Progressive Education Society's

MODERN COLLEGE OF ENGINEERING, PUNE-05.

An Autonomous Institute Affiliated to Savitribai Phule Pune University

Approved by AICTE & Government of Maharashtra
Accredited by NAAC (A++)

First Year - Master of Technology (F. Y. M.Tech.)

National Education Policy (NEP)-2020 Compliant Curriculum

COMPUTER ENGINEERING

(w. e. f. A.Y. 2024 – 2025)

www.moderncoe.edu.in

**(Recommended by the Board of Studies and Approved by Academic Council)*

Acronyms,

Acronym of Course Type*	Course Type
MCC	Major Core Course
MEC	Major Elective Course
RM	Research Methodology
RP	Research Project
HR	Human Rights
SD	Skill Development
CS	Introduction to Cyber Security / Information Security
Seminar	Seminar
LP	Lab Practice

** Acronym of Courses as per NEP Verticals and AICTE Domains.*

Acronym of Scheme Type*	Scheme Type
TH	Theory
PR	Practical
OR	Oral
CIE	Continuous Internal Examinations
SEE	Semester End Examination
L	Lecture
T	Tutorial
P	Practical

First Year M. Tech. Computer Engineering (2024 Pattern)

(with effect from 2024 – 25)

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Program Outcomes (POs)	
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report / document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

First Year M. Tech. Computer Engineering: Curriculum Structure (2024 Pattern)

Semester I												
Course Type	Course Code	Course Title	Teaching Scheme (Hours / week)		Examination / Evaluation Scheme and Marks					Credit Scheme		
			L	P	CIE	SEE	TW	OR	Total	L	P	Total
MCC	CSE01501	Mathematical Foundations in Computer Science	3	-	40	60	-	-	100	3	-	3
MCC	CSE01502	Software Engineering and Project Management	3	-	40	60	-	-	100	3	-	3
MEC	CSE10501	Elective – I	3	-	40	60	-	-	100	3	-	3
RM	RMT06501	Research Methodology	4	-	40	60	-	-	100	4	-	4
LP	CSE01503	Laboratory Practice – I	-	4	-	-		50	50	-	2	2
LP	CSE10502	Laboratory Practice– II	-	4	-	-	50	-	50	-	2	2
Seminar	CSE07501	Seminar – I	-	4	-	-	-	50	50	-	2	2
HR	HRT04501	Human Rights – I	-	2	-	-	25	-	25	-	1	1
Total Hours/week, Credits, Marks			13	14	160	240	75	100				
TOTAL			27 Hrs / week		400 Marks (TH)		175 Marks (PR)		575	13	7	20

List of Elective-I Courses		
MEC	CSE10501A	Artificial Intelligence
MEC	CSE10501B	Data Mining & Business Intelligence
MEC	CSE10501C	Network Computing

(Prof. Dr. Mrs. Kalyani R. Joshi)
Principal, PESMCOE

PES Modern College of Engg. Pune-05

(Dr. Mrs. Aparna P. Laturkar)
Dean Academics

First Year M. Tech. Computer Engineering: Curriculum Structure (2024 Pattern)

Semester II												
Course Type	Course Code	Course Title	Teaching Scheme (Hours / week)		Examination / Assessment Scheme and Marks					Credit Scheme		
			L	P	CIE	SEE	TW	OR	Total	L	P	Total
MCC	CSE01551	Algorithms and Complexity Theory	3	-	40	60	-	-	100	3	-	3
MCC	CSE01552	Internet of Things	3	-	40	60	-	-	100	3	-	3
CS	CYS06551	Introduction to Cyber Security	4	-	40	60	-	-	100	4	-	4
MEC	CSE10551	Elective – II	3	-	40	60	-	-	100	3	-	3
LP	CSE01553	Laboratory Practice – III	-	4	-	-	-	50	50	-	2	2
LP	CSE10552	Laboratory Practice – IV	-	4	-	-	50	-	50	-	2	2
Seminar	CSE07551	Seminar – II	-	4	-	-	-	50	50	-	2	2
HR	HRT04551	Human Rights-II	-	2	-	-	25	-	25	-	1	1
Total Hours/week, Credits, Marks			13	14	160	240	75	100	575	13	07	20
TOTAL			27 Hrs/ week		400 Marks (TH)		175 Marks (PR)					

List of Elective-II Courses		
MEC	CSE10551A	Machine Learning
MEC	CSE10551B	Big Data Analytics
MEC	CSE10551C	Applied Cryptography

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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE01501	**Course Name: Mathematical Foundations in Computer Science**

Semester: I

Teaching Scheme: **Lecture: 03 Hrs./ week**	**Credit:** **Theory: 03**	**Examination Scheme:** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To inculcate the mathematical fundamentals that are prerequisites for a variety of courses.
- To develop the understanding of the mathematical and logical basis to many modern techniques in information technology.
- To analyse various sampling and classification problems.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO501.1: Perform statistical analyses and solve problems related to basic probability.	Unit I
CO501.2: Analyze the basic notions of discrete and continuous probability distribution.	Unit II
CO501.3: Analyze the stochastic processes using Markov chains.	Unit III
CO501.4: Apply linear regression and correlation to solve problems in machine learning.	Unit IV

Course Contents

Unit I	**Statistics and Probability**	**10 Hours**

Statistics: Statistical inference, probability sampling procedures, collection of data, measures of location, measures of variability, discrete and continuous data, statistical modelling.
Probability: Probability axioms, conditional probability, independence of events, Bye's rule, Bernoulli trial.

Unit II	**Random Variables and Probability Distributions**	**10 Hours**

Random variable: Concept of a random, discrete probability distributions, continuous probability distributions, joint probability distributions, conditional distribution, and expectation.

Unit III	**Markov Chains**	**10 Hours**

Discrete-time Markov chains: Computation of *n*-step transition probabilities, state classification and limiting probabilities, distribution of times between state changes, Markov modulated Bernoulli process, The *M*/*G*/ 1 queuing system.
Continuous-time Markov chains: The birth–death process, non-birth–death processes, automated generation.

Unit IV	**Linear Regression and Correlation**	**10 Hours**

Linear regression: The simple linear regression model, least squares and the fitted model, properties of the least squares estimators, inferences concerning the regression coefficients, prediction, analysis-of-variance approach, test for linearity of regression, data plots and transformations, correlation.

Total Hours	**40**

Learning Resources
Text Books: 1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition Prentice Hall, ISBN: 9781292161365. 2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley, ISBN-13: 978-8126518531, ISBN: 9788120305083.
Reference Books: 1. M. Mitzenmacher and E. Upfal.," Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, ISBN-13: 978-1107154889.
MOOC Courses (Web Links): 1. Probability for Computer Science, Prof. Nitin Saxena, IIT Kanpur: https://nptel.ac.in/courses/106104233 2. Introduction to Probability Theory and Stochastic Processes, by Prof. S Dharmaraja, IIT Delhi: https://onlinecourses.nptel.ac.in/noc24_ma97/preview

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Course Code: CSE01502	**Course Name: Software Engineering and Project Management**

Semester: I

Teaching Scheme: **Lecture:03 Hrs./ week**	**Credit:** **Theory: 03**	**Examination Scheme:** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To apply a systematic, disciplined, quantifiable approach to the cost-effective development, operation, and maintenance of software systems to the satisfaction of their beneficiaries.
- To illustrate core project management techniques to manage project schedule, and resources with the aid of suitable project management tools.
- To analyse the various issues in each phase of project management and people management.
- To emphasize the importance of software project management skills to cater the changing industry needs and constraints across the advancing domains of computing.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO502.1: Analyze software requirements and formulate design solutions for a software.	Unit I
CO502.2: Apply agile process model for software development.	Unit II
CO502.3: Utilize project management methodologies based on project needs and constraints.	Unit III
CO502.4: Explain emerging trends in software engineering.	Unit IV

Course Contents

Unit I	**Software Process Framework**	**10 Hours**

Various software process models: Prescriptive, specialized, unified, personal and team process models.
Software requirement engineering: Requirements elicitation, specification, formal specifications, specification qualities, classification of specification styles, descriptive specifications: logic and algebraic specifications, operational specifications: DFD, FSM, Petri nets, validation, change.
System Modelling: Context, interaction, structural, behavioural models; unified modelling language.

