix computations.
CO2	Implement advanced data structures such as trees and heaps for problem solving.
CO3	Solve computational problems using graph algorithms and linear programming techniques.
CO4	Apply randomized algorithms for solving complex problems efficiently.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Fundamentals of Analysis Techniques: Growth of Functions: Asymptotic notations, Standard notations and common functions. Sorting: Review of various sorting algorithms, topological sorting. Recurrences and Solution of Recurrence equations: The substitution method, The recurrence – tree method, The master	6



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	method, Amortized Analysis: Aggregate, Accounting and Potential Methods.	
2	Advanced Data Structures: Red-Black Trees & Related Operations, B-Trees, B+ Trees, Binomial Heap, Fibonacci Heap Data Structures for Disjoint Sets	6
3	Graph Algorithms: Johnson's Algorithm for sparse graphs, Maxflow-mincut theorem, Flow networks and Ford-Fulkerson method, Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT, Efficient implementation of FFT, Edmond's Blossom algorithm to compute augmenting path	6
4	Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	6
5	Linear Programming: Formulation of Problems as Linear Programs, Duality, Simplex, Interior Point, and Ellipsoid Algorithm, proof of NP-hardness and NP-completeness.	6
6	Probabilistic and Randomized Algorithms: Probabilistic algorithms, Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms, Probabilistic numeric algorithms.	6

Text books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 3rd edition, 2009.
2. Jon Kleinberg, Éva Tardos, "Algorithm Design", Pearson, 1st edition, 2005.

Reference books:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson, 1st edition, 1974.
2. Rajeev Motwani, Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, 1st edition, 1995.

**P25CS103-Machine Learning**

Course Name: Machine Learning	L	T	P	Credits
Course Code: P25CS103	3	1		4
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:100	10	30	10	50

Pre-Requisite: Basic programming skills (in Python), algorithm design, basics of probability & statistics

Course Objective: The course aims:

1. Introduce the fundamental concepts and types of machine learning, including supervised, unsupervised, and reinforcement learning.
2. understanding of key algorithms such as linear and logistic regression, decision trees, support vector machines, and neural networks.
3. Provide knowledge on hypothesis evaluation, cross-validation, overfitting, regularization, and feature engineering techniques.
4. Explore probabilistic learning approaches, including Bayes learning and hypothesis testing.

Course Outcomes:

CO1	Explain basic machine learning concepts, learning types, hypothesis spaces, and evaluation methods.
CO2	Apply supervised learning techniques (regression, decision trees, SVM) and feature selection methods to solve real-world problems.
CO3	Analyze and implement probabilistic models and neural networks, including backpropagation and deep learning basics.
CO4	Evaluate advanced models using ensemble methods, clustering algorithms, and reinforcement learning techniques.



Course Content

Unit No.	Unit title and Content	Hrs
1	Core Concepts in Machine Learning : Basic definitions, Application, Types of Machine learning, hypothesis space and inductive bias, evaluation, cross-validation.	6
2	Predictive Modeling and Recommendation Systems: Linear regression, Decision trees, overfitting. Instance based learning, Overfitting and Regularization, Feature reduction, Feature Selection, Collaborative filtering based recommendation.	6
3	Bayes Learning and Performance Metrics: Probability and Bayes learning, Evaluation Measures, Hypothesis Testing	6
4	Classification Algorithms and Loss Functions: Logistic Regression, Linear Classification, Support Vector Machine, softmax and Cross-Entropy, Kernel function and Kernel SVM.	6
5	Neural Networks and Deep Learning Foundations: Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.	6
6	PAC Learning and RL Basics : Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning ad methods. Clustering: k-means, adaptive hierarchical clustering, and Gaussian mixture model. Expectation Maximization, Introduction to Reinforcement Learning.	6

Text books:

Tom M. Mitchell, "Machine Learning" Publisher: McGraw Hill

Reference books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning"
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow",
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning",



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Program Elective I - P25CS104A Artificial Neural Networks

Title of the Course Name: Artificial Neural Networks	L	T	P	Credits
Course Code: P25CS104A	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Machine Learning

Course Objectives: The course aims:

1. Identify neural network types and relate them to their biological origins.
2. Implement neural networks using tools like TensorFlow or Keras.
3. Use optimization and regularization methods to enhance model accuracy.
4. Design and evaluate deep learning models like CNNs, RNNs, autoencoders, and GANs.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explain how neural networks work, including basic parts like layers, activation functions, and how they learn using back propagation.
CO2	Learn how to train neural networks better using optimization methods and techniques to prevent over fitting.
CO3	Build and use different types of neural networks like CNNs for images and RNNs (including LSTM and GRU) for sequence or time-based data.
CO4	Use deep learning models like auto encoders to reduce data size or find unusual patterns, and GANs to create new data.



Course Content

Unit No.	Contents	Hrs
1	Introduction to Neural Networks : Human brain structure: neurons, synapses, activation, learning Biological vs artificial neurons, MLP, perceptron, feed forward Neural Networks, back propagation algorithms, activation functions	6
2	Training & Optimization : Gradient descent variants (SGD, Adam, RMS Prop), loss functions, Advanced Optimizers, Regularization Techniques, Weight Initialization overfitting, bias-variance, regularization (L1/L2, dropout), batch norm, early stopping	6
3	Convolutional Neural Networks : Convolution Operations, pooling layers, CNN architectures design, Pretrained Models & Transfer Learning (LeNet, AlexNet, VGG, ResNet), CNN in Real-World Applications, frameworks (TensorFlow/Keras)	6
4	Recurrent Neural Networks : Sequential Data Handling, Basic RNN Architecture, Training RNNs, BPTT, vanishing/exploding gradients LSTM and GRU Architectures, Bidirectional RNNs & Deep RNNs	6
5	Autoencoders :Basic Autoencoder Architecture, Types of Autoencoders, Undercomplete, Overcomplete, denoising, sparse & Variational Autoencoders (VAEs), applications - Dimensionality reduction, Anomaly detection, Image compression and denoising.	6
6	Generative & Advanced Models : Introduction to Generative Adversarial Networks (GANs), Types of GANs Deep Convolutional GAN (DCGAN),Conditional GAN (CGAN), Cycle GAN and Pix2Pix for image translation, GANs(generator/discriminator), applications, transformers, Overview of Pretrained Transformer Models BERT/GPT.	6

Text Books:

1. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 1st edition, 2016.
2. Bishop, Christopher M., "Pattern Recognition and Machine Learning," Springer, 1st edition, 2006.



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Reference Books:

1. Aggarwal, Charu C., “Neural Networks and Deep Learning”, Springer, 1st edition, 2018.
2. Chollet, François, “Deep Learning with Python,” Manning Publications, 1st edition, 2018.

Program Elective I - P25CS104B Digital Image Processing

Course Name: Digital Image Processing	L	T	P	Credits
Course Code: P25CS104B	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Linear algebra, probability, Signal processing & programming.

Course Objective: The course aims:

1. Explore the fundamentals of digital images and image processing systems.
2. Learn techniques for image enhancement, filtering, restoration, and compression.
3. Explore segmentation, representation, and description methods.
4. Apply DIP techniques in real-world applications like medical imaging, satellite image analysis, etc.

Course Outcomes:

CO1	Analyze the fundamental principles of digital image formation, acquisition, and enhancement techniques in both spatial and frequency domains.
CO2	Apply restoration, compression, and filtering techniques to improve image quality and storage efficiency using suitable mathematical and algorithmic models.
CO3	Develop intelligent image analysis solutions using machine learning and deep learning frameworks for classification, segmentation, and object recognition.
CO4	Evaluate the role of nanoscience in image-based material characterization and utilize image processing methods to interpret data from microscopic and nanoscopic imaging systems.

**Course Content**

Unit No.	Unit title and Content	Hrs
1	Introduction and Digital Image Fundamentals: Digital image processing: Origin and Applications , Image acquisition, sampling, quantization ,Image resolution, size, and formats ,Basic relationships between pixels, Color models: RGB, CMY, HIS, YCbCr.	6
2	Image Enhancement : Spatial domain enhancement :contrast stretching, histogram equalization, Filtering: smoothing and sharpening filters (mean, Gaussian, Laplacian, Sobel),Frequency domain enhancement: Fourier Transform, frequency filtering, Homomorphic filtering.	6
3	Image Restoration and Reconstruction : Image degradation model, Noise models (Gaussian, salt & pepper, etc.),Restoration techniques: inverse filtering, Wiener filter, Constrained least squares filtering, Blind deconvolution.	6
4	Image Compression: Lossless vs lossy compression, Entropy coding: Huffman, Arithmetic, Transform coding: DCT, Wavelet, JPEG, JPEG 2000 standards, Run Length and Block Coding	6
5	Cognitive Approaches to Image Understanding : Introduction to Cognitive Image Understanding, Machine Learning for Image Classification, Deep Learning Architectures for Vision, Image Segmentation and Object Detection Techniques, Feature descriptors: SIFT, SURF, ORB	6
6	Nanoscience and Nanotechnology: Introduction to nano-science and nanotechnology, Surface to volume ratio, two main approaches in nanotechnology - Bottom up technique and top down technique; Nano materials: Methods to synthesize nanomaterials (Ball milling, colloidal synthesis), properties and applications of nanomaterials. Characterization techniques – XRD, Scanning Electron Microscope.	6

Text books:

1. Rafael C. Gonzalez and Richard E. Woods “Digital Image Processing,” Pearson Education, 4th Edition, 2018
2. Anil K. Jain “Fundamentals of Digital Image Processing”, Prentice Hall India, 2001

Reference books:

1. William K. Pratt, “Digital Image Processing”, PIKS Scientific Inside, 4th Edition, 2007
2. Milan Sonka, Vaclav Hlavac, Roger Boyle,” Image Processing, Analysis, and Machine Vision”, Cengage Learning, 4th Edition, 2015



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Program Elective I- P25CS104C Agile Project Management & DevOps

Title of the Course Name: Agile Project Management & Devops	L	T	P	Credit
	3	--	--	3
Course Code: P25CS104C				
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Software Engineering

Course Objectives: The course aims:

