Curriculum Structure for M. Tech. Programmes

(In light of NEP2020)

NCrF Level 7

For students admitted in 2023-24 onwards

Govt. College of Engineering, Amravati

(*An Autonomous Institute of Govt. of Maharashtra*)

Near Kathora Naka, Amravati, Maharashtra

PIN 444 604

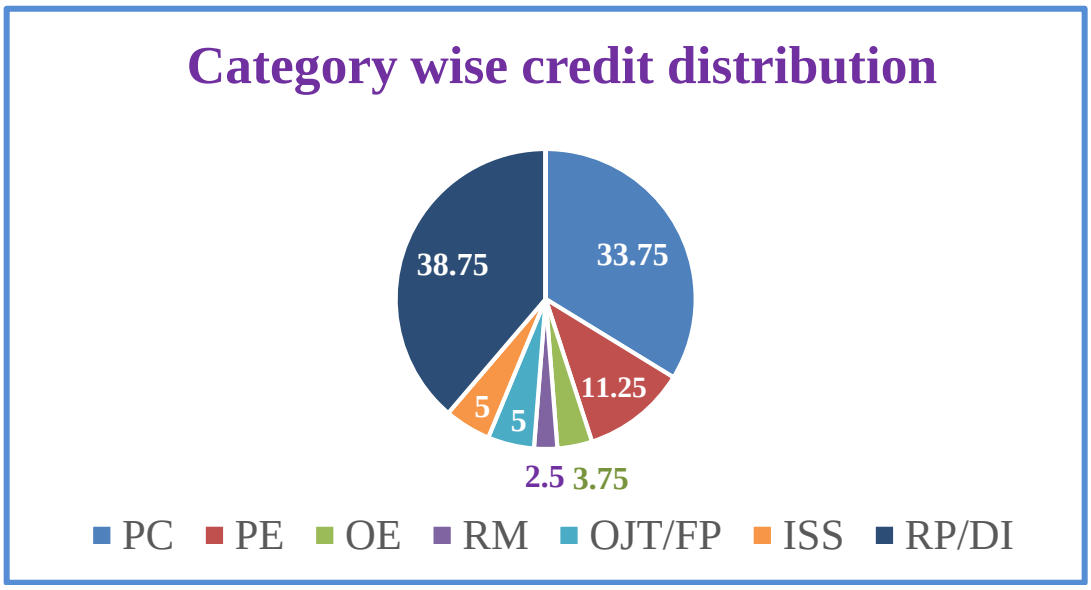
Member Secretary | BoS Chairperson | Dean (Academics) | Principal

Curriculum Structure for M. Tech. (Computer Science & Engineering)
(In light of NEP 2020)

Category wise credit distribution:

Semester	PC	PE	OE	RM	OJT / FP	ISS	RP / DI	Total
I	15	03	---	---	---	02	---	20
II	12	03	---	02	04	02	---	23
III	---	03	03	---	---	---	13	19
IV	---	---	---	---	---	---	18	18
Total	**27**	**09**	**03**	**02**	**04**	**04**	**31**	**80**

SN	Abbreviation	Meaning	Credits	Percentage
01	PC	Programme Core	27	33.75
02	PE	Programme Elective	09	11.25
03	OE	Open Elective	03	03.75
04	RM	Research Methodology	02	02.50
05	OJT	On-Job Training/ Internship	04	05.00
06	FP	Field Projects		
07	ISS	Independent Study & Seminar	04	05.00
08	RP	Research Project	31	38.75
09	DI	Dissertation		
		Total	80	100.00



General Instructions:

1) 10% content of syllabus of each theory course of first, second and third semesters shall be completed by the students with self-study. The 10% portion of each course (for self-study) shall be declared by the concerned course-coordinator at the beginning of teaching of the course.

2) Student can complete any two theory courses of second semester, if desired, in "online" mode, offered through SWAYAM/ NPTEL. In this case –

i) Students can register and complete these online courses any time after beginning of first semester, however, the student must successfully complete and pass the course, and submit the score card/ certificate before declaration of result of second semester.

ii) In case if a student registers for a course in online mode but fails in the course the student will have to register for the course in the institute whenever it is offered. In this case, the student will have to attend the classes of the course (in order to satisfy the minimum attendance criteria), appear for all the examinations (MSE, TA, ICA, ESE etc) of the course, and successfully complete the course with at least D grade.

3) Student can complete the two theory courses of third semester, if desired, in "online" mode, offered through SWAYAM/ NPTEL. In this case –

i) Students can register and complete these online courses any time after beginning of first semester, however, the student must successfully complete and pass the course, and submit the score card/ certificate before declaration of result of third semester.

ii) In case if a student registers for a course in online mode but fails in the course the student will have to register for the course in the institute whenever it is offered. In this case, the student will have to attend the classes of the course (in order to satisfy the minimum attendance criteria), appear for all the examinations (MSE, TA, ICA, ESE etc) of the course, and successfully complete the course with at least D grade.