Unit II	**Agile Development**	**10 Hours**

Agile methods, agile development techniques, extreme programming, various agile process models – ASD, SCRUM, DSDM, crystal, FDD, LSD, AM, AUP.

Unit III	**Software Project Management**	**10 Hours**

Project management spectrum; project metrics; project planning- estimation and scheduling- PERT, CPM, GERT, resource loading and resource levelling, types of project contracts from project management, agile planning, risk mitigation and monitoring, project control techniques, earned value project, change management, quality management, challenges in software project maintenance - code cloning: detection, classification, and refactoring.

Unit IV	Emerging Trends in Software Engineering and Project	10 Hours
Agents and mobile agents in software engineering, aspect-oriented programming, software process improvement and maturity models, distributed software engineering, service-oriented software engineering, real-time software engineering.		
	Total Hours	**40**

Learning Resources

Text Books:

1. Roger S. Pressman, Software Engineering: A practitioner's approach, TMH, Seventh Edition, ISBN 978–0–07–337597–7, ISBN 0–07–337597–7.
2. Ian Sommerville, Software Engineering, Addison-Wesley, Tenth Ed. ISBN-13: 978-0133943030 ISBN-10: 0133943038.

Reference Books:

1. Linda I. Shafer, Robert T. Futrell, Donald F. Shafer, "Quality Software Project Management", Prentice Hall, ISBN 0130912972.
2. Scott Berkun, "The Art of Project Management", O'Reilly, First Edition, ISBN 0596007868.
3. Orit Hazzan and Yael Dubinsky, "Agile software engineering", Springer –Verlag London, First Edition, ISBN 978-1-84800-199-2.

MOOC Courses (Web Links):

1. Software Engineering, By Prof. Rajib Mall, IIT Kharagpur: https://onlinecourses.nptel.ac.in/noc24_cs119/preview.

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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10501A	**Course Name: Elective I(A) - Artificial Intelligence**

Semester: I

Teaching Scheme: **Lecture: 03 Hrs./ week**	**Credit:** **Theory: 03**	**Examination Scheme:** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To comprehend the concept of Artificial Intelligence (AI) in the form of various Intellectual tasks.
- To analyse multi-agent environment in competitive environment.
- To plan problem solving in nondeterministic domain.
- To formulate plan of action to achieve goals as a critical part of Artificial Intelligence.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO503A.1: Explain the concept of artificial intelligence and intelligent agents.	Unit I
CO503A.2: Identify suitable Intelligent agents for various AI applications.	Unit II
CO503A.3: Utilize planning and knowledge representation framework for problem solving.	Unit III
CO503A.4: Formulate complex problems in uncertain domain.	Unit IV

Course Contents

Unit I	**Fundamentals of AI**	**10 Hours**

Introduction: What is artificial intelligence? The foundations of artificial intelligence, history of artificial intelligence.

Intelligent Agents: Agents and environments, good behaviour, the concept of rationality, the nature of environments, the structure of agents.

Solving Problems by Searching: Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Unit II	**Reasoning**	**10 Hours**

Logical Agents: Knowledge-based agents, WUMPUS world, logic, propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.

First-Order Logic: Representation revisited, syntax and semantics of first-order logic, using first-order logic, knowledge engineering in first-order logic.

Inference in First-Order Logic: Propositional vs. first-order inference, unification and lifting, forward chaining, backward chaining.

Unit III	**Planning and Knowledge Representation**	**10 Hours**

Planning: Classical planning, algorithms for planning as state-space search, planning graphs, time, schedules, and resources, hierarchical planning, planning, and acting in nondeterministic domains, multiagent planning.

Knowledge Representation: Ontological engineering, categories and objects, events, mental events and mental objects, reasoning systems for categories, reasoning with default information, the internet shopping world.

Prolog: Facts, Rules, Clauses, Lists, Logical Operators, Prolog Program for Relations, List Operations, Prolog for artificial intelligence.

Unit IV	**Uncertain Reasoning**	**10 Hours**

Quantifying Uncertainty: Acting under uncertainty, basic probability notation, inference using full joint distributions, independence, Bayes' rule, and its use, the Wumpus world revisited.

Probabilistic Reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, time and uncertainty, inference in temporal models, hidden Markov models.

Total Hours	**40**

Learning Resources

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third edition, Pearson, 2003, ISBN :10: 0136042597.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013, ISBN: 978-1-25-902998-1.
3. Bratko I.," Prolog Programming for Artificial Intelligence / Ivan Bratko.", 3rd ed. Addison Wesley; 2001, ISBN-10: 0201403757.

Reference Books:

1. Elaine Rich, Kevin Knight, and Nair, "Artificial Intelligence", TMH, ISBN-978-0-07-008770-5.
2. Patrick Henry Winston, "Artificial Intelligence", Addison-Wesley Publishing Company, ISBN: 0-201-53377-4.
3. W.F. Clocksin and Mellish, "Programming in PROLOG", Narosa Publishing House, 3rd edition, 2001, ISBN-13: 978-3540175391.

MOOC Courses (Web Links):

1. Fundamentals of Artificial intelligence, By Prof. Shyamanta M. Hazarika, IIT Guwahati: https://onlinecourses.nptel.ac.in/noc24_ge47/preview

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Course Code: CSE10501B	**Course Name: Elective I(B) - Data Mining and Business Intelligence**

Semester: I

Teaching Scheme: **Lecture: 03 Hrs./ week**	**Credit:** **Theory: 03**	**Examination Scheme:** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To elaborate different data mining techniques for classification.
- To illustrate different algorithms for clustering applications.
- To identify advanced data mining concepts to solve real world problems.
- To describe the concepts and components of business intelligence.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO503B.1: Apply association rules mining and classification algorithms to solve real world problems.	Unit I
CO503B.2: Compare and contrast different clustering algorithms.	Unit II
CO503B.3: Illustrate the various advanced Data Mining Concepts.	Unit III
CO503B.4: Identify role of business intelligence in various applications.	Unit IV

Course Contents

Unit I	**Data Mining Techniques**	**10 Hours**

Association Rule Mining: Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules. Pattern Evaluation Measures.

Advanced Classification Techniques: Bayesian Belief Networks-Concepts and Mechanisms, Training Bayesian Belief Networks, Support Vector Machines.

Classification Using Frequent Patterns: Associative Classification, Discriminative Frequent Pattern–Based Classification, k-Nearest-Neighbour Classifiers.

Unit II	**Cluster Analysis**	**10 Hours**

Cluster analysis: Partitioning methods, hierarchical methods, density-based methods, grid-based methods, clustering graph and network data, clustering with constrains, evaluation of clustering outliers and analysis, outlier detection methods, scalable clustering algorithms.

Unit III	**Advanced Data Mining Concepts**	**10 Hours**

Mining Sequence Data: Time-Series, spatial data mining, temporal data mining.

Mining Graphs and Networks: Mining graph data, Mining network data.

Mining Other Kinds of Data: Mining text data, Mining web data, Mining multimedia data, Visual and Audio Data Mining.

Unit IV	Business Intelligence	10 Hours
Introduction: BI, its components & architecture, previewing the future of BI, data, information and knowledge, The role of mathematical models, BI architectures, Ethics and BI **Reporting Authoring: Building** reports with relational vs Multidimensional data models; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc. **Applications:** BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production.		
	Total Hours	**40**

Learning Resources

Text Books:

1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. Parag Kulkarni, "Reinforcement and Systemic Machine Learning for Decision Making" by Wiley-IEEE Press, ISBN: 978-0-470-91999-6
3. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer,2015, ISBN-3662465310, 9783662465318

Reference Books:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More", Shroff Publishers, 2nd Edition, ISBN: 9780596006068
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Start-ups: Finding connections on the social web", Shroff Publishers, ISBN: 10: 1449306462

MOOC Courses (Web Links):

1. Data Mining, By Prof. Pabitra Mitra, IIT Kharagpur: https://onlinecourses.nptel.ac.in/noc21_cs06/preview

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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10501C	**Course Name: Elective I(C) - Network Computing**	
Semester: I		
Teaching Scheme **Lecture:03 Hrs./ week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To explain basic computer networking principles, architecture, and protocols.
- To examine the applications and requirements of Ubiquitous Computing, including smart devices and services, as well as smart mobiles, cards, and device networks.
- To utilize a strong understanding of the principles and practices of Internet Protocol networking.
- To analyse the latest technological advancements and innovations in the field of computer networking.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO503C.1: Explain fundamental concepts in computer networks, including protocols, architectures, and their practical applications.	Unit I
CO503C.2: Design ubiquitous computing applications with advanced network services.	Unit II
CO503C.3: Analyze the working of IP addressing and sub-netting.	Unit III
CO503C.4: Identify emerging trends in computer networks.	Unit IV

Course Contents

Unit I	**Introduction to Computer Networks**	**10 Hours**

Introduction to Computer Networks: Types of Networks, Network design issues. Network design tools, Advanced network architectures.