1. Understand basic agile methods for software development.
2. Use DevOps tools for automation and deployment.
3. Handle projects using Scrum, Kanban, and cloud tools.
4. Check results and fix issues in DevOps projects.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explore agile frameworks and the DevOps culture.
CO2	Identify and apply CI/CD pipelines using tools like Jenkins.
CO3	Identify and use automation and container tools like Ansible, Terraform, Docker and Kubernetes.
CO4	Integrate and manage cloud services within DevOps workflows effectively.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Foundations – Agile & DevOps Introduction to Software Development Life Cycles (SDLCs), Scrum Framework, Kanban boards, WIP limits, XP practices, DevOps Basics: History, goals, and benefits. Agile vs DevOps: Differences and synergy, DevOps lifecycle overview, CALMR Model.	6



2	CI/CD Pipelines & Tools Introduction to Continuous Integration (CI) & Continuous Delivery/Deployment (CD), Build Automation Tools, Jenkins Overview Jenkins Pipelines: Scripted vs Declarative pipelines, CI/CD Workflow Design, Integrating Git, Docker, and Jenkins for end-to-end CI/CD	6
3	Infrastructure Automation & Configuration Need for Infrastructure as Code (IaC), Overview of provisioning and configuration, Configuration Management with Ansible, Chef & Puppet Basics, Introduction to Terraform: Providers, modules, state files, Infrastructure Versioning & Reusability Best Practices, Demo: Automating infrastructure setup using Ansible and Terraform	6
4	Containers & Container Orchestration Introduction to Docker: Containers vs VMs, Docker architecture, Docker CLI, Docker file, building and running images, Docker Compose, Kubernetes Basics: Cluster architecture, master/worker nodes, Kubernetes Components: Pods, Replica Sets, Deployments, Services, Orchestration Workflow	6
5	Cloud & DevOps Integration Cloud Service Models: IaaS, PaaS, SaaS; DevOps in cloud context, Introduction to AWS, Azure, GCP: Core services, Setting up CI/CD pipelines on AWS using Code Pipeline & Code Build, Container Services, DevOps for Microservices in Cloud Environments, Introduction to Edge Computing and Kub Edge	6
6	Monitoring, Security & Agile Governance Continuous Monitoring: Prometheus, Grafana, ELK Stack, Feedback Loops in Agile & DevOps: Metrics, velocity, burndown, Security in DevOps (DevSecOps), Governance: Policies, access control, audit trails, Anti-Patterns in DevOps & Agile, KPIs & Metrics: Deployment frequency, change lead time, MTTR, DORA metrics	6

Text Books:

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations", IT Revolution Press, 1st Edition, 2016.
2. Ken Schwaber, Mike Beedle, "Agile Software Development with Scrum", Prentice Hall, 1st Edition, 2001.

Reference Books :

1. Jez Humble, David Farley, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", Addison-Wesley, 1st Edition, 2010.
2. Nigel Poulton, "Docker Deep Dive", Independently published, 5th Edition, 2020.



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P25CS105-Research Methodology and IPR

Course Name: Research Methodology and IPR	L	T	P	Credits
Course Code: P25CS105	2	--	--	2
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Mathematics Foundation & Basic Research Concepts.

Course Objective: The course aims:

1. To introduce the fundamental principles of research methodology.
2. To develop an understanding of research design and analysis.
3. To enable formulation of research problems and objectives.
4. To provide knowledge about Intellectual Property Rights and their importance
5. To create awareness about patents, copyrights, and trademarks

Course Outcomes:

CO1	Apply fundamentals of research and ethics
CO2	Formulate Research Problems and Proposals
CO3	Apply Intellectual Property Rights (IPR)
CO4	Analyze the Role of IPR in Innovation and Economic Development

Course Content

Unit No.	Unit title and Content	Hrs
1	Introduction to Research Methodology : Meaning, Objectives, Motivation, Types of Research, Research Approaches, Research Process, Criteria of Good Research	6
2	Research Problem and Design : Identifying Research Problem, Literature Survey, Research Objectives, Research Design Concepts, Features of Good Design	6
3	Data Collection and Analysis: Sources of Data, Sampling Methods, Data Processing, Statistical Techniques, Hypothesis Testing, Report Writing	6



4	Ethics in Research : Ethical Principles, Plagiarism, Impact of Misconduct, Ethical Committees, Publishing Ethics	6
5	Introduction to IPR : Overview of Intellectual Property, Importance of IPR, Types: Patents, Trademarks, Copyrights, Industrial Designs	6
6	IPR Procedures and Case Studies : Patent Filing Procedure, Patentable and Non-patentable Items, Patent Search, Licensing, Case Studies on IPR Disputes	6

Text books:

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International.
2. P. Pandey & S. Pandey, "Research Methodology: Tools and Techniques", Bridge Center.
3. Neeraj Pandey & Khushdeep Dharni, "Intellectual Property Rights", PHI Learning.

Reference books:

1. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide", Sage Publications.
2. T. Ramakrishna, "Basic Principles and Acquisition of Intellectual Property Rights", CIPRA, NLSIU.
3. V. Scaria, "Intellectual Property Rights in the Global Era", LexisNexis.

P25CS106 - Seminar

Title of the Course Name: Seminar	L	T	P	Credits
Course Code: P25CS106	--	--	2	1

Pre-Requisite: Core subject Knowledge, Technical writing skill and Presentation skill

Course Objectives: The course aims:

1. To enable students to explore current trends, technologies, and research issues in computer science and engineering.
2. To enhance students' abilities to perform independent literature review and technical analysis.
3. To develop professional communication and presentation skills for academic and industry contexts.
4. To encourage critical thinking, peer feedback, and academic discussion among students.



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Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Identify and select a relevant research problem or emerging topic in the field of computer science and engineering.
CO2	Analyze and synthesize literature and technical content from journals, conferences, and reputable online sources.
CO3	Prepare and deliver a structured seminar presentation using appropriate technical and visual communication tools.
CO4	Demonstrate the ability to answer queries, participate in technical discussions, and respond to peer feedback effectively.

Sr.No.	Guidelines
1	Topic Selection: The topic should be recent, innovative, and relevant to the CSE domain Finalize in consultation with a Guide.
2	Literature Survey: - Use IEEE Xplore, Springer, Elsevier, ScienceDirect, ACM, etc. - Minimum 15–20 references from recent publications (preferably last 5 years). - Maintain a citation style (IEEE preferred in CSE).
3	Report Writing: - Cover Page with title, student name, guide name, institution. - Abstract (150–250 words). - Introduction. - Literature Review. - Technical Discussion / Methodology. - Challenges and Research Gaps. - Conclusion and Future Scope. - References (IEEE format).
4	Presentation: Duration: 12–15 minutes + 5 minutes Q&A. - Use professional PowerPoint slides: 12–20 slides covering title, abstract, objectives, literature review, analysis, conclusion. - Include diagrams, block diagrams, or simulation results if applicable.
6	Submission Requirements: Final seminar report (spiral bound and PDF). Presentation file (PPT/PDF).



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P25CS107-PG Lab-I

Title of the Course Name: PG Lab-I	L	T	P	Credits
Course Code: P25CS107	--	--	04	2

Prerequisites:-

- A fundamental understanding of Python programming and object-oriented concepts.
- Knowledge of basic statistics, probability, and linear algebra.
- Familiarity with data handling libraries like **NumPy**, **Pandas**, and **Matplotlib**.

Course Objective: The course aims:

1. To understand and implement core machine learning algorithms for classification, regression, and clustering.
2. To evaluate and analyze model performance using appropriate metrics and visualization techniques.
3. To demonstrate the impact of regularization, bias-variance tradeoff, and tuning hyper parameters in ML models.
4. To apply deep learning techniques using Keras/TensorFlow and ensemble methods for enhanced model performance.

Course Outcomes:

CO1	Implement machine learning algorithms like Linear Regression, Decision Trees, k-NN, Naive Bayes, Logistic Regression, and SVM using Python libraries.
CO2	Apply unsupervised learning methods such as k-Means and Gaussian Mixture Models for clustering data.
CO3	Demonstrate and evaluate techniques like regularization, ensemble learning, and basic neural networks using real-world datasets.
CO4	Interpret model accuracy using performance metrics like confusion matrix, ROC curve, F1-score, and visualize decision boundaries.



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Sr. No.	Experiment List
1	Implementation of Linear Regression using Python Scikit-learn
2	Implementation Decision Tree Classifier and Visualization
3	Demonstration of Overfitting and Regularization (L1 & L2)
4	Implementation of k-Nearest Neighbors (k-NN) Algorithm
5	Implementation of Naive Bayes Classifier for Text Classification
6	Implementation of Logistic Regression for Binary Classification
7	Implementation of Support Vector Machine (SVM) with Linear and RBF Kernels
8	Implementation of Neural Network using Keras/TensorFlow (MLP)
9	Implementation of Clustering using k-Means and Gaussian Mixture Model
10	Implementation of Ensemble Methods: Random Forest and AdaBoost



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P25CS108- Yoga and Meditation

Title of the Course Name: Yoga and Meditation	L	T	P	Credits
Course Code: P25CS108	1	--	--	--

Pre-Requisite: Basic understanding of human anatomy and interest in physical and mental well-being

Course Objectives: The course aims:

1. To explore the philosophical and psychological foundations of Yoga and Meditation.
- 2.To introduce and practice the Eight Limbs of Yoga (*Ashtanga Yoga*) for holistic self-regulation.
3. To train students in meditation, breathing, and ethical practices for enhancing clarity, focus, and emotional balance.
- 4.To help students integrate yogic wisdom and mindfulness

Course Outcomes: At the end of the course, students will be able to:

CO1	Comprehend the core teachings of YogaSutras.
CO2	Practice foundational yogic techniques.
CO3	Apply principles of Yama and Niyama for improved discipline, ethics, and self-awareness.
CO4	Develop concentration and mindfulness for stress reduction and productivity.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Foundations of Yoga Philosophy : Origin and evolution of Yoga; Introduction to Yoga Sutras. Definition of Yoga – “YogasChittaVrittiNirodha”. The five Vrittis (mental fluctuations) and their control.	03
2	Ethical and Personal Discipline (Yama & Niyama) : The five Yamas – Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha. The five Niyamas – Shaucha, Santosha, Tapas, Svadhyaya, Ishwar Pranidhana. Relevance of Yama-Niyama in academic and professional life.	03



3	Physical & Mental Purification (Asana, Pranayama, Pratyahara) <i>Asana</i> – Role of posture; stability and comfort in the body <i>Pranayama</i> – Breath control techniques; calming the nervous system <i>Pratyahara</i> – Withdrawal of senses; mastering inner awareness	03
4	Concentration, Meditation, and Liberation (Dharana, Dhyana, Samadhi) : <i>Dharana</i> – Developing concentration and focus <i>Dhyana</i> – The process and practice of meditation <i>Samadhi</i> – State of absorption; experiencing inner peace and unity	03

Text Books:

1. Iyengar, B.K.S., “Light on Yoga”, HarperCollins Publishers, Revised Edition, 2015.
2. Swami Satchidananda, “The Yoga Sutras of Patanjali”, Integral Yoga Publications, 2nd Edition, 2012.
3. Taimni, I.K., “The Science of Yoga”, The Theosophical Publishing House, 4th Edition, 2005.
4. Swami Vivekananda, “Raja Yoga”, Advaita Ashrama Publications, 12th Edition, 2014.