4) Students must complete On-the-job training/ Internship/ Field work for a duration of minimum four weeks during summer break, after completion of second semester of first year in the respective major subject.

The assessment of the same shall be done in third semester. The company/ organization for On-job training/ Internship/ Field work must be approved by the DFB

5) Students going for industrial project or going for dissertation at some other institute (approved by DFB), during third and fourth semester, shall complete the courses Programme Elective – III and Open Elective in any one of the two modes –

i) Online courses offered through SWAYAM/ NPTEL: In this case the student must complete the course and submit the score card/ certificate before commencement of fourth semester. Students can register and complete these courses any time after beginning of first semester

In case if a student registers for a course in online mode but fails in the course the student will have to register for the course in the institute whenever it is offered. In this case, the student will have to attend the classes of the course (in order to satisfy the minimum attendance criteria), appear for all the examinations (MSE, TA, ICA, ESE etc) of the course, and successfully complete the course with at least D grade.

ii) Self-study mode: In this case the student will have to study the course of his/her own. The student shall appear for all the college assessments/ examinations (MSE, TA and ESE) personally as per the schedule declared by the institute.

6) Maximum period for completion of M. Tech. programme:

The maximum duration for completion of the PG full time programme is eight semesters from the date of initial registration. The maximum duration of the programme includes the period of withdrawal, absence and different kinds of leaves permissible to a student but it shall exclude the period of rustication of the student from the institute and it shall also exclude the period lapsed between exit after first year (second semester) and reentry at second year (third semester). However, genuine cases on confirmation of valid reasons may be referred to Academic Council for extending this limit by additional one year.

M. Tech. (Computer Science & Engineering) Semester I

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PC	CS2101	Computational Methodology	03	01	--	04	30	10	60	---	---	100	04
PC	CS2102	Advanced Software Engineering	04	--	--	04	30	10	60	---	---	100	04
PC	CS2103	Intelligent System	03	01	--	04	30	10	60	---	---	100	04
PE	CS2104	Programme Elective – I	03	--	--	03	30	10	60	---	---	100	03
PC	CS2105	Laboratory Practice – I	--	--	06	06	--	--	--	50	50	100	03
ISS	CS2106	Seminar – I	--	--	01	01	--	--	--	50	---	50	02
		Total	13	02	07	22	120	40	240	100	50	550	20

List of Programme Electives	
CS2104: Programme Elective – I	
A	Information Security & Digital Forensics
B	Advanced Machine Learning
C	Parallel Programming
D	Internet of Things (IoT)

Note:

i) The contact hours for the students (with concerned supervisor) for Seminar – I shall be one hour per week per student, subject to maximum of four hours per week.

ii) The hours shown in the teaching scheme for Seminar I are the contact hours for the students with concerned supervisor. Each student is expected to devote at least four hours per week for Seminar I.

Member Secretary | BoS Chairperson | Dean (Academics) | Principal

M. Tech. (Computer Science & Engineering) Semester II

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PC	CS2201	Advance Database Management System	03	--	--	03	30	10	60	--	--	100	03
PC	CS2202	Cyber Security	03	--	--	03	30	10	60	--	--	100	03
PC	CS2203	Cloud Computing	03	--	--	03	30	10	60	--	--	100	03
PE	CS2204	Programme Elective – II	03	--	--	03	30	10	60	--	--	100	03
RM	SH2201	Research Methodology	02	--	--	02	30	20	--	--	--	50	02
PC	CS2205	Laboratory Practice – II	--	--	06	06	--	--	--	50	50	100	03
ISS	CS2206	Seminar – II	--	--	01	01	--	--	--	50	--	50	02
OJT/FP		OJT/FP	--	--	--	--	--	--	--	50	--	50	04
		Total	14	--	07	21	150	60	240	150	50	650	23

List of Programme Electives	
CS2204: Programme Elective – II	
A	Information Retrieval & Mining for Hypertext & Web
B	Advanced Compilers
C	Optimization Techniques
D	Advanced Computer Architecture

Note:

i) The contact hours for the students (with concerned supervisor) for Seminar – II, shall be one hour per week per student, subject to maximum of four hours per week.

ii) The hours shown in the teaching scheme for Seminar II are the contact hours for the students with concerned supervisor. Each student is expected to devote at least four hours per week for Seminar II.

iii) Individual students are required to choose a topic of their interest for Seminar II. They shall acquire state-of-the art knowledge in that area and shall define the grey area related to topic (gap analysis) so as to carry dissertation in that area. The students are required to review literature on the topic and deliver seminar.