Network Architecture: Reliable data delivery, Routing and forwarding, resource allocation, Mobility, Networked applications, Data in support of network design, General Principles of Network Design, network characteristics.

Unit II	**Advanced Network Services and Ubiquitous Computing**	**10 Hours**

Quality of Service in Networks: Application and QoS, QoS mechanisms, Queue management Algorithms, Feedback, Resource reservations, traffic engineering.

Ubiquitous Computing: Applications and Requirements, Smart Devices and Services, Smart Mobiles, Cards and Device Networks.

Unit III	**Introduction to IP Networking Fundamentals**	**10 Hours**

IP Networking Fundamentals: IP packet format, IP routing method, routing using masks, fragmentation of IP packet, IPv6.

Advanced features of IP routers: Filtering, IP QoS, NAT, routers.

Unit IV	**Emerging Trends and Technologies in Computer Networks**	**10 Hours**

Advanced topics in computer networks: Wireless and sensor networks, multimedia networking, content distribution networks.

Network simulator: Domain-specific networks, Next generation networks, Cyber physical systems.

	Total Hours	**40**

Learning Resources

Text Books:

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", ISBN- 978-013212695.
2. Stefan Poslad, "Ubiquitous Computing", Wiley India Edition, ISBN: -978-8126527335.
3. Behrouz A. Forouzan," Data Communications and Networking", ISBN-978-0070634145.
4. Olivier Bonaventure, "Computer Networking: Principles, Protocols and Practice", ISBN- 978-1365185830.
5. Babak Akhgar and Hamid R. Arabnia," Emerging Trends in ICT Security", ISBN-978-0124114746.

Reference Books:

1. Kershenbaum A, "Telecommunication Network Design Algorithms", Tata McGraw Hill ISBN: - 0-07-112518-3.
2. Natalia Olifer, Victor Olifer, "Computer Networks, Principles, Technologies and Protocols for network design", Wiley India ISBN: - 978-0470869826.

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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: RMT06501	**Course Name: Research Methodology**

Semester: I

Teaching Scheme: **Lecture: 04 Hrs./ week**	**Credit** **Theory:** **04**	**Examination Scheme:** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To understand the fundamental concepts and objectives of research.
- To develop the skills necessary for conducting effective literature reviews and synthesizing information ethically.
- To demonstrate proficiency in developing research proposals and understand the principles of research design.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO504.1: Explain the fundamental concepts and role of literature review of research methodology	Unit I
CO504.2: Interpret the fundamentals of designing sample surveys.	Unit II
CO504.3: Apply various data analysis techniques in research.	Unit III
CO504.4: Demonstrate Ethical Considerations in Research Methodology.	Unit IV

Course Contents

Unit I	**Introduction to Research Methodology and Design**	**10 Hours**

Introduction and meaning of research, types of research, research methods vs. methodology, significance and process of research, criteria of good research.

Research Problem Definition: Selecting the problem, defining the problem.

Literature Review: Process of reviewing literature- selecting, and reviewing existing literature, and developing theoretical and conceptual frameworks, writing the literature review

Hypothesis in Research: Definition and characteristics, testing hypotheses, types of hypotheses.

Research Design: Meaning and features of a research design, key concepts in research design, types of research design- exploratory, descriptive, and experimental.

Unit II	**Sampling Design and Data Collection**	**10 Hours**

Design of Sample Surveys: Introduction, sample design, sampling and non-sampling errors, sample survey versus census survey, types of sampling designs.

Measurement and Scaling: Qualitative and quantitative data, classifications of measurement scales, goodness of measurement scales, sources of error in measurement, techniques of developing measurement tools, scaling, Scale classification bases, scaling techniques, multidimensional scaling, deciding the scale.

Data Collection: Introduction, experimental and surveys, collection of primary data and secondary data, selection of appropriate method for data collection, case study method.

Exemplar/Case Study: Draft a questionnaire to find online social sites of top 10 business practices.

Unit III	**Data Analysis and Interpretation**	**10 Hours**

Data Analysis: Types of analysis, descriptive statistics- measure of central tendency, dispersion, skewness, measures of relationship.

Interpretation: Meaning, need, techniques, and precautions in interpreting research results.

Linear Regression Analysis: Definition of regression, purpose and use, linear regression; interpretation of regression co-efficient, regression analysis, curve fitting and developing correlation, parameter estimation, multivariate statistics, moments, and response curve methods.

Unit IV	**Report Writing, and Ethical Considerations in Research**	**10 Hours**

Report Writing: Significance, steps, types of reports, oral presentation, writing mechanics, **Ethical Considerations in Research Design**: **Intellectual Property Rights (IPR)** - Introduction to IPR, publications & patents, **patenting Process,** international scenario, patents & copyrights. Exemplar/Case Study: Draft the documentation required for e-filing of copyright and intellectual property rights (IPR). Exemplar/Case Study-Exploring thesis writing, focusing on structure, style guidelines, and cautious interpretation of findings.

Total Hrs.	**40 Hours**

Learning Resources

Text Books:

1. C. R. Kothari and Gaurav Garg, "Research Methodology Methods and Techniques", 4th Edition, New Age International Publishers, 2019
2. Ranjit Kumar, "Research Methodology": A Step-by-Step Guide for Beginners, 3rd Edition, Sage Publications, 2011
3. T. Ramappa, "Intellectual Property Rights under WTO: Tasks before India", Wheeler Publications, 2010
4. Debora J. Halbert, "Resisting Intellectual Property", Routledge, Taylor & Francis Group, 2005

Reference Books:

1. William G. Zikmund, Barry J. Babin, John C. Carr, and Mitch Griffin, "Business Research Methods", Cengage Learning, 2013
2. Royce Singleton and Bruce C. Straits, "Approaches to Social Research", Oxford University Press, 2017

MOOC Courses (Web Links):

1. https://onlinecourses.nptel.ac.in/noc21_ge03/preview

PES's Modern College of Engineering
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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE01503	**Course Name: Laboratory Practice I**	
Semester: I		
Teaching Scheme **Practical: 04 Hrs./ week**	**Credit** **Practical: 02**	**Examination Scheme** **Oral (OR): 50 Marks**

Course Objectives:

- To apply mathematical concepts in computer science for solving the problems.
- To apply a systematic, disciplined, quantifiable approach to the cost-effective development, operation, and maintenance of software systems to the satisfaction of their beneficiaries.

Course Outcomes:

On completion of the course, the student will be able to,

CO505.1: Implement the program to solve the problems using probability.

CO505.2: Use probabilistic models to solve the real-world problems.

CO505.3: Identify the resources required for a software project and to produce a work plan and resource schedule

CO505.4: Decide and justify the use of most appropriate software process model for a given project definition.

Guidelines for Laboratory Conduction

A minimum of six experiments should be performed under Lab Practice – II i.e. 3 from MCC-I and 3 from MCC-II subjects. Mathematical Foundations in Computer Science (MCC-I) lab assignments are expected to be implemented using any programming language. Software Engineering and Project Management (MCC-II) lab assignments are expected to be implemented using MS Project/ Gantt Project/Primavera/any free open-source tool. A list of experiments that may be performed under various subjects of semester - I is given below as a guideline.