Reference Books:

1. “Raja Yoga”, Advaita Ashrama Publication, 32nd Reprint, 2021.
2. Bryant, Edwin F., “The Yoga Sutras of Patanjali”, A New Edition, Translation and Commentary, North Point Press, 1st Edition, 2009.
3. Feuerstein, Georg, “The Yoga Tradition: Its History”, Literature, Philosophy and Practice, Hohm Press, Revised Edition, 2001.
4. Ranganathananda, Swami, “The Message of the Upanishads”, Bharatiya Vidya Bhavan, 3rd Edition, 2010.



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Semester-II

P25CS201- Advanced Database Management System

Title of the Course Name: Advanced Database Management System	L	T	P	Credits
Course Code: P25CS201	3	1	--	4
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Basics of Database

Course Objectives: The course aims:

1. Learn advanced database design and tuning methods.
2. Explore parallel and distributed database systems.
3. Analyze object-oriented, web, and XML-based data models.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Apply normalization and tuning techniques in database design.
CO2	Analyze how parallel and distributed databases work with distributed transaction and recovery mechanism of database
CO3	Use object-oriented DBMS concepts and standards with web technology and XML.
CO4	Evaluate mobile DBMS issues and apply database security techniques.

**Course Content**

Unit No.	Unit title and Content	Hrs
1	Database Design and tuning: Schema Refinement and Normal Forms: Introduction to schema refinement, functional dependencies, reasoning about FD's, Normal forms, properties of decompositions, Normalization, schema refinement in database designs, other kinds of dependencies. Physical Database Design and Tuning: Introduction to physical database design, guidelines for index selection, basic examples of index selection, clustering and indexing, indexes that enables index- only plan, tools to assist in index selection, overview of database tuning, choices in tuning the conceptual schema, choices in tuning queries and views, Impact of concurrency.	6
2	Parallel Database : Introduction, architecture for parallel databases, parallel query evaluation, parallelizing individual operations, parallel query optimization. Distributed DBMS-Concepts and Design: Introduction, overview of networking, functions and architecture of a DBMS, distributed relational database design, transparencies in a DDBMS, Dates twelve rules for a DBMS.	6
3	Distributed DBMS—Advanced Concepts: Distributed Transaction Management, Distributed Concurrency control, Distributed deadlock management, distributed database Recovery, the X/Open Distributed Transaction Processing Model, Distributed Query optimization, distribution in oracle.	6
4	OBJECT-DATABASE Management SYSTEMS : Object-Oriented DBMS— Concepts and Design: Next-generation database systems, introduction to OODBMSs, Persistence in OODBMSs, Issues in OODBMSs, Advantages and disadvantages of OODBMSs, comparison of ORDBMS and OODBMS, object-oriented database design and object-oriented analysis and design with UML. Object-Oriented DBMS—Standards and Systems: Object Management Group, Object Data Standard ODMG 3.0,1999, Object Store.	6
5	Web and DBMS Web Technology and DBMS: Introduction to the internet and the Web, the web, scripting languages, common gateway interface, HTTP Cookies, Extending the web server, Java, Microsoft web platform and oracle internet platform. Semi structured Data and XML: Semi structure data, Introduction to XML, XML-Related technologies, XML schema, XML Query Languages, XML and databases and XML in oracle.	6



6	Mobile Databases and security Introduction to Mobile Databases: Mobile DBMS, Issues with mobile DBMS. Security and administration: Database security, Countermeasures- computer based controls, Security in Microsoft office access DBMS, security in Oracle DBMS, DBMSs and Web security, Database Administration.	6
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Text books:

1. Raghu Ramakrishnan and Johannes Gehrke “Database Management Systems”, 3rd Edition, McGraw Hill, 2013.
2. Thomas M. Connolly, Carolyn E. Begg “Database Systems - A Practical Approach to Design, Implementation, and Management”, 6th Edition, Pearson Education, 2015.

Reference books:

1. RamezElmasri, Shamkant B. Navathe “Fundamentals of Database Systems”, 7th Edition, Pearson Education, 2016.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan “Database System Concepts”, 7th Edition, Tata McGraw Hill, 2019



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P25CS202- Advanced Software Architecture

Title of the Course Name: Advanced Software Architecture	L	T	P	Credits
Course Code: P25CS202	3	1	--	4
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Software Engineering

Course Objectives: The course aims:

1. To Evaluate core software architecture principles and quality attributes.
2. To Learn and apply architectural styles and patterns.
3. To Analyze and evaluate architectural decisions and distributed designs
4. To Manage architecture knowledge and align designs with performance, security, and scalability needs.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Analyze role of software architecture with attribute and apply foundational architectural patterns in software design.
CO2	Apply advanced structural and domain-specific architectural patterns.
CO3	Analyze and evaluate architectures using scenario-based techniques.
CO4	Build scalable systems using distributed design.



Course Content

Unit No.	Unit title and Content	Hrs
1	Introduction & Architectural Foundations: Definition and roles of software architecture, architecture viewpoints, quality attributes (availability, modifiability, performance) documenting styles	6
2	Architectural Patterns I : Layered, MVC, Pipe-and-Filter, Broker, Publish–Subscribe frameworks	6
3	Architectural Patterns II: Presentation-Abstraction-Control, Client–Server, Domain-specific patterns, connectors	6
4	Architectural Analysis & Quality Evaluation: ATAM, ADRs, trade-off analysis, scenario-based evaluation, documenting decisions	6
5	Distributed Systems & Parallel Architectures: Multi-tier and distributed architectures, scalability concerns, concurrency patterns, microservices, cloud-native design	6
6	Architecture Knowledge & Evolution: Architecture knowledge management, tech radar, architectural debt, modernization, emerging architectures	6

Text books:

- 1.Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”,4th Edition, Addison -Wesley Publication 2021
- 2.Richard N. Taylor Nenad Medvidovic, Eric M. Dashofy “Software Architecture: Foundations, Theory, and Practice”, 1st Edition, Wiley Publication, 2010

Reference books:

- 1.Paul Clements, Felix Bachmann, Len Bass, David Garlan et al “Documenting Software Architectures: Views and Beyond”, 2nd Edition, Addison-Wesley Publication, 2016
- 2.Humberto Cervantes, Rick Kazman “Designing Software Architectures: A Practical Approach”, 1st Edition, Addison-Wesley Publication, 2016



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P25CS203- Big Data Analytics

Title of the Course Name: Big Data Analytics	L	T	P	Credits
Course Code: P25CS203	3	--	--	3
Evaluation Scheme:	ISE-1	MSE	ISE-2	ESE
Marks:	10	30	10	50

Pre-Requisite: Database management systems, Distributed Systems & Cloud Computing

Course Objectives: The course aims:

1. Identify the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4. Achieve adequate perspectives of big data analytics in various applications like Recommender systems, social media applications.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Explain key challenges in big data management and discuss its applications in business intelligence and scientific computing..
CO2	Demonstrate the use of Hadoop ecosystem, MapReduce programming model, and NoSQL databases for scalable big data processing.
CO3	Analyse various business models and scientific computing paradigms and select appropriate big data tools for analytics.
CO4	Manage big data with aspects of Security, Privacy and ethics.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction to Big Data: Definition, 3 V's, Importance and applications of Big Data, Convergence of key trends, Industry Applications(Digital Marketing, Fraud Detection, Healthcare, Credit Risk & Algorithmic Trading, Risk Management), Discuss real-world challenges and scenarios.	6
2	Big Data Technologies: Parallel Processing and Hadoop Overview(Hadoop Framework, Introduction to YARN), Cloud Computing and Big Data, Open Source Tools(Apache Spark, Kafka, Flume for Big Data processing), Mobile	6



	Business Intelligence, Industry Use Cases(Real-life examples of businesses using Big Data)	
3	Hadoop and MapReduce: Hadoop Ecosystem Overview(Key components, Interaction between components), MapReduce Basics(Structure of Map and Reduce phases, Job scheduling and execution), Scaling Hadoop, Discuss challenges, such as resource management and fault tolerance.	6
4	NoSQL Data Management: Introduction to NoSQL Databases, Data Distribution and CAP Theorem, Popular NoSQL Databases(MongoDB, Cassandra, Neo4j), Case Studies.	6
5	Analytics Framework: Introduction to analytics tools and frameworks: Pig, Hive, Spark, Data Processing with Pig, HiveQL: Querying Big Data, Real-Time Data Analytics(Tools like Kafka, Apache Storm for stream processing)	6
6	Security, Data Privacy, and Ethics : Big Data Security Overview (Authentication and authorization: Kerberos for Hadoop security, Ensuring secure data access and processing), Data Privacy and Protection (Data encryption, anonymization, and privacy laws (GDPR, CCPA)), Ethical Issues in Big Data, Compliance and Regulatory.	6

Text books:

1. Michael Mineli, Michele Chambers, AmbigaDhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses”, Wiley Publication

Reference books:

1. Chris Eaton, Dirk derooset al. ,” Understanding Big data”, McGraw Hill.
2. Douglas Eadline, “Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem”, Pearson Education.