Exit option:

- The exit option at the end of one year of the Master's degree program will commence from AY 2024-25.
- Students who have joined a two-year Master's degree program may opt for exit at the end of the first year and he/ she shall be eligible for M. Voc. Degree (Level 6.5)
- The M. Voc. Degree may be awarded to a student provided they have earned all 39 credits of first year (first and second semester) and have earned04 credits of On-job training / Internship/ Field work during summer break, after completion of the second semester of the first year in the respective Major Subject.
- The student must submit the report of On-job training / Internship/ Field work, in the format prescribed by the institute, as partial fulfilment of award of M. Voc. degree.
- Re-entry to complete the PG degree, after taking the exit option, will be permissible up to 05 years from the date of admission to the PG programme. Such students, after completion of PG degree, shall have to surrender the M. Voc. degree. There shall be a gap of at least six months between exit after first year and re-entry to PG degree at third semester

M. Tech. (Computer Science & Engineering) Semester III

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PE	CS2301	Program Elective-III	03	--	--	03	30	10	60	---	---	100	03
OE	SH2301	Open Elective	03	--	--	03	30	10	60	---	---	100	03
PR/DI	CS2303	Dissertation Stage – I	--	--	04	04	--	--	--	150	---	150	13
		Total	06	--	04	10	60	20	120	150	---	350	19

Note: The hours shown in the teaching scheme for Dissertation Stage I are the contact hours for the students with concerned supervisor. The student is expected to devote at least twenty-six hours per week for Dissertation Stage I.

List of Programme Electives		List of Open Electives	
CS2301: Programme Elective – III		SH2301: Open Elective	
A	Advanced Data Science	A	Industrial Safety
B	Human Computer Interaction	B	Operations Research
C	Natural Language Processing	C	Project Management
D	Image Processing	D	Data Structures and Algorithms
		E	Nano Technology

Member Secretary | BoS Chairperson | Dean (Academics) | Principal

M. Tech. (Computer Science & Engineering) Semester IV

Category	Course Code	Name of the course	Teaching Scheme				Examination Scheme						Credits
							Theory			Practical		Total	
			Theory	Tut	Pract	Total	MSE	TA	ESE	ICA	ESE		
PR/DI	CS2431	Dissertation Stage – II	--	--	04	04	--	--	--	100	200	300	18
		Total	--	--	04	04	--	--	--	100	200	300	18

Note:

i) Dissertation Stage – I is pre-requisite for Dissertation Stage – II

ii) The hours shown in the teaching scheme for Dissertation Stage II are the contact hours for the students with concerned supervisor. The student is expected to devote at least thirty-six hours per week for Dissertation Stage II.

Comparison of existing and new programme structure:

i) On the basis of Marks and Credit:

Semester	Marks		Credits	
	Existing	**New**	**Existing**	**New**
I	610	550	17	20
II	600	600	19	19
III	300	400	16	23
IV	400	300	16	18
Total	**1910**	**1850**	**68**	**80**

ii) On the basis of semester wise number of courses:

	Number of courses									
	Semester I		Semester II		Semester III		Semester IV		Total	
	Existing	New	Existing	New	Existing	New	Existing	New	Existing	New
Theory	05	04	05	05	02	02	---	---	12	11
Practical	01	01	01	01	---	---	---	---	02	02
Seminar	01	01	01	01	---	---	---	---	02	02
Internship	---	---	---	---	---	01	---	---	---	01

Member Secretary | BoS Chairperson | Dean (Academics) | Principal

Dissertation	---	---	---	---	01	01	01	01	02	02

iii) On the basis of course category:

Course category	Number of courses		Credits	
	Existing	**New**	**Existing**	**New**
PC	08	08	24	27
PE	03	03	09	09
OE	02	01	03	03
RM	01	01	02	02
OJT / FP	---	01	---	04
ISS	02	02	04	04
RP / DI	02	02	26	31
Total	**18**	**18**	**68**	**80**

Course Code	CS2101							Course category			PC
Course Name	COMPUTATIONAL METHODOLOGY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	01	--	04	30	10	60	2 Hrs 30 Min	--	--	100	04

Course Objectives:

1. To develop the mathematical model for Research.
2. To learn number theory
3. To learn Computational geometry.
4. Student will learn approximation algorithm
5. Perform linear, polynomial, and general curve fits.

Course Contents:

The Role of Algorithms in Computing Algorithms:
Algorithms as a technology fundamental of algorithmic problem solving, fundamental of the analysis of algorithm efficiency. Analyzing algorithm, designing algorithms growth of functions, asymptotic notation, substitution method the recursion-tree method, the master method

Discrete Mathematics and Automata Theory:
Proofs, mathematical induction, functions, relations, set theory, summation and counting, Graph Theory, Finite automata, minimization of DFA Regular expressions, Context-free Grammars and its simplification, recursively enumerable languages, Undecidable problems, complexity

Number theory:
Divisibility, modular arithmetic, congruence and reminders, Chinese reminder theorem, Fermat's theorem, greatest common divisor; cryptography, cryptanalysis, and cryptosystems