Sr. No.	**List of Laboratory Assignments**	**CO Mapping**
	Mathematical Foundations in Computer Science (CSE01501)	
1.	Given a 6-sided fair dice, compute the mean and variance for the probability distribution that models said dice. Plot the probability mass function for the sum of two 6-sided fair dice when you throw it twice using any programming language.	**CO505.1**
2.	Generate data that follows continuous probability distributions. Implement a Naive Bayes classifier for continuous data using any programming language.	**CO505.1**
3.	Implement Hidden Markov Chain for generation of the text.	**CO505.2**
4.	Build a simple linear regression model to predict sales based on TV marketing expenses. Dataset Link - https://www.kaggle.com/datasets/devzohaib/tvmarketingcsv?select=tvmarketing.csv	**CO505.2**
	Software Engineering and Project Management (CSE01502)	
1.	Consider a Problem statement for software development and Prepare SRS for the same.	**CO505.3**
2.	Design the Software Architecture for software to be developed for selected problem Statement using appropriate Architectural Style	**CO505.3**
3.	Prepare the Work breakdown structure for the software to be developed for selected problem Statement and estimate resources required to work on all activities of WBS.	**CO505.4**

4.	Case Studies/ Problems of Project Planning using CPM and PERT	**CO505.4**

Learning Resources

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition Prentice Hall, ISBN: 9781292161365.
2. Roger S. Pressman, "Software Engineering: A practitioner's approach", TMH, Seventh Edition, ISBN 978–0–07–337597–7, ISBN 0–07–337597–7.
3. Ian Sommerville, "Software Engineering", Addison-Wesley, Tenth Ed. ISBN-13: 978-0133943030 ISBN-10: 0133943038.

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10502	**Course Name: Laboratory Practice II**
Semester: I	

Teaching Scheme	**Credit**	**Examination Scheme**
Practical: 04 Hrs./ week	**Practical: 02**	**Term work (TW): 50 Marks**

Course Objectives:

- To inculcate different tools and technologies to solve real life problems.
- To understand applications development using techniques of artificial intelligence, data mining and network computing.
- To understand the fundamental concepts and objectives of research.
- To develop the skills necessary for conducting effective literature reviews and synthesizing information ethically.
- To demonstrate proficiency in developing research proposals and understand the principles of research design.

Course Outcomes:

On completion of the course, the student will be able to,

CO506.1: Use different tools and technologies to solve real life problems.

CO506.2: Develop applications using techniques of artificial intelligence, data mining and network computing.

CO506.3: Demonstrate comprehension of research proposal components.

CO506.4: Develop proficiency in summarizing technical papers.

Guidelines for Laboratory Conduction

A minimum of six experiments should be performed under Lab Practice – II i.e. 3 from MEC-I and 3 from RM subjects. A list of experiments that may be performed under various subjects of semester - I is given below as a guideline.

Sr. No.	**List of Laboratory Assignments**	**CO Mapping**
	Elective -I- Artificial Intelligence (CSE10503A)	
1.	Implement A star Algorithm for any game search problem.	**CO506.1**
2.	Implement any one of the following expert systems in prolog. a) Medical Diagnosis b) Financial Investment Advisor	**CO506.1**
3.	Define the operators for controlling domestic robot; use these operators to plan an activity to be executed by the robot. For example, transferring two/three objects one over the other from one place to another. Prepare a plan and implement the solution in prolog.	**CO506.2**
4.	Implementation of Unification algorithm.	**CO506.2**
	Elective -I- Data Mining & Business Intelligence (CSE10503B)	
1.	Consider a suitable dataset. For clustering of data instances in different groups, apply different clustering algorithms. Visualize the clusters using suitable tool.	**CO506.1**
2.	Implement the Apriori and FPGrowth algorithm. Build your own association task. Design the task for generating association rules based on minsup and minconf. Compare and analyse the performance of Apriori and FPGrowth	**CO506.1**

	algorithms.	
3.	Implement an application for the share marketing sector which will help customers to suggest whether to buy or sell the shares for a particular company/organization. Apply classification algorithm to Share purchase dataset using any suitable analytical tool such as KNIME, WEKA, R	**CO506.2**
4.	A supermarket has number of items for sale. Build a required Database to develop an application using BI tool for considering one aspect of growth to the business Such as organization of products based on demand and patterns use R Programming or other equivalent latest tools.	**CO506.2**
Elective -I- Network Computing (CSE10503C)		
1.	Create a network design using a specified tool and simulate network traffic. Tools to be used: Cisco Packet Tracer, NetSim, or GNS3.	**CO506.1**
2.	Set up a network that uses feedback mechanisms (e.g., TCP congestion control) to manage QoS. Tools to be used: Wireshark, netcat.	**CO506.1**
3.	Capture and analyse IP packets using a network analyser tool. Tools to be used: Wireshark.	**CO506.2**
4.	Set up a network to stream video and audio, implementing protocols such as RTP (Real-time Transport Protocol) and RTSP (Real-Time Streaming Protocol). Tools to be used: VLC Media Player, Wireshark, Cisco Packet Tracer or GNS3.	**CO506.2**
Research Methodology (RMT06504)		
1.	Study of various research proposals.	**CO506.3**
2.	Summarize technical papers.	**CO506.4**
3.	Design and analyse a sample survey.	**CO506.4**
4.	Analyse data and testing of hypotheses to derive meaningful conclusions.	**CO506.4**
5.	Explore report writing process using Latex.	**CO506.3**
6.	Elaborating Intellectual Property process	**CO506.4**

Learning Resources

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition Prentice Hall, ISBN: 9781292161365.
2. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN:9780123814791, 9780123814807.
3. Natalia Olifer, Victor Olifer, "Computer Networks, Principles, Technologies and Protocols for network design", Wiley India ISBN: - 978-0470869826.
4. C. R. Kothari and Gaurav Garg, "Research Methodology Methods and Techniques", 4th Edition, New Age International Publishers, 2019
5. Ranjit Kumar, "Research Methodology": A Step-by-Step Guide for Beginners, 3rd Edition, Sage Publications, 2011
6. T. Ramappa, "Intellectual Property Rights under WTO: Tasks before India", Wheeler Publications, 2010.
7. Debora J. Halbert, "Resisting Intellectual Property", Routledge, Taylor & Francis Group, 2005

MOOC Courses (Web Links):

1. NPTEL, IIT Patna, Dr. Rajiv Misra, "Big Data Computing", https://nptel.ac.in/courses/106104189
2. Introduction to Research, By Prof. Prathap Haridoss, IIT Madras, https://onlinecourses.nptel.ac.in/noc21_ge03/preview

P.E.S. Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE07501		**Course Name: Seminar I**
Semester: I		
Teaching Scheme: **Lecture: 04 Hrs./ week**	**Credit:** **Practical: 02**	**Examination Scheme:** **Oral Examination (Presentation): 50 Marks**

Course Objectives:

- To explore the basic principles of communication and active, empathetic listening, speaking, and writing techniques.
- To discuss current, real-world issues, new technologies, research, products, algorithms, and services.

Course Outcomes:

On completion of the course, student will be able to,

CO507.1: Use multiple thinking strategies to examine real-world issues and explore creative avenues of expression.

CO507.2: Explain intended meaning using verbal and nonverbal methods of communication.

CO507.3: Discuss through independent learning in computer science and technology and the ability to integrate information across.

CO507.4: Organize the presentation with professional technical presentation skills.

Guidelines for Students:

The student shall have to deliver the seminar I on a topic approved by guide and authorities.
It is recommended that seminar shall be on the topic relevant to latest trends in the field of concerned branch, preferably on the topic of specialization based on the electives selected or domain of interest. It is appreciated and strongly recommended that the student will select the domain of his/her dissertation and identify the literature confined to the domain. Thorough literature study based on the broad identified topic has to be carried out. This practice will eventually lead to convergence of the efforts for the dissertation in Semester III and IV.
The relevant literature then be explored as state-of-the-art, exotic, recent technological advancement, future trend, application, and research & innovation. Multidisciplinary topics are encouraged. The student shall submit the duly approved and certified seminar report in standard format, for satisfactory completion of the work by the concerned Guide and head of the department/institute.
The student will be assessed based on his/her presentation and preparations by the panel of examiners. The students are expected to validate their study undertaken by publishing it at standard platforms.
The student has to exhibit the continuous progress through regular reporting and presentations and proper documentation of the frequency of the activities in the sole discretion of the PG coordination.
The continuous assessment of the progress needs to be documented unambiguously. For standardization and documentation, follow the guidelines circulated / as in the seminar logbook approved by the Board of Studies.