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Program Elective-II -Intrusion Detection System- P25CS204A

Course Name: Intrusion Detection System	L	T	P	Credits
Course Code: P25CS204A	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Computer Networks

Course Objectives: The course aims:

1. Analyze types of intruders and methods for detecting intrusion.
2. Learn models and techniques used in data-driven intrusion detection
3. Apply anomaly detection and classification techniques for threat detection.
4. Design secure IDS architectures with real-time monitoring capabilities

Course Outcomes:

CO1	Recognize various types and methods of intrusions, and grasp foundational techniques for intrusion detection.
CO2	Explain IDS architectures and utilize data-mining techniques to identify security threats.
CO3	Develop and implement anomaly detection models to assess and respond to network-based threats.
CO4	Configure and manage host- and network-based IDS components, including alarm handling for secure monitoring and response operations.

Course Content

Unit No.	Unit title and Content	Hrs
1	Fundamentals of Intrusion Detection: Intruder types and attack classifications, Intrusion methods and processes, Message integrity and authentication techniques, Introduction to honeypots and deception-based defenses	6



2	IDS Models and Data Mining for Detection: General IDS model, data miningbased IDS, Denning model, data mining framework for constructing features and models for intrusion detection systems	6
3	Advanced Detection Techniques and Network Attacks: Unsupervised anomaly detection, CV5 clustering, SVM, probabilistic and statistical modeling, general IDS model and taxonomy, evaluation of IDS, cost sensitive IDS. NBAD, specification based and rate based DDOS, scans/probes, predicting attacks, network based anomaly detection, stealthy surveillance detection; Defending against DOS attacks in scout: signaturebased solutions, snort rules.	6
4	Host-Based Detection and Software Security: Host-based anomaly detection, taxonomy of security flaws in software,Self-modeling system calls for intrusion detection with dynamic window size	6
5	Secure IDS Design and Alarm Handling: Secure IDS environment: architecture and components,Secure Policy Manager, IDS sensors,Alarm types and management, IP blocking and incident response strategies	6
6	IDS Configuration and Deployment: IDS signature formats and configurations, Sensor placement and tuning, Signature-based vs behavior-based models.Deployment strategies and maintenance	6

Text books:

1. C. Endorf, E. Schultz & J. Mellander, "Intrusion Detection and Prevention", McGraw- Hill Osborne Media, 1st ed., December 2003
2. K. Bhatnagar, "Cisco Security", Course Technology PTR, October 2002

Reference books:

1. D. J. J. Marchette, "Computer Intrusion Detection and Network Monitoring: A Statistical Viewpoint", Springer, New York (Information Science and Statistics series), 1st ed., June 26, 2001
2. M. Rash, A. D. Orebaugh & G. Clark, "Intrusion Prevention and Active Response: Deploying Network and Host IPS", Syngress (Elsevier imprint), 1st ed., April 26, 2005



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Program Elective-II - Pattern Recognition- P25CS204B

Title of the Course Name: Pattern Recognition	L	T	P	Credits
Course Code: P25CS204B	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Vector spaces and Linear Algebra, Algorithms, Probability theory, Statistics.

Course Objectives: The course aims:

1. Introduce fundamental concepts of pattern recognition, classification, and clustering.
2. Apply linear algebra and probability for building classification models.
3. Implement and evaluate clustering and feature selection/extraction techniques.
4. Understand advanced PR methods including SVMs and fuzzy/neuro-fuzzy systems.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explain fundamental and modern techniques in pattern recognition.
CO2	Apply classification and clustering methods to solve pattern recognition problems.
CO3	Analyze and choose important features to improve model accuracy.
CO4	Apply PCA and Kernel PCA for feature extraction and reducing data dimensions.

Course Content		
Unit No.	Unit title and Content	Hrs
1	Introduction and mathematical preliminaries: What is pattern recognition?, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques, Decision Boundaries, Decision region / Metric spaces/ distances.	6



2	Classification: Bayes decision rule, Normal Distribution, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries. Mahalanobis Distance, K-NN Classifier, Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.	6
3	Clustering: Basics of Clustering; similarity/dissimilarity measures, clustering criteria, Different distance functions and similarity measures, Minimum within cluster distance criterion, Kmeans clustering, single linkage and complete linkage clustering, MST, K-medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.	6
4	Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm. Probabilistic separability based criterion functions, interclass distance based criterion functions.	6
5	Feature Extraction: PCA, Kernel PCA. Importance of feature extraction in ML and pattern recognition, Curse of dimensionality, Types of features: numeric, categorical, text, image, Overview of dimensionality reduction techniques: Linear vs Non-linear, Applications: Image compression, NLP, bioinformatics, Mathematical Foundations of PCA, PCA Algorithm & Implementation, Introduction to Kernel PCA, algorithms & Applications	6
6	Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real-life examples.	6



Text Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 1st Edition, 2006.
2. R. O. Duda, P. E. Hart, and D. G. Stork, "Pattern Classification", John Wiley & Sons, 2nd Edition, 2001.

Reference Books:

1. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", Academic Press, 4th Edition, 2009.
2. K. Fukunaga, "Statistical Pattern Recognition", Academic Press, 2nd Edition, 2000.

**Program Elective-II Block Chain & Cyber Security P25CS204C**

Course Name: Block Chain & Cyber Security Course Code: P25CS204C	L	T	P	Credits
	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite: Basic understanding of computer networks, cryptography, and programming fundamentals is required.

Course Objectives: The course aims:

1. Explain the core principles and architecture of block chain technology, including cryptographic components and consensus mechanisms.
2. Identify and evaluate various types of cybercrimes, attack methods, and corresponding legal frameworks such as the IT Act 2000.
3. Apply cyber security tools and techniques for threat detection, network defense, and digital forensics.
4. To analyze real-world use cases of block chain and cyber security, highlighting their benefits, limitations, and implementation challenges.

Course Outcomes:

CO1	Describe the structure, components, and functioning of blockchain systems, including cryptographic elements and network models.
CO2	Classify different types of cybercrimes and explain the methods used by cybercriminals to exploit systems.
CO3	Use cyber security tools and techniques to detect, prevent, and respond to common cyber threats and attacks.
CO4	Evaluate block chain and cyber security solutions in practical scenarios, considering legal, technical, and ethical aspects.

Course Content

Unit No.	Unit title and Content	Hrs
1	Introduction to Block Chain: Overview, objectives, and scope of the course, History and definition of blockchain, Types of block chain (Public, Private, Consortium), Hash	6



	functions: Concept and properties, Digital signatures and their role in blockchain,How block chain works: Structure, transactions, and blocks, Features, benefits, and challenges of blockchain,Nodes and peer-to-peer (P2P) networks.	
2	Block chain Architecture & Applications: Block chain lifecycle and mining mechanism,Merkle trees and Patricia trees, Gas limit and transaction fees in Ethereum,Forks: Types and implications, Basic cryptography in blockchain,Use cases in finance, healthcare, supply chain, Game theory basics: Nash equilibrium, Prisoner's Dilemma	6
3	Cybercrime and Cyber Law: Definition, origin, and classification of cybercrimes, Cybercriminals and their methods, Attack planning: Cybercafés, botnets, attack vectors, Overview of Indian IT Act 2000 and key amendments, Role of information security in cybercrime prevention	6
4	Cybercrime Techniques and Digital Forensics: Malware types: viruses, worms, Trojans, backdoors, Password cracking, key loggers, and spyware, Attacks: DOS, DDOS, SQL injection, buffer overflow, Phishing: methods and toolkits, Identity theft: techniques and prevention, Introduction to digital forensics and forensic lifecycle, Collection and preservation of digital evidence	6
5	Network Security and Defense: Firewalls: concepts, types, and working principles, Packet filtering: stateless vs. stateful firewalls, Network Address Translation (NAT) and port forwarding, Virtual Private Networks (VPNs) basics, Intrusion Detection Systems (IDS) overview (e.g., Snort),Firewall management in Linux and Windows environments	6
6	Integration and Practical Applications: Combining block chain and cyber security for secure systems, Case studies on block chain security in finance, healthcare, and supply chains, Hands-on exercises: configuring firewalls, analyzing cyber threats, Legal and ethical considerations in block chain and cyber security	6

Text books:

1. Dejei Nurugan, "Cyber Forensics ", Oxford University Press
2. Jennifer L. Bayuk, "Cyber Security: Policy Guide Book", Wiley Publisher
3. Nina Godbole, Sunit Belapure, " Cyber Security", Wiley Publisher

Reference books:

1. Rajneesh Gupta, "Hands-On Cyber security with Block chain," Packt Publishing, June 2018, ISBN: 9781788990189

**Open Elective-I**

Title of the Course Name: Environment and Development	L	T	P	Credits
Course Code: P25CM205A/ P25CS205A/ P25ET205A/ P25MD205A / P25MP205A	3	--	--	3

Pre-Requisite: Basic knowledge of environmental science and sustainable practices**Course Objectives:** The course aims:

1. To introduce the interrelationship between environment and development.
2. To understand the causes and consequences of environmental degradation.
3. To evaluate sustainable development principles and ethical approaches to environmental issues.
4. To explore global environmental policies, governance, and contemporary challenges.

Course Outcomes: At the end of the course, students will be able to

CO	Course Outcomes
CO1	Define concepts of environmental development, sustainability, and major environmental movements.
CO2	Explain natural resource issues and assess environmental degradation impacts.
CO3	Apply principles of sustainability and ethics to evaluate environmental decisions.
CO4	Analyze environmental governance, policies, and contemporary global issues through case studies.

Course Content		
Unit No.	Contents	Hrs
1	Introduction to Environment and Development Definition and Scope, Need for Sustainable Development, Historical Background, Environmental Movements.	6
2	Natural Resources and Environmental Degradation Types of Natural Resources, Resource Depletion, Land Degradation, Pollution and Biodiversity Loss.	6
3	Sustainable Development and Environmental Ethics Principles of Sustainability, Environmental Ethics, Ecological Footprint, Green and Clean Technologies.	6



4	Climate Change and Global Concerns Climate Change Causes and Impacts, Global Warming, Carbon Cycle, Adaptation and Mitigation Strategies.	6
5	Policy and Governance Environmental Policies, Acts and Protocols (India & Global), Role of Government and NGOs, Environmental Impact Assessment (EIA).	6
6	Contemporary Issues and Case Studies Urbanization and Environment, Renewable Energy, Case Studies on Sustainable Practices in India and Abroad.	6

Text Books:

1. Rajagopalan R., “Environmental Studies: From Crisis to Cure” , Oxford University Press.
2. Erach Bharucha, “Textbook of Environmental Studies”, UGC Publication.
3. Sharma P.D., “ Ecology and Environment”, Rastogi Publications.