Learning Resources

Reference Books:

1. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435.
2. Johnson-Sheehan, Richard, "Technical Communication", Longman. ISBN 0-321-11764-6.

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: HRT04501	**Course Name: Human Rights-I**	
Semester: I		
Teaching Scheme: **Practical: 02 Hrs./ week**	**Credit:** **Practical: 01**	**Examination Scheme:** **Term work (TW): 25 Marks**

Course Objectives:

- To understand the basics of human values and rights.
- To understand the brief history of human rights in international and national perspective.
- To acquaint with terminology of various legal instruments to protect Human Rights.
- To know the effort taken by UN for protecting Human Rights.

Course Outcomes:

On completion of the course, the student will be able to,

CO508.1: Recall the basics of human values.

CO508.2: Compare the concept of rights and duties.

CO508.3: Identify the terminology of various legal instruments.

CO508.4: Analyze the efforts taken by United Nations for protecting Human Rights.

Sr. No.	List of content to be covered in assignments or activity	CO Mapping
1.	**Case Study Analysis of** human rights from national and international courts to understand the application and impact of human rights laws.	**CO508.1**
2.	**Debate** on contemporary human rights issues, such as freedom of speech vs. hate speech or privacy vs. security.	**CO508.1**
3.	**Role-Playing**: Simulate United Nations Human Rights Council meetings where students represent different countries or NGOs and debate human rights issues.	**CO508.2**
4.	**Report Review**: students have to research a report on recent human rights violations in different parts of the world and review the report to highlighting the involved rights and the response of the community.	**CO508.2**
5.	**Role Play** to explore the legal aspects of human rights violations and the role of different legal instruments.	**CO508.3**
6.	**Article Writing** on topics like the significance of human dignity, the importance of diversity, or the relationship between rights and duties.	**CO508.3**
7.	**Analysing RTI or RTE Act to** understand the importance and provisions related to rights.	**CO508.4**
8.	**Use simulation games** to teach about the various types of legal instruments, such as treaties and protocols, and their real-world applications.	**CO508.4**
9.	Facilitate a **group discussion** on ethical and moral principles, discussing how they intersect with legal rights and duties, have students analyse different types of legal instruments, such as covenants and treaties, to understand their binding nature and implications.	**CO508.4**
10.	**Article Review on** role of UN in protecting human rights.	**CO508.3**

Learning Resources

Text Books:

1. Rhona K. M. Smith, Textbook on International Human Rights, 7th Edition, Oxford University Press, 2016, ISBN: 9780198746218

Reference Books:

1. H.O. Agarwal, Human Rights, 21st Edition, Central Law Publications, 2020, ISBN: 978-9388267915.

MOOC Courses (Web Links):

1. https://www.humanrights.com/course/
2. https://academy.amnesty.org/learn/course/external/view/elearning/115/an-introduction-to-human-rights

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE01551	**Course Name: Algorithm and Complexity Theory**
Semester: II	

Teaching Scheme **Lecture: 03 Hrs./ week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To analyse the effectiveness of algorithms using dynamic programming and greedy strategy.
- To utilize the graph and geometric algorithms to solve the problems.
- To apply the approximation algorithm to solve problems.
- To use algorithms for solving linear programming problems.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO509.1: Design solution for a problem using greedy, dynamic programming and randomized strategies.	Unit I
CO509.2: Utilize graph and geometric algorithms to solve problems.	Unit II
CO509.3: Analyze the algorithms with respect to the NP-completeness.	Unit III
CO509.4: Employ the linear programming and numerical algorithms to solve the problems.	Unit IV

Course Contents

Unit I	**Advanced Algorithms and Randomized Algorithms**	**10 Hours**

Dynamic Programming: Elements of dynamic programming, longest common subsequence, optimal binary search trees. **Greedy strategy:** Elements of the greedy strategy, Huffman codes, matroids and greedy methods, amortized analysis.

Randomized algorithms: Randomization in algorithms design, probability aspects for randomization, randomized quick-sort, Karger's min-cut, median finding, Miller-Rabin primality test. **Case study:** Amortized weight-balanced trees.

Unit II	**Graph and Geometric Algorithms**	**10 Hours**

Graph algorithms: Breadth-first search, depth-first search, Dijkstra's algorithm, Bellman-Ford algorithm, Ford-Fulkerson method, Hungarian Algorithm.

Geometric algorithms: Maximum Flows: Augmenting Paths and Push-Relabel Methods. Minimum Cost Flows. Bipartite Matching. Convex hulls, Closest pair of points, Voronoi diagrams.

Unit III	**NP-Completeness and Approximation Algorithms**	**10 Hours**

NP-Completeness: Polynomial time, Polynomial-time verification, Cook Levin theorem, NP-completeness and reducibility, NP-completeness proofs, NP-complete problems.

Approximation algorithms: The vertex-cover problem, the traveling-salesman problem, the set-covering problem, randomization and linear programming, the subset-sum problem.

Unit IV	**Linear Programming and Numerical Algorithms**	**10 Hours**

Linear Programming: Standard and slack forms, formulating problems as linear programs, simplex algorithm, duality, initial basic feasible solution.

Numerical Algorithms: Solving modular linear equations, Chinese remainder theorem, powers of an element, primality testing, and integer factorization.

	Total Hours	**40**

Learning Resources

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, MIT Press, ISBN: 978-0-262-04630-5.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2008, ISBN: 9788173716126
3. Motwani R and Raghavan P, Randomized Algorithms, 1st Edition, Cambridge University Press (2004), ISBN: 9780511814075

Reference Books:

1. Merc De-Berg et al. Computational Geometry: Algorithms and Applications, 3rd Edition, Springer, ISBN: 978-3-540-77974-2.
2. Vijay Vazirani, Approximation Algorithms, Springer.ISBN-13978-3642084690.
3. Algorithmics: Theory and Practice by Brassard and Bratley, Prentice Hall, ISBN:9780130232434, 0130232432.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", ISBN: 978-81-265-0986-7

MOOC Courses (Web Links):

1. NPTEL Course, "Selected Topics in Algorithms", Prof. Palash Dey, IIT Kharagpur: https://archive.nptel.ac.in/courses/106/105/106105242/
2. NPTEL Course, "Randomized Algorithms", Prof. Benny George K, IIT Guwahati: https://archive.nptel.ac.in/courses/106/103/106103187/
3. NPTEL Course, "Computer Algorithms - 2", Prof. Shashank K. Mehta, IIT Kanpur: https://archive.nptel.ac.in/courses/106/104/106104019/

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. Computer Engineering (2024 Pattern)

Course Code: CSE01552	**Course Name: Internet of Things**	
Semester: II		
Teaching Scheme **Lecture: 03 Hrs./week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To study different IoT Protocols and its use in various applications.
- To analyse the need of IoT Security.
- To Comprehend Industrial IoT.
- To understand use of IIoT in building smart city applications.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO510.1: Select appropriate IoT protocols and software to build schematic for IoT solutions.	Unit I
CO510.2: Realize IoT security requirements and management tools.	Unit II
CO510.3: Apply key skills employed in the IIoT.	Unit III
CO510.4: Identify different IoT smart cities applications with IoT architecture.	Unit IV

Course Contents

Unit I	**IoT Fundamentals and Architecture**	**10 Hours**

Evolution of IoT: Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, sub netting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer.

IoT protocols: MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols.

IoT application and its Variants: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0, IoT standards.

Unit II	**IoT Security**	**10 Hours**

Securing the Internet of Things: Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications.

Security Architecture in the Internet of Things: Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Attacks Specific to IoT.

Security and Vulnerability in the Internet of Things: Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

Unit III	**Industrial Internet of Things (IIOT)**	**10 Hours**

Introduction IIoT: Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, placement of IoT devices, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Embedded systems in the Automotive and Transportation market segment.

IIoT Methodology: Top operating systems used in IIoT deployments, Networking and wireless communication protocols used in IIoT deployments. Smart Remote Monitoring Unit, components of monitoring system, control and management, Wireless Sensor Network (WSN).

Unit IV	Industrial IoT for Smart Cities	10 Hours

Introduction & Industry 4.0: IoT in smart city& their distinctive advantages like smart environment, smart streetlight, smart water management, Smart Road & Traffic, Smart Parking & waste management. The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

Interoperability for Smart City IoT systems: Wireless communication modules and topology such as Zigbee, Bluetooth, GSM module, Wi-fi module &Things speak (IoT Platform) cloud, Ethernet, M2M Wireless Sensor Network (WSN).

Total Hrs.	40

Learning Resources

Text Books:

1. Kamal, R.," Internet of Things – Architecture and Design Principles," 1st Edition, McGraw Hill,2017.
2. "Securing the Internet of Things", Shancang Li, Li Da Xu, Syngress, Elsevier, 2017
3. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
4. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist, Apress, 2016

Reference Books:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.
3. Designing, Developing, and Facilitating Smart Cities Urban Design to IoT Solutions", Vangelis Angelakis Springer, 2019

MOOC Courses (Web Links):

1. NPTEL Course, "Introduction to Industry 4.0 And Industrial Internet of Things", By Prof. Sudip Misra, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc22_cs52/preview

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.0: First Year M. Tech. (2024 Pattern) (2024 Pattern)

Course Code: CYS06551	**Course Name: Introduction to Cyber Security**

Semester: II

Teaching Scheme **Lecture: 04 Hrs./ week**	**Credit** **Theory: 04**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To protect and defend computer systems and networks.
- To plan, implement and monitor cyber security mechanisms to ensure protection of Information Technology Assets.
- To identify, analyse and remediate computer security breaches.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO511.1: Classify various cybercrimes using IT Act 2000.	Unit I
CO511.2: Make use of cyber security tools, methods, and cryptography techniques.	Unit II
CO511.3: Apply different processes for cyber forensics.	Unit III
CO511.4: Explain the diverse legal, social, ethical viewpoint of cybercrimes.	Unit IV

Course Contents

Unit I	**Introduction to Cyber Crimes**	**10 Hours**

Introduction to Cyber Crimes: Cyber-crime definition and origins of the world, cybercrime and information security, classification of cybercrimes, cyber defamation, web jacking, forgery, pornographic offences, software piracy, credit card frauds, identity theft, cybercrime and the IT Act 2000, a global perspective on cybercrimes.

Unit II	**Basic Cryptography, Tools and Methods used in Cybercrimes**	**10 Hours**

Introduction to Cryptography: Data encryption standards, other classical ciphers, public key cryptography, private key cryptography, cryptographic checksums, applications of cryptography.
Introduction to tools and Methods: Proxy servers, phishing, password cracking, key loggers and spywares, virus and worms, Trojan horses and backdoors, steganography, DoS (Denial of Service) and DDoS (Distributed Denial of Service) attacks, SQL injection, buffer overflow, attacks on wireless networks, identity theft.

Unit III	**Computer Forensics**	**10 Hours**

Introduction to Computer Forensics: Digital forensics science, the need for computer forensics, cyber forensics and digital evidence, digital forensics life cycle, chain of custody concept, network forensics, approaching computer forensics investigation, forensics and social networking sites, challenges in computer forensics.

Unit IV	**Legal, Social, Ethical and Psychological Aspects of Cyber Crimes**	**10 Hours**

Introduction to Legal perspective: Cybercrime and legal landscape around the world, need of cyber laws, The Indian context of cyber laws, The Indian IT Act, challenges to Indian law, cybercrime scenario in India, digital signatures and the Indian IT Act, amendments to the Indian IT Act, cybercrimes, and punishments.
Introduction to Intellectual property related crimes: copyright, patent, trademarks, trade secrets, trade name, domain name, ethical dimension of cybercrimes, the psychology, mindset and skills of hackers and other cyber criminals, sociology of cyber criminals, information warfare.

	Total Hours	**40 Hours**

Learning Resources

Text Books:

1. Nina Godbole," Cyber Security: Understanding cyber-crimes, Computer Forensics and Legal perspective" WILEY India Pvt. Ltd, ISBN: 978-81-265-2179-1.
2. Matt Bishop, "Introduction to Computer Security", Pearson Education ISBN: 978-81-775-8425-7.

Reference Books:

1. Dr. Jyoti Rattan," Cyber Laws and Information Technology" by Bharat law House Pvt. Ltd. ISBN: 978-93-5139-470-9.
2. Ankit Fadia, "An unofficial guide to Ethical Hacking", by Macmillan publishers India Ltd. ISBN:13:978-1403-92964-8.
3. M.V. Arun Kumar, "Network Security", University Science Press", ISBN:978-93-80856-72-8.
4. Justice Yatindra Singh, "Cyber Laws", Universal law publishing company, ISBN: 978-81-7534-831-8.

MOOC Courses:

1. Ethical Hacking by Prof. Indranil Sen Gupta- IIT Kharagpur: https://nptel.ac.in/courses/106105217
2. Cyber Security and Privacy by Prof. Saji K Mathew –IIT Madras: https://onlinecourses.nptel.ac.in/noc23_cs127/preview

PES's Modern College of Engineering
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)
Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10551A	**Course Name: Elective II(A) - Machine Learning**
Semester: II	

Teaching Scheme **Lecture: 03 Hrs./ week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To acquaint with the basic concepts and techniques of Machine Learning.
- To study various data pre-processing techniques.
- To study various optimization techniques for regression.
- To learn nature of the problem and apply Supervised, Unsupervised machine learning techniques.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO512A.1: Identify the needs and challenges of machine learning for real world problems.	Unit I
CO512A.2: Apply data pre-processing techniques to prepare training data set for machine learning.	Unit II
CO512A.3: Analyse the data and apply regression techniques for real world applications.	Unit III
CO512A.4: Implement supervised and unsupervised machine learning algorithms.	Unit IV

Course Contents

Unit I	**Machine Learning Concepts**	**10 Hours**

Introduction to Machine Learning, Machine Learning applications, Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models, Predictive and descriptive learning, Classification concepts, Binary and multi-class classification

Unit II	**Learning Theory**	**10 Hours**

Feature Extraction, Feature Construction and Transformation, Feature Selection, Dimensionality Reduction: Subset selection, the Curse of dimensionality, Principle Components analysis, Independent Component analysis, Factor analysis, Multidimensional scaling, Linear discriminant analysis, Bias/Variance trade-off, Union and Chernoff / Hoeffding bounds, VC dimension, Probably Approximately Correct (PAC) learning, Concept learning, the hypothesis space, Least general generalization, Internal disjunction, Paths through the hypothesis space, model Evaluation and selection

Unit III	**Linear Methods for Regression**	**10 Hours**

Introduction, Linear Regression Models and Least Squares, Subset Selection, Shrinkage Methods-Ridge Regression, Lasso Regression, Least Angle Regression, Methods Using Derived Input Directions-Principal Components Regression, Partial Least Squares, A Comparison of the Selection and Shrinkage Methods , Multiple Outcome Shrinkage and Selection, More on the Lasso and Related Path Algorithms, Logistic Regression-Fitting Logistic Regression Models, Quadratic Approximations and Inference, L1 Regularized Logistic Regression.

Unit IV	**Logical, Grouping and Grading Models**	**10 Hours**

Decision Tree Representation, Alternative measures for selecting attributes, Decision tree algorithm: ID3, Minimum Description length decision trees, Ranking and probability estimation trees, Regression trees, Clustering trees, Rule learning for subgroup discovery, Association rule mining, Distance based clustering-K-means algorithm, choosing number of clusters, Clustering around medoids – silhouettes, Hierarchical clustering, Ensemble methods: Bagging and Boosting	
Total Hours	**40**

Learning Resources

Text Books:

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that make sense of data", Cambridge University Press, 1st Edition, 2012, ISBN No.: 978-1-316-50611-0.
2. Ethem Alpaydin, "Introduction to Machine Learning", PHI, 2nd edition, 2013, 978-0-262-01243-0.

Reference Books:

1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997, ISBN: 0-07-042807-7.
2. Kevin Murphy, "Machine Learning: A Probabilistic Approach", MIT Press, 1st Edition, 2012, ISBN No.: 978-0262-30616-4.