Reference Books:

1. Cunningham W.P. & Cunningham M.A., “Principles of Environmental Science”, Tata McGraw-Hill.
2. Botkin D.B. & Keller E.A., “Environmental Science: Earth as a Living Planet”, Wiley India.
3. Sachs J.D., “ The Age of Sustainable Development”, Columbia University Press.



Title of the Course Name: Engineering Economics	L	T	P	Credits
Course Code: P25CM205B/ P25CS205B/ P25ET205B/P25MD205B / P25MP205B	3	--	--	3

Pre-Requisite: Management Information Systems (MIS)**Course Objectives:** The course aims:

1. To introduce fundamental economic principles relevant to engineering and decision-making.
2. To apply time value of money and interest formulas for evaluating engineering alternatives.
3. To analyze cost-based decisions such as make-or-buy, value engineering, and depreciation methods.
4. To compare alternative investments, assess replacement strategies, and understand project financing.

Course Outcomes: At the end of the course, students will be able to

CO	Course Outcomes
CO1	Define basic economic terms and apply them in the context of engineering problems.
CO2	Illustrate the use of time value of money concepts and evaluate cash flows using different economic methods.
CO3	Analyze and compare alternatives using present worth, annual worth, and rate of return methods.
CO4	Evaluate maintenance, replacement, depreciation, and public vs private project economics effectively.

Course Content		
Unit No.	Contents	Hrs
1	Introduction Engineering Economy Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering – Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, P – V ratio, Elementary economic Analysis– Material selection for product, Design selection for a product, Process planning.	6



2	Value Engineering Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications– Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor–equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.	6
3	Cash Flow Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, Cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, Cost dominated cash flow diagram), rate of return method, Examples in all the methods.	6
4	Replacement And Maintenance Analysis Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with an ewasset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.	6
5	Depreciation Depreciation – Introduction, Straight line method of depreciation, – Declining balance method of depreciation – Sum of the years digits method of depreciation, – Sinking fund method of depreciation/Annuity method of depreciation, service output method of depreciation – Evaluation of public alternatives – Introduction – Examples – Inflation adjusted decisions – Procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.	6
6	Financing & Public vs Private Projects Financing sources, economic evaluation in public projects, social costs, regulatory factors.	6

Text Books:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, “ Managerial economics”, Oxford university press 2006



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3. A Text book of Economic Theory: by stonier and hauge, pearson Publication.

Reference Books:

1. Sampat Mukherjee, Modern Economic Theory, New Age International Publisher
2. Degramo , Engineering Economics, prentice Hall.
3. Bo Sodersten, Macmillan, International Economics.



Title of the Course Name: Project Management	L	T	P	Credits
Course Code: P25CM205C/ P25CS205C/ P25ET205C/P25MD205C / P25MP205C	3	--	--	3

Pre-Requisite: Basic understanding of engineering processes and organizational management principles.

Course Objectives: The course aims:

1. To understand the fundamental principles, life cycle, and stages of project management.
2. To apply planning and scheduling tools like Gantt charts, WBS, CPM, and PERT.
3. To evaluate project cost estimation, budgeting, and risk management techniques.
4. To analyze project execution, monitoring, resource optimization, and control strategies

Course Outcomes: At the end of the course, students will be able to

CO	Course Outcomes
CO1	Describe the key concepts, characteristics, and life cycle of project management.
CO2	Apply scheduling and planning tools such as WBS, Gantt Charts, CPM/PERT to manage project timelines.
CO3	Analyze resource constraints and perform time-cost trade-off using resource leveling and crashing methods.
CO4	Evaluate project execution, monitoring strategies, and post-project assessment using cost and performance metrics.

Course Content		
Unit No.	Description	Hrs
1	Introduction to Project Management Definition of project and project management, Characteristics of a project, Project life cycle phases, Project vs operations, Role of project manager, Project stakeholders, Project organization structures (functional, matrix, projectized)	07
2	Project Identification and Selection Project identification methods, Feasibility study (technical, economic, financial, social), Project selection techniques, Cost-benefit analysis, Project charter, Project scope definition, Work Breakdown Structure (WBS)	07
3	Project Planning and Scheduling Project planning process, Bar charts and milestone charts, Network techniques, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Time estimation, Float and slack analysis.	07
4	Project Cost and Resource Management Project cost estimation techniques, Budgeting and cost control, Earned Value Analysis (EVA), Resource planning and allocation, Resource leveling, Project procurement management.	07



5	Project Risk and Quality Management Concept of project risk, Risk identification and classification, Risk analysis (qualitative and quantitative), Risk mitigation strategies, Quality planning and assurance, Total Quality Management (TQM), Six Sigma concepts in projects.	07
6	Project Monitoring, Control, and Closure Project monitoring techniques, Performance measurement, Project control systems Project communication management, Project documentation, Project audit Project termination and closure, Introduction to project management software (MS Project)	07

Text Books:

1. Shtub, Bard and Globerson, "Project Management: Engineering, Technology and Implementation", Prentice Hall, India
2. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Wiley, 12th Edition.

Reference books:

1. Erik W. Larson, Clifford F. Gray, Project Management: The Managerial Process, McGraw-Hill Education, 8th Edition.
2. Lock, Gower, "Project Management Handbook"
3. James P. Lewis, Project Planning, Scheduling and Control: The Ultimate Hands-On Guide to Bringing Projects in On Time and On Budget, McGraw-Hill Education, 5th Edition

Title of the Course Name: Health Care Engineering	L	T	P	Credits
Course Code: P25CM205D/ P25CS205D/ P25ET205D/P25MD205D / P25MP205D	3	--	--	3

Pre-Requisite: Basic understanding of human biology & healthcare terminology, Foundational knowledge in probability, statistics, and operations research Familiarity with optimization techniques and queuing theory, Introductory exposure to programming (Python/MATLAB) and simulation modeling

Course Objectives: The course aims:

1. To understand how the healthcare system works and what challenges it faces.
2. To learn how to improve hospital services using planning and optimization methods.
3. To study how patient waiting lines and hospital processes can be modeled and improved.
4. To explore new technologies like AI, remote care, and digital tools in future healthcare.



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Course Outcomes: At the end of the course, students will be able to

CO	Course Outcomes
CO1	Recall fundamental components of healthcare systems, including resource planning, queuing models, data flows, and innovations in digital health.
CO2	Interpret and formulate mathematical models for workforce optimization, facility layout, patient queuing, and healthcare delivery systems
CO3	Apply optimization, queuing theory, and simulation methods to enhance healthcare system efficiency, throughput, and patient experience.
CO4	Evaluate emerging healthcare technologies and simulation outcomes to improve clinical operations, policy design, and access to quality care.

Unit No.	Course Contents Contents	Hours
1	Introduction to Healthcare System Introduction: Facets of a Healthcare System, Size of a Healthcare System, Health Insurance and Financing, Healthcare Services, Healthcare Ecosystem, Healthcare System Challenges, Access to Healthcare, Healthcare Systems Engineering, Understanding Delivery: Data and Processes: Types of Healthcare Data, National Datasets, Healthcare Delivery Process Data, Process Throughput	7
2	Healthcare Resource Workforce and Access to Care Optimization Workforce: Optimization, Supply-Demand Matching, Assignment Models Optimization : Facility Optimization, Developing Facility Layout to Minimize Travel Wastage, Considering Multiple Conflicting Objectives, Optimization using a Modeling Language	6
3	Modeling Patient Queues Kendall's Notation for Queuing Systems, Little's Law, Markovian Queuing Models: M/M/1, M/G/1 Queuing Model, Modeling Interconnected Services using Queuing Networks,	6
4	Healthcare System Simulation Building a Simulation Study Framework, Event Calendars in Discrete	7



	Event Simulation, Input Modeling in Simulation, Output Analysis in Simulation, Estimation in a Non-Terminating, Non-Stationary System: Emergency Department, Simulation of a Hospital Queuing Network	
5	Future of Healthcare Shifting from Volume to Value, Evidence-Based Medicine, Personalized Medicine, Vision of the Future, Connected Medicine, Disease and Condition Management: Virtual Assistants, Remote Monitoring, Medication Adherence, Accessible Diagnostic Tests, Smart Implantable, Digital Health and Therapeutics, AI, Conversational AI, Making and rationalizing decisions: Drug discovery, 3-D printing, Personalized prosthetics, Bioprinting and tissue engineering, Pharmacology and devices, Education, Gene therapy, Virtual and Augmented Reality, Merged Reality, Pain Management, Physical Therapy, Nursing and Delivery of Medicine, Virtual Appointments and Classrooms, Blockchain, Patient Record Access., Applications of AI in Healthcare	10

Text Books:

1. Sanjay Mehrotra, Kevin Bui, "Healthcare Engineering", Springer, 1st edition, 2022.
2. Arjun Panesar, "Machine Learning and AI for Healthcare", Apress, 1st edition, 2019.

Reference Books:

1. S. M. Dehkordi, L. Monsef, T. Huschka, "Healthcare Systems Engineering," Springer, 1st Edition
2. Dinesh Kumar, "Health Systems: Planning, Organization and Management", Oxford University Press, 1st Edition
3. Paul M. Griffin (Ed.), "Healthcare Systems Engineering", Wiley, 1st Edition



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P25CS206-Technologies for Industrial Evolution

Title of the Course Name: Technologies for Industrial Evolution	L	T	P	Credits
Course Code: P25CS206	2	--	--	2
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	25	--	25	50

Pre-Requisite: Knowledge of Automation, IoT and Industrial Engineering

Course Objectives: The course aims:

- 1.To understand the key technologies & impact of technological evolution on modern industries
- 2.To provide insight into the integration of AI, Big Data, and Cloud Computing in industrial operations.
- 3.To familiarize students with digital twin, predictive maintenance, and robotic process automation.
4. To enable students to analyze current trends and future directions in industrial digitization.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explain the evolution and principles of Industry 4.0 and its associated technologies.
CO2	Apply knowledge of AI, Cloud Computing, and Big Data for industrial process optimization.
CO3	Design integrated models using smart manufacturing and automation technologies.
CO4	Interpret emerging industrial trends to enable future-ready innovation.

Course Content		
Unit No.	Unit Title & Contents	Hrs
1	Introduction to Industrial Evolution: Historical Industrial Revolutions, Key Drivers of Industry 4.0, Comparison of Industry 3.0 and 4.0, Global Trends and Indian Scenario.	6
2	Core Technologies in Industry 4.0: IIoT, Smart Sensors, Embedded Systems, Cyber Physical Systems (CPS), Edge and Fog Computing.	6



3	Digital Transformation Tools: Cloud Computing, Big Data Analytics, AI & Machine Learning for Industry, Blockchain in Supply Chain.	6
4	Automation and Smart Manufacturing: Additive Manufacturing, Smart Factories, Industrial Robotics, Human-Machine Collaboration.	6
5	Predictive Maintenance and Digital Twin: Condition Monitoring, Real-time Data Acquisition, Digital Twin Modeling, Fault Diagnosis.	6
6	Future Trends and Case Studies: Green Manufacturing, Sustainable Technologies, 5G for Industry, Case Studies on Digital Transformation.	6

Text Books:

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, A press.
2. Sabina Jeschke et al., “Industrial Internet of Things: Cyber manufacturing Systems”, Springer.
3. Brettel M. – How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective.

Reference Books:

1. Klaus Schwab – “The Fourth Industrial Revolution”, World Economic Forum.
2. Jay Lee – Smart Manufacturing, Springer.
3. Andrew Ng – Machine Learning Yearning, DeepLearning.ai (for AI relevance).



P25CS207 - Mini Project

Title of the Course Name: Mini Project	L	T	P	Credits
Course Code: P25CS207	--	--	2	1

Pre-Requisite:

- Proficiency in at least one programming language (e.g., Python/Java/C++) and version control (Git)
- Strong foundation in data structures, algorithms, and basic software engineering practices.
- Prior exposure to research methodology: literature review, problem formulation, and experimental design.
- Domain basics relevant to the chosen project area (e.g., ML, systems, networks, security, data analytics).

Course Objectives: The course aims:

1. Formulate a well-scoped technical/research problem informed by literature or industry need.
2. Apply appropriate computing methods, tools, and frameworks to develop a working prototype or study
3. Implement and experiment with datasets, metrics, or benchmarking to generate and analyze results.
4. Communicate and reflect on technical findings, limitations, ethical considerations, and future work

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Analyze scholarly/technical sources to define and justify a project problem statement..
CO2	Design and implement a functional software, model, or system component addressing the problem..
CO3	Evaluate the proposed solution using appropriate experiments, datasets, metrics, or



	comparisons.
CO4	Present project results effectively through reports, code artifacts, and oral presentation while adhering to research and professional ethics.

Sr.No.	Guidelines
1	Activities involved: 1. Mini project should be undertaken individually. 2. Topic should be relevant to CS with focus on problem solving, innovation, or application 3. A detailed proposal should be submitted with problem statement, objectives, methodology, and timeline 4. Regular progress reviews should be conducted (at least two internal reviews) 5. Implementation can be software-based or hardware-based Emphasis should be placed on originality, practical relevance, and feasibility 6. Maintain a project logbook detailing weekly progress, issues faced, and resolutions 7. Final submission must include a well-structured report, simulation/implementation files, and presentation 8. Viva-voce will be conducted to assess individual contribution and understanding
2	Format for Report (Spiral Bound & Soft Copy) 1. Cover Page 2. Certificate (Guide + Head of Department) 3. Declaration 4. Acknowledgement 5. Abstract 6. Table of Contents 7. List of Figures/Tables (if applicable) 8. Chapters: - o Introduction - o Literature Review - o Problem Statement - o Objectives - o System Design and Methodologies - o Implementation and Testing - o Results and Discussions - o Conclusion and Future Work 9. References (IEEE format) 10. Appendix (if applicable)
3	Deliverables • Mini Project Proposal (hard copy & soft copy – before implementation begins) • Weekly Progress Logbook signed by the guide • Final Project Report in hard copy and PDF (as per the given format)



- **Working Model/Simulation Output** (if applicable)
- **Presentation Slides (PPT)**
- **Final Viva & Demonstration** before PRC
- **Source Code/Design Files** on CD/pen drive or shared via link

P25CS208 - PG Lab II

Title of the Course Name: PG Lab-II	L	T	P	Credits	
Course Code: P25ET208	--	--	4	2	

Prerequisites:

- Fundamental knowledge of relational database concepts, including ER modeling, relational algebra, and SQL (DDL, DML, DCL).
- Understanding of schema design principles and normalization techniques, including functional dependencies and normal forms up to BCNF.
- Basic awareness of indexing, query optimization, and database programming, with familiarity in using tools like Oracle, MySQL, or PostgreSQL.
- Introductory exposure to distributed databases, XML technologies, and web/database integration using scripting or programming languages.

Course Outcomes:	
CO1	Analyze and apply normalization techniques and functional dependencies to refine relational database schemas.
CO2	Design and evaluate distributed and parallel database systems with efficient query processing and optimization strategies
CO3	Construct and compare object-oriented and object-relational database models using standard modeling languages and tools.
CO4	Examine advanced data models and technologies such as XML, mobile databases, and implement secure, web-integrated database solutions.



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Sr. No.	Experiment/ Assignment/ Title
1	Design and implementation of a normalized database schema using functional dependency analysis and decomposition up to BCNF
2	Performance comparison of SQL queries before and after index creation on large datasets using cost analysis tools
3	Implementation of a parallel query execution plan using PostgreSQL or a simulation tool, and analysis of performance gains
4	Simulation of data fragmentation and distributed query execution in a distributed database environment (using tools like Oracle or MySQL Cluster)
5	Case study and implementation of distributed transaction management with concurrency control and recovery mechanisms
6	Design and analysis of a distributed relational database with transparency properties (location, fragmentation, replication)
7	Design of an object-oriented database schema using UML and implementation using an object-relational DBMS (like PostgreSQL or Oracle)
8	CRUD operation implementation on complex data types using object-relational features in Oracle or PostgreSQL
9	Design and execution of XML-based queries using XPath and XQuery; integrate with relational data using XML in Oracle
10	Implementation of a secure web-based database application using backend Oracle/MySQL and frontend PHP/JavaScript, with session management and role-based access control.



P25CS209 - Internship & Field Training

Pre-Requisite:

1. Completion of core PG coursework in Computer Science & Engineering
2. Basic technical and communication skills
3. Awareness of industrial tools, platforms, or technologies relevant to the chosen domain

Title of the Course Name: Internship/Training	L	T	P	Credits
Course Code: P25CS209	--	--	--	--

4. Readiness for professional work ethics and environment
5. Resume and basic documentation (cover letter, academic transcripts)

Course Objectives: The course aims:

1. Bridge academic learning with industry practices by exposing students to real-world engineering environments.
2. Develop domain-specific technical skills through hands-on experience and use of industrial tools and workflows.
3. Foster teamwork and professional communication by engaging in collaborative project execution.
4. Promote understanding of innovation, industry standards, and regulatory frameworks relevant to engineering practice.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Identify and analyze industrial problems relevant to the field of specialization and associated workflows.
CO2	Demonstrate technical and professional competencies applied during the internship through assigned tasks.
CO3	Evaluate engineering knowledge and practices used in solving real-world industrial challenges.
CO4	Develop industry-relevant solutions and effectively communicate findings through a professional report and presentation.



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Sr.No.	Guidelines
1	Activities Involved 1. Identifying and applying to companies, startups, or R&D organizations in the CSE domain. 2. Completion of a 4-week internship, preferably full-time, at an approved organization. 3. Hands-on work under guidance of assigned industry mentor(s) in project or team settings. 4. Weekly task reporting and feedback sessions coordinated with internal faculty mentors. 5. Final presentation and submission of internship report before an evaluation panel.
2	Requirements 1. Internship must be in a core or allied Computer Science domain such as AI, Data Science, Cybersecurity, Cloud Computing, IoT, or Software Development. 2. Students must obtain prior approval from the Internship/Training Coordinator before starting the internship. 3. Internship duration should be a minimum of 4 weeks and preferably full-time. 4. Students must maintain a daily logbook or weekly activity sheet documenting tasks, tools used, and reflections. 5. At the end of the internship, students must collect an Internship Completion Certificate from the host organization.
3	Internship Report Format (Hard bound Copy) 1. Cover Page (Institute, Title, Student Name, Industry Name, Duration) 2. Certificate from Institute 3. Certificate from Company 4. Acknowledgment 5. Table of Contents 6. Chapter 1: Introduction – Overview of the organization and objectives 7. Chapter 2: Training Activities – Tasks performed, tools used, departments visited 8. Chapter 3: Technical Learning – Concepts, skills, technologies learned 9. Chapter 4: Analysis and Outcomes – Contributions made, learnings, challenges 10. Chapter 5: Conclusion – Summary and future scope 11. References (if applicable) 12. Appendices – Screenshots, tools used, code samples (if allowed)



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Semester III

Open Elective-II

Title of the Course Name: Labour Welfare and Industrial Relations	L	T	P	Credits
Course Code: P25CM301A/ P25CS301A/ P25ET301A/ P25MD301A / P25MP301A	3	--	--	3

Pre-Requisite: Fundamentals of Human Resource Management, Basics of Organizational Behaviour, Indian Labour Laws (basic awareness preferred)

Course Objectives: The course aims:

1. Provide an in-depth understanding of labour welfare concepts and principles.
2. Study the evolution and framework of industrial relations in India.
3. Analyze the role of trade unions, collective bargaining, and dispute resolution mechanisms.
4. Evaluate labour policies, legislation, and welfare measures with real-world applications.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Define and explain the concepts of labour welfare and industrial relations.
CO2	Analyze the role of trade unions, employee participation, and dispute resolution mechanisms.
CO3	Examine labour laws and welfare measures applicable in industrial settings.
CO4	Evaluate the effectiveness of industrial relations strategies in promoting harmony and productivity.