PES's Modern College of Engineering
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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10551B	**Course Name: Elective II(B) - Big Data Analytics**	
Semester: II		
Teaching Scheme **Lecture: 03 Hrs./week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To acquire the basic concepts of big data analytics.
- To elaborate Hadoop ecosystem for big data analysis.
- To explain the concept of NoSQL database system.
- To develop programs using MapReduce and Apache spark.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO512B.1: Explain the fundamentals of big data analytics.	Unit I
CO512B.2: Utilize the Hadoop Ecosystem for Big Data Analytics.	Unit II
CO512B.5: Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.	Unit III
CO512B.6: Implement Big Data analysis using Map-reduce and Apache Spark.	Unit IV

Course Contents

Unit I	**Introduction to Big Data Analytics**	**10 Hours**

Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies like Walmart, Netflix, Uber.

Unit II	**Introduction to Hadoop**	**10 Hours**

Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.
Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands.
Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

Unit III	**NoSQL and Big Data Management**	**10 Hours**

Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB Databases, Cassandra Databases, HiveQL.

Unit IV	**MapReduce, Hive and Pig**	**10 Hours**

Introduction: MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Apache Spark.
Big Data Analytics Applications: Retail Analytics, Financial Data Analytics, Healthcare Analytics, Supply chain management.

Total Hours	**40**

Learning Resources

Text Books:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966.
2. Arshdeep Bahga and Vijay Madisetti, "Big Data Science and Analytics- A Hands-on Approach", ISBN:

978-1-949978-00-1.

3. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 st Edition, Pearson Education, 2016. ISBN13: 978-9332570351.

Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", 4 th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672.
2. EMC Education Services, "Data Science and Big Data Analytics- Discovering, analysing Visualizing and Presenting Data", ISBN: 978-1-118-87613-8.
3. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, "Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press, ISBN: 978-9351199373.
4. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publication, 2012, ISBN0-07-120413-X.

MOOC Courses (Web Links):

1. Big Data Computing, By Prof. Rajiv Misra | IIT, Patna:
https://archive.nptel.ac.in/courses/106/104/106104189/

PES's Modern College of Engineering
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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE10551C	**Course Name: Elective II(C) - Applied Cryptography**
Semester: II	

Teaching Scheme **Lecture: 03 Hrs./ week**	**Credit** **Theory: 03**	**Examination Scheme** **Cumulative Internal Examination (CIE): 40 Marks** **Semester-End Examination (SEE) (Paper): 60 Marks**

Course Objectives:

- To inculcate the fundamental principles of cryptography and its applications.
- To specify cryptographic techniques for secure communication of two parties over an insecure channel.
- To use cryptographic Hash Functions for encryption of message.
- To describe professionally about Cryptography and cryptanalysis.

Course Outcomes: On completion of the course, the student will be able to,	Mapping of Course Outcome to Unit
CO512C.1: Compare various encryption techniques of Cryptography.	Unit I
CO512C.2: Utilize the public and private key cryptography for secure application development.	Unit II
CO512C.3: Apply digital signatures, hash functions and message Authentication codes for security.	Unit III
CO512C.4: Explain different cryptanalysis techniques which can be applied in real time scenarios.	Unit IV

Course Contents

Unit I	**Introduction to Cryptography**	**10 Hours**

Introduction to cryptography Classical Encryption Techniques: Stream Ciphers, Substitution Techniques: Caesar Cipher, Mono alphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Block Ciphers and Data Encryption standards, Symmetric Cipher Model: Feistel cipher structure, DES, Tipple DES, Block Cipher Design Principles; AES Cryptographic Hash Functions. 3DES, Advanced Encryption standard.

Unit II	**Public and Private Key Cryptography**	**10 Hours**

Public Key Cryptography: RSA – Algorithm and Computational Aspects, Public Key Cryptography and RSA, Key Management, Diffie Hellman Key Exchange; Elgamal Cryptographic System; Elliptic Curve Cryptography, Key management, and distribution: Symmetric key distribution using symmetric & asymmetric encryption, distribution of public keys.

Unit III	**Cryptographic Hash Functions**	**10 Hours**

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, MD4, MD5.

Message Authentication Codes: Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs.

Digital Signatures: Schemes, Digital Signature standard, PKI X.509 Certificate. Web Security issues, HTTPS, SSH, Email security: PGP, S/MIME, IP Security: IPsec

Unit IV	Cryptanalysis	10 Hours
Cryptanalysis, Cryptanalysis on Substitution Cipher (Frequency Analysis), Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Time-Memory Trade-off Attack, Linear Cryptanalysis, Differential Cryptanalysis.		
	Total Hours	**40**

Learning Resources

Text Books:

1. William Stallings, "Cryptography and Network security -Principles and Practices", Pearson publication sixth Edition, ISBN: 9789332585225.
2. Atul Kahate, "Cryptography and Network security", McGraw Hill publication, ISBN-10. 9781259029882.

Reference Books:

1. William Stallings, Lawrie Brown "Computer security -Principles and Practices", Pearson publication, ISBN: 978-1-292-22061-1.
3. John F. Dooley, History of Cryptography & Cryptanalysis-Codes, Ciphers & Algorithms, Springer, ISBN 10: 3030080161.
4. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education. 4. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, ISBN: 0-13-066943-1.

MOOC Courses:

1. Course NPTEL: Cryptography and Network Security , Prof. Sourav Mukhopadhyay, IIT Kharagpur.

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Course Code: CSE01553	**Course Name: Laboratory Practice III**	
Semester: II		
Teaching Scheme **Practical: 04 Hrs./ week**	**Credit** **Practical: 02**	**Examination Scheme** **Oral (OR): 50 Marks**

Course Objectives:

- To apply algorithmic strategies for solving the problems.
- To design real time applications using IOT technology.

Course Outcomes:

On completion of the course, the student will be able to,

CO513.1: Solve the problems using appropriate algorithmic strategies.

CO513.2: Analyse the solution for a given problem using different algorithms.

CO513.3: Use different tools and technologies of Internet of Things to solve real life problems.

CO513.4: Develop applications using techniques of internet of things.

Guidelines for Laboratory Conduction

A minimum of six experiments should be performed under Lab Practice – III from the list below. A list of experiments that may be performed under various subjects of semester - II is given below as a guideline.

Sr. No.	List of Laboratory Assignments	CO Mapping
	Algorithm and Complexity Theory (CSE01509)	
1.	Implement an approximation algorithm for the vertex cover problem.	**CO513.1**
2.	Implement randomized Karger's min-cut algorithm and analyse the solution.	**CO513.1**
3.	Implement Push Relabel Algorithm for solving Max Flow Problem and analyse the solution.	**CO513.2**
4.	Implement the solution for integer factorization problem and analyse the solution. build a simple linear regression model to predict sales based on TV marketing expenses.	**CO513.2**
	Internet of Things (CSE01510)	
1.	Arduino Programming, Integration of Sensors and Actuators with Arduino, Raspberry Pi, Implementation of IoT with Raspberry Pi.	**CO513.3**
2.	Implementing on any one Protocol MQTT, CoAP, XMPP with real life applications.	**CO513.3**
3.	Interface generic Biomedical (various types of sensors) used in Smart Healthcare. Measure parameters: Normal Heart Rate, Measure the heart abnormality conditions and Real-time streaming data in healthcare applications through sensor signals.	**CO513.4**
4.	IoT-Based Agriculture monitoring system development.	**CO513.4**

Learning Resources

Virtual Laboratory (links):

1. Artificial Intelligence & Deep Learning Virtual Lab, S.P.I.T., https://vlab.spit.ac.in/ai/

MOOC Courses (Web Links):

1. Deep Learning - IIT Ropar, Prof. Sudarshan Iyengar and Prof. Padmavati, IIT Ropar, IITM: https://nptel.ac.in/courses/106106184.

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Course Code: CSE10552	**Course Name: Laboratory Practice IV**	
Semester: II		
Teaching Scheme **Practical: 04 Hrs./ week**	**Credit** **Practical: 02**	**Examination Scheme** **Term work (TW): 50 Marks**

Course Objectives:

- To inculcate different tools and technologies to solve real life problems.
- To understand applications development using techniques of machine learning, big data analytics, and applied cryptography.
- To detect and prevent cyber-attacks for social security.
- To identify Social, ethical, and legal aspects of cyber-crimes.