Course Content		
Unit No.	Contents	Hrs
1	Introduction to Labour Welfare:	6



	Concept of labour welfare and its importance, Principles and types of labour welfare, Role of the government and employers in labour welfare, Statutory and non-statutory welfare measures	
2	Industrial Relations Framework: Evolution and scope of industrial relations, Objectives and importance of industrial relations, Approaches to industrial relations, Role of stakeholders (government, employers, employees)	6
3	Trade Unions in India: Trade unions: concept, structure, and functions, Growth of trade union movement in India, Trade union legislation, Role of trade unions in industrial relations, Challenges faced by trade unions	6
4	Collective Bargaining and Employee Participation: Concept and process of collective bargaining, Types and importance of collective bargaining, Workers' participation in management, Joint management councils, Works committees	6
5	Industrial Disputes and Resolution Mechanisms: Causes and effects of industrial disputes, Methods of dispute resolution (conciliation, arbitration, adjudication), Role of grievance redressal systems, Disciplinary procedures	6
6	Labour Legislation and Contemporary Issues: Overview of key labour laws (Factories Act, Trade Unions Act, Industrial Disputes Act), Recent changes in Indian labour codes, Case studies on labour welfare and industrial relations, Emerging trends and challenges	6

Text Books:

1. Sinha, P.R.N., Sinha, I.B., and Shekhar, S.P. – “Industrial Relations, Trade Unions, and Labour Legislation”, Pearson Education
2. Mamoria, C.B. and Mamoria, S. – “Dynamics of Industrial Relations”, Himalaya Publishing House

Reference Books:

1. Monappa A., Nambudiri R. & Selvaraj, P. – Industrial Relations and Labour Laws, 2nd Edition, McGraw Hill
2. Srivastava, S.C. – “Industrial Relations and Labour Laws”, Vikas Publishing
3. Indian Labour Codes & Government Publications – Ministry of Labour and Employment

MOOC/NPTEL Platform:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc25_mg159/preview



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Title of the Course Name: Sustainable Technology	L	T	P	Credits
Course Code: P25CM301B/ P25CS301B/ P25ET301B/ P25MD301B/ P25MP301B	3	--	--	3

Pre-Requisite: Basic knowledge of science, environment, and technological applications, Awareness of current environmental challenges and sustainability needs

Course Objectives: The course aims:

1. To introduce the concepts and principles of sustainable development and technology.
2. To evaluate the impact of current technologies on environmental, social, and economic systems.
3. To explore clean and green technologies that promote sustainability.
4. To enable students to design or adopt sustainable solutions for real-world applications.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explain the core principles of sustainability and sustainable development
CO2	Analyze various sustainable technologies in energy, water, and waste sectors
CO3	Evaluate lifecycle and environmental impact of a given technology
CO4	Propose sustainable technology solutions for specific local/global issues

Course Content		
Unit No.	Contents	Hrs
1	Introduction to Sustainable Development and Technology: Sustainability principles, triple bottom line, SDGs, environmental degradation, ecological footprint, carbon emissions, circular economy	6



2	Sustainable Energy Technologies: Renewable energy sources, solar PV, wind, hydropower, biomass, green hydrogen, energy efficiency, smart grids	6
3	Sustainable Water and Sanitation Technologies: Rainwater harvesting, water purification technologies, wastewater treatment, greywater recycling, low-flow devices, SDG 6 focus	6
4	Sustainable Waste Management: Waste hierarchy (Reduce-Reuse-Recycle), e-waste, composting, biodegradable packaging, plastic alternatives, waste-to-energy	6
5	Green Building and Smart Infrastructure: Energy-efficient building materials, passive solar design, green rating systems (LEED, GRIHA), smart cities, sustainable transportation	6
6	Life Cycle Assessment and Sustainable Innovation: LCA tools and methods, carbon footprint tools, eco-design, green product innovation, sustainable entrepreneurship, case studies	6

Text Books:

1. Sustainable Engineering: Concepts, Design and Case Studies – D. Allen, D. Shonnard
2. Sustainability Principles and Practice – Margaret Robertson

Reference Books:

1. Green Technologies and Environmental Sustainability – R. Raveendran
2. Reports from UNEP, NITI Aayog, MoEFCC

MOOC/NPTEL Platform:

1. **NPTEL:** Sustainable Engineering Concepts and Life Cycle by By Prof. Brajesh Kumar Dubey, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc25_ce117/preview



Title of the Course Name: Entrepreneurship Development	L	T	P	Credits
Course Code: P25CM301C/ P25CS301C/ P25ET301C/ P25MD301C/ P25MP301C	3	--	--	3

Pre-Requisite: Basics of Management, Market Research Fundamentals, Financial Accounting Basics.

Course Objectives: The course aims:

1. To introduce the fundamental concepts and evolution of entrepreneurship, including the role of creativity and innovation.
2. To enable students to recognize business opportunities and develop viable business models using structured techniques.
3. To equip students with knowledge of business planning, financial feasibility, legal structures, and institutional support for startups.
4. To explore funding strategies, growth management, and emerging trends in entrepreneurship and intrapreneurship.

Course Outcomes: At the end of the course, students will be able:

CO	Course Outcomes
CO1	Explain the concepts, types, and evolution of entrepreneurship along with the importance of innovation.
CO2	Apply opportunity recognition and business modeling techniques like BMC and lean startup.
CO3	Analyze the feasibility of a business idea considering financial, legal, and institutional frameworks.
CO4	Evaluate different funding options and growth strategies, including emerging trends in entrepreneurship.

Course Content		
Unit No.	Contents	Hrs



1	Fundamentals of Entrepreneurship Definition, types and evolution of entrepreneurship, Entrepreneur vs intrapreneur, Importance of creativity and innovation in venture creation.	6
2	Opportunity Recognition & Business Models Idea generation techniques - brainstorming, TRIZ, SCAMPER, Market research and feasibility analysis, Business Model Canvas and lean startup methodology.	6
3	Business Planning and Project Feasibility Components of a business plan, Cost-benefit analysis - NPV, IRR, ROI, Financial planning, budgeting, cost structures.	6
4	Legal & Institutional Framework Business entity types - sole proprietorship, LLP, Pvt. Ltd, Registration processes, IPR fundamentals - patents, trademarks, Schemes and support - Start-up India, SIDBI, NABARD.	6
5	Financing and Growth Management Funding sources - bootstrapping, angel investors, VC, loans, Scaling strategies, growth stages, risk management, Role of incubation, accelerators, and mentorship.	6
6	Emerging Entrepreneurship Trends Social, rural, digital entrepreneurship, Corporate intrapreneurship dynamics, Technology-driven ventures and ecosystem trends.	6

Text Books:

1. Engineering Entrepreneurship: From Idea to Business Plan – Paul Swamidass, Cambridge University Press, 2015.
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Business, 2011.
3. Entrepreneurship Development, S. Anil Kumar, Scientific Publishers, 2019.

Reference Books:

1. Disciplined Entrepreneurship: 24 Steps to a Successful Startup, Bill Aulet, Wiley, 2013.
2. Opportunity Recognition in Entrepreneurial Teams, Maureen McKelvey, Per Davidsson, Leif Wennberg, Springer, 2021.
3. Effectuation: Elements of Entrepreneurial Expertise, Saras D. Sarasvathy, Edward Elgar, 2008, 2nd ed. 2021.



Title of the Course Name: Industrial Automation	L	T	P	Credits
Course Code: P25CM301D/ P25CS301D/ P25ET301D/ P25MD301D/ P25MP301D	3	--	--	3

Pre-Requisite: Electrical Networks and Control, Digital Electronics Basics.

Course Objectives: The course aims:

1. To familiarize students with the hierarchical structure of industrial automation systems and various sensing technologies used in the industry.
2. To impart knowledge of process control systems and tuning techniques including PID controllers and advanced control methods.
3. To train students in PLC programming, sequential control, and industrial networking protocols for automation.
4. To introduce advanced automation technologies including IIoT, CNC, robotics, and cyber-secure smart manufacturing systems.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Explain the structure of industrial automation systems and describe the working principles of common industrial sensors and actuators.
CO2	Apply PID tuning techniques to control processes using feedback loops, cascade control, and feed-forward methods.
CO3	Develop ladder and structured text programs for automation using PLCs and integrate industrial communication protocols (e.g., Modbus, Profibus).
CO4	Analyze and evaluate the integration of advanced automation systems like SCADA, IIoT, and robotics for Industry 4.0 implementations.

Course Content		
Unit No.	Contents	Hrs
1	Architecture and Sensing in Industrial Automation Overview of Automation Systems - Architecture, CPS, levels of automation,	6



	discrete vs process systems, Industrial Sensors and Signal Conditioning - Temperature, pressure, displacement, flow, force sensors; calibration, error analysis and conditioning circuits.	
2	Process Control and PID Techniques Fundamentals of Control Systems - Feedback loops, stability, controller types, PID Controllers - P/PI/PID tuning methods Ziegler–Nichols, feed-forward, cascade, predictive control.	6
3	Sequence Control and PLC Programming Components of a business plan, PLC Basics - Hardware architecture, scan cycle, I/O interfacing, Programming in Ladder and Structured Control - Relay logic, timers, counter blocks, structured design.	6
4	Fieldbus Protocols, SCADA and DCS Industrial Communication Networks -Modbus, Profibus, HART, Fieldbus, Ethernet/IP, SCADA/DCS Architecture and HMI - Data acquisition, historian logs, alarms, cyber security, OPC UA.	6
5	Actuators and Drive Systems Actuator Technologies - Hydraulic, pneumatic valves, electric drives, stepper and servo motors, Drive Systems and VFDs - Variable frequency drives, speed control, energy-efficient operation.	6
6	Advanced Automation and Industry 4.0 Integration CNC & Robotics Basics - Machine tool control loops, robotic manipulators, grippers, kinematics, IIoT, Analytics and Cyber security - Edge computing, data analytics, smart manufacturing and automation system security.	6

Text Books:

1. Industrial Automation: Hands-On, Frank Lamb, McGraw-Hill, 1st ed., 2013
2. Industrial Automation Solutions for PLC, SCADA, Drive and Field Instruments – Sanjay B. Katariya, Notion Press, 2020..

Reference Books:

1. Standard Handbook of Industrial Automation – Douglas M. Considine & Glenn D. Considine, Springer, 1st ed., 1987.
2. Instrumentation for Process Measurement and Control – Norman A. Anderson, Chilton Company, 3rd ed., Circa 1990.
3. Industrial Automation from Scratch, Olushola Akande, Packt Publishing, 2023.



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P25CS302- Artificial Intelligence & Machine Learning

Title of the Course Name: Artificial Intelligence & Machine Learning Course Code: P25CS302	L	T	P	Credits
	3	--	--	3
Evaluation Scheme:	ISE-I	MSE	ISE-II	ESE
Marks:	10	30	10	50

Pre-Requisite:

Course Objectives: The course aims:

1. Apply AI techniques to solve the given problems.
2. Implement trivial AI techniques on relatively large system
3. Explain uncertainty and Problem-solving techniques.
4. Compare various learning techniques.

Course Outcomes: At the end of the course, students will be able to:

Course Outcomes	
CO1	Identify and analyze AI-based problems
CO2	Apply appropriate techniques and advanced search methods
CO3	Discuss and apply various learning techniques
CO4	Design expert systems

**Course Content**

Unit No.	Unit title and Content	Hrs
1	Introduction to AI Basic Concepts of AI and State space search, Introduction to unguided and guided search	6
2	Heuristic Search and Intelligent Learning Methods Problems in search and solutions, Genetic algorithms, Neural Networks, BPNN, learning process in BPNN	6
3	Advanced Search, Planning, and Problem Solving Some other search methods and Admissibility, Planning, Game Playing	6
4	Game Playing and Knowledge Representation Minimax and other game playing algorithms , using predicate logic for Knowledge Representation	6
5	Advanced Knowledge Representation and Reasoning Resolution and non-monotonic reasoning, Strong methods for knowledge representation, Fuzzy logic and certainty factors (CD)	6
6	Expert Systems and Machine Learning Concepts Scripts and introduction to expert systems, Developing expert systems, Basics of machine learning	6

Text books:

3. Stuart J. Russell, Peter Norvig ,” Artificial Intelligence: A Modern Approach”, Pearson, 4th edition, 2021.
4. Elaine Rich, Kevin Knight, Shivashankar B. Nair,” Artificial Intelligence”, McGraw Hill Education, 3rd edition, 2017.

Reference books:

3. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education, 3rd edition (Indian Adaptation), 2019.
4. Wolfgang Ertel, Introduction to Artificial Intelligence, Springer, 2nd edition, 2017.
5. Saroj Kaushik, Artificial Intelligence, Cengage Learning India, Revised edition, 2020.



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P25CS303 - Dissertation Phase-I

Title of the Course Name: Dissertation Phase-I	L	T	P	Credits
Course Code: P25CS303	--	--	20	10

Pre-Requisite:

1. Understanding of core and elective subjects in Computer Science and Engineering, based on the chosen area of research.
2. Familiarity with research methodology, academic writing, and citation/reference standards.
3. Working knowledge of software tools, programming platforms, or computational frameworks as per project requirement.

Course Objectives: The course aims:

1. Identify a research problem relevant to Computer Science and Engineering.
2. Conduct a comprehensive literature review and identify gaps in existing work.
3. Formulate clear objectives, scope, and methodology for the proposed research.
4. Develop skills in research planning, time management, and technical documentation.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Identify and define a computer science research problem with clear scope and relevance.
CO2	Perform a detailed literature review and identify research gaps.
CO3	Formulate the problem statement, research objectives, and suitable methodology.
CO4	Prepare and present a structured project proposal with technical justification.
CO5	Demonstrate professional documentation and presentation of research progress.



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Sr.No.	Guidelines
1	Activities Involved 1. Selection of a relevant research topic in consultation with a guide. 2. Literature review using journals, conference papers, patents, and technical reports. 3. Identification of research gaps, problem statement formulation. 4. Planning of methodology, tools, datasets, and experimental setup (if applicable). 5. Partial implementation or simulation (as feasible). 6. Periodic presentations and documentation.
2	Format for Report (Spiral Bound & Soft Copy) 11. Cover Page 12. Certificate (Guide + Head of Department) 13. Declaration 14. Acknowledgement 15. Abstract 16. Table of Contents 17. List of Figures/Tables (if applicable) 18. Chapters: - o Introduction - o Literature Review - o Problem Statement - o Objectives - o Proposed Methodology - o Preliminary Work Done - o Conclusion and Future Work 19. References (IEEE format) 20. Appendix (if applicable)
3	Deliverables • Synopsis (approved by guide and PRC). • Interim progress report. • Final report of Dissertation Phase–I. • Presentation and viva before the department PRC.

**P25CS401-Dissertation Phase-II**

Title of the Course Name: Dissertation Phase-II	L	T	P	Credits
Course Code: P25CS401	--	--	40	20

Pre-Requisite:

- Completion of Dissertation Phase–I with approved synopsis and partial implementation.
- Working knowledge of software design tools, programming environments, simulation platforms, or cloud-based development frameworks relevant to the project domain.
- Familiarity with academic writing, plagiarism policies, and peer-reviewed publishing process.

Course Objectives: The course aims:

1. To implement the proposed system, model, or algorithm as outlined in Dissertation Phase–I.
2. To perform rigorous experimentation, simulation, or software development, and analyze the obtained results.
3. To interpret findings in the context of existing literature and assess their technical significance and impact.
4. To prepare and submit a complete dissertation report following academic and ethical research standards.

Course Outcomes: At the end of the course, students will be able to:

CO	Course Outcomes
CO1	Implement the proposed methodology using appropriate tools, platforms, or frameworks.
CO2	Conduct systematic experimentation or development and analyze results effectively.
CO3	Interpret findings in relation to existing research and identify their contribution or impact.
CO4	Document and present the complete dissertation work adhering to academic standards.
CO5	Demonstrate research aptitude and communication skills through seminars or publications.



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Sr.No.	Guidelines
1	Activities Involved 1. Complete full implementation of the proposed system, algorithm, or methodology using suitable programming languages, frameworks, or tools. 2. Conduct simulations, software experiments, or data analysis to validate the proposed work. 3. Compare results with existing approaches or baseline systems using standard evaluation metrics. 4. Prepare and submit research papers to relevant conferences or peer-reviewed journals (optional but encouraged). 5. Compile and finalize the dissertation report, following academic writing standards and department guidelines. 6. Deliver the final seminar and viva-voce before a panel of internal and external examiners.
2	Mandatory Paper Publication Requirements • Each student must publish a minimum of two research papers based on their dissertation work before submission. • The papers must be: ◦ At least one in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal. ◦ The second can be in a national/international conference with review and proceedings. • Proof of acceptance or publication must be submitted along with the final dissertation. • Co-authorship with guide or peer students is acceptable, but the student must be the primary contributor.
	Report Format (Hardbound Copy) 1. Cover Page 2. Certificate (Guide, HoD, External Examiner) 3. Declaration 4. Acknowledgement 5. Abstract 6. Table of Contents 7. List of Figures and Tables 8. Chapters: ◦ Introduction ◦ Literature Review ◦ Gap Identification ◦ Problem Statement ◦ Objectives ◦ Methodology ◦ Implementation



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	○ Results and Discussion ○ Conclusion and Future Scope 9. References (IEEE format) 10. Appendices (if applicable) 11. Copies of Published Papers (as Annexure)
3	Deliverables • Hardbound final dissertation report (in prescribed format). • Soft copy of report and presentation (PDF and PPT). • Plagiarism report (Turnitin/Urkund $\leq 10\%$). • Proof of 2 paper publications (acceptance letters/certificates/published copy). • Source code, design files, datasets (if applicable). • Final presentation and viva sheet signed by the PRC.
	Mandatory Paper Publication Requirements • Each student must publish a minimum of two research papers based on their dissertation work before submission. • The papers must be: ○ At least one in a SCI/ SCIE/ SCOPUS/ Web of Science/ Peer-Reviewed Journal. ○ The second can be in a national/international conference with review and proceedings. • Proof of acceptance or publication must be submitted along with the final dissertation. • Co-authorship with guide or peer students is acceptable, but the student must be the primary contributor.



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P25CS210- Employability Skill Development

Title of the Course Name: Employability Skill Development	L	T	P	Credits
Course Code: P25CS210	4	--	--	4

Pre-Requisite: Basic English communication

Course Objectives: The course aims:

1. To develop effective communication, teamwork, and interpersonal skills
2. To enhance professional readiness through resume building and interview practice
3. To build leadership qualities and critical thinking for workplace adaptability
4. To inculcate ethics, etiquette, and time management in professional settings

Course Outcomes: At the end of the course, students will be able:

CO	Course Outcomes
CO1	Demonstrate effective communication and interpersonal skills
CO2	Apply leadership and teamwork principles in professional settings
CO3	Prepare resumes and participate effectively in interviews and group discussions
CO4	Practice workplace etiquette, time management, and ethical behavior

Course Content		
Unit No.	Contents	Hrs
1	Communication Skills Verbal and non-verbal communication, active listening, barriers to communication, clarity and coherence, email and business communication, public speaking, presentation skills	6
2	Personality Development and Interpersonal Skills Positive attitude, self-confidence, grooming and body language, self-awareness, empathy, emotional intelligence, teamwork and collaboration,	6



	conflict resolution	
3	Resume and Cover Letter Writing Types of resumes, components of an effective resume, tailoring resumes to job roles, cover letter writing, common errors in resumes, creating a LinkedIn profile	6
4	Interview Preparation and Group Discussion Types of interviews, interview etiquette, commonly asked questions, STAR technique, mock interviews, types of group discussions, do's and don'ts in GD, communication in a group setting	6
5	Professional Skills and Workplace Etiquette Workplace behavior, ethics and integrity, corporate etiquette, professionalism, time management, goal setting, stress management, adaptability	6
6	Career Planning and Employability Readiness Career planning techniques, self-assessment and SWOT analysis, decision-making skills, building confidence, job search strategies, facing challenges in the workplace	6

Text Books:

1. Barun K. Mitra , Personality Development and Soft Skills, Oxford University Press
2. Andrews, Sudhir , How to Succeed at Interviews, Tata McGraw Hill

Reference Books:

1. Dr. K. Alex – *Soft Skills: Know Yourself & Know the World*, S. Chand
2. Wallace & Masters – *Personal Development for Life and Work*, Cengage Learning
3. Dale Carnegie – *How to Win Friends and Influence People*, Simon & Schuster
4. NSDC / NASSCOM soft skills modules, National Skill Development Corporation resources.

MOOC/NPTEL Platform:

1. Developing Soft Skills and Personality by Prof. T Ravichandran (IIT Kanpur)]
Link: <https://nptel.ac.in/courses/109/104/109104115>