Course Outcomes:

On completion of the course, the student will be able to,

CO514.1: Classify various tools and techniques used in cyber-attacks.

CO514.2: Make use of digital forensic life cycle in cyber-crime investigation process

CO514.3: Use different tools and technologies to solve real life problems.

CO514.4: Develop applications using techniques of machine learning, big data analytics, and applied cryptography.

Guidelines for Laboratory Conduction

A minimum of six experiments should be performed under Lab Practice – IV from the list below. A list of experiments that may be performed under various subjects of semester - II is given below as a guideline.

Sr. No.	List of Laboratory Assignments	CO Mapping
	Introduction to Cyber Security (CYS06511)	
1.	Study of various Cybercrimes.	**CO514.1**
2.	Summarize the techniques used for cyber-attacks.	**CO514.1**
3.	Apply various digital forensic processes for cyber-crime investigation.	**CO514.2**
4.	Elaborate Intellectual property related cyber-crimes.	**CO514.2**
	Machine Learning (CSE10512A)	
1.	Download Housing Rent Prediction Dataset from Kaggle and predict the house rent using regression. https://www.kaggle.com/datasets/iamsouravbanerjee/house-rent-prediction-dataset/.	**CO514.3**
2.	Implement Medical diagnostics for detecting diseases using machine learning.	**CO514.3**
3.	Implement multivariant linear regression for weather forecasting.	**CO514.4**
4.	Implement Twitter sentiment prediction using Machine Learning techniques.	**CO514.4**
	Big Data Analytics (CSE10512B)	
1.	Develop a MapReduce program to analyse weather dataset and print whether of the day.	**CO514.3**
2.	Develop a MapReduce program to find the tags associated with each movie by analysing movielens dataset.	**CO514.3**
3.	Write queries to sort and aggregate the data in a table using HiveQL and	**CO514.4**

	Cassandra for healthcare application.	
4.	Develop a Java application to find the maximum temperature using Spark.	**CO514.4**
Applied Cryptography (CSE10512C)		
1.	Design and implement secure communication using 3-DES algorithm.	**CO514.3**
2.	Implement public key cryptographic algorithm RSA to encrypt and decrypt massage. Evaluate for different cryptanalytic attacks possible on system.	**CO514.3**
3.	Implement Diffie-Hellman key exchange algorithm for a real-life application.	**CO514.4**
4.	Create a new policy-based proxy agent that can identify if a request is scripted or query-based and can also identify the type of attack, if any, that is being made against the request. Both SQL injection and Cross-Site Scripting attacks need to be detected by proxy agent.	**CO514.4**
Learning Resources		
Virtual Laboratory (links): 1. Artificial Intelligence & Deep Learning Virtual Lab, S.P.I.T., https://vlab.spit.ac.in/ai/		
MOOC Courses (Web Links): 1. Deep Learning - IIT Ropar, Prof. Sudarshan Iyengar and Prof. Padmavati, IIT Ropar, IITM Link: https://nptel.ac.in/courses/106106184.		

P.E.S. Modern College of Engineering
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Level 6.5: First Year M. Tech. (2024 Pattern)

Course Code: CSE07551		**Course Name: Seminar II**
Semester: II		
Teaching Scheme: **Lecture: 04 Hrs./ week**	**Credit:** **Practical: 02**	**Examination Scheme:** **Oral Examination (Presentation): 50 Marks**

Course Objectives:

- To explore the basic principles of communication and active, empathetic listening, speaking, and writing techniques.
- To discuss current, real-world issues, new technologies, research, products, algorithms, and services.

Course Outcomes:

On completion of the course, student will be able to,

CO515.1: Use multiple thinking strategies to examine real-world issues and explore creative avenues of expression.

CO515.2: Explain intended meaning using verbal and nonverbal methods of communication.

CO515.3: Discuss through independent learning in computer science and technology and the ability to integrate information across.

CO515.4: Organize the presentation with professional technical presentation skills.

Guidelines for Students:

The student shall have to deliver the seminar II on a topic approved by guide and authorities.

It is recommended that seminar shall be on the topic relevant to latest trends in the field of concerned branch, preferably on the topic of specialization based on the electives selected or domain of interest. It is appreciated and strongly recommended that the student will select the domain of his/her dissertation and identify the literature confined to the domain. Thorough literature study based on the broad identified topic has to be carried out. This practice will eventually lead to convergence of the efforts for the dissertation in Semester III and IV.

The relevant literature then be explored as state-of-the-art, exotic, recent technological advancement, future trend, application, and research & innovation. Multidisciplinary topics are encouraged. The student shall submit the duly approved and certified seminar report in standard format, for satisfactory completion of the work by the concerned Guide and head of the department/institute.

The student will be assessed based on his/her presentation and preparations by the panel of examiners. The students are expected to validate their study undertaken by publishing it at standard platforms.

The student has to exhibit the continuous progress through regular reporting and presentations and proper documentation of the frequency of the activities in the sole discretion of the PG coordination.

The continuous assessment of the progress needs to be documented unambiguously. For standardization and documentation, follow the guidelines circulated / as in the seminar logbook approved by the Board of Studies.

Learning Resources

Reference Books:

3. Rebecca Stott, Cordelia Bryan, Tory Young, "Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)", Longman, ISBN-13: 978-0582382435.
4. Johnson-Sheehan, Richard, "Technical Communication", Longman. ISBN 0-321-11764-6.

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Course Code: HRT04551	**Course Name: Human Rights-II**	
Semester: II		
Teaching Scheme: **Practical: 02 Hrs./ week**	**Credit:** **Practical:01**	**Examination Scheme:** **Term work (TW): 25 Marks**

Course Objectives:

- To make aware about Human Values and rights.
- To understanding of legal instruments of Human Rights.
- To know about UN efforts on protecting Human Rights.

Course Outcomes: On completion of the course, the student will be able to,

CO516.1: Outline the Indian context on Human Rights.

CO516.2: Analyze the Enforcement Mechanism for Human Rights.

CO516.3: Extend the legal redress on human rights violation.

CO516.4: Criticize the role of advocacy groups in protecting human rights.

Sr. No.	**List of content to be covered in assignments or activity**	**CO Mapping**
1.	**Screening a documentary/ movie, follow up with discussions on** understanding Human Rights and Duties in the Indian Constitution, and discuss gain insights into the interplay between fundamental rights, duties, and human rights in India.	**CO516.1**
2.	**Study** the provisions of the Protection of Human Rights Act, 1993 and **discuss** the importance of human right act, 1993.	**CO516.1**
3.	**Case Analysis of** specific cases where the NHRC or SHRCs intervened to protect human rights.	**CO516.3**
4.	**Group Discussion on** role and responsibilities of Commissions on Women, Children, Minority and Scheduled Castes, and Scheduled Tribes in protecting their rights.	**CO516.2**
5.	**Article Writing** on topics like Inequalities in society and Human Rights and Good Governance.	**CO516.2**
6.	**Situation Analysis** on recent abuse of Executive Power in different parts of the world, highlighting the involved rights and the response of the international community.	**CO516.3**
7.	**Group Discussion** to explore the role of Protection Bodies in protecting Human Rights	**CO516.3**
8.	**Role-Playing**: Simulate international Complaint Mechanism for Human Rights.	**CO516.4**
9.	**Article review** on Role of Corporate sector and NGOs in protecting Human Rights	**CO516.4**
10.	**Guest Session on** Overview of ESG principles, SDG goals and their relevance to human rights	**CO516.4**

Learning Resources

Text Books:

1. Rhona K. M. Smith, Textbook on International Human Rights, 7th Edition, Oxford University Press, 2016, ISBN: 9780198746218
2. H.O. Agarwal, Human Rights, 21st Edition, Central Law Publications, 2020, ISBN: 978-9388267915

Reference Books:

1. Bhagyashree Deshpande, Human Rights: Law & Practice, Central Law Publications,2017, ISBN: 9789382676744

MOOC Courses (Web Links):

1. https://onlinecourses.swayam2.ac.in/cec24_hs06/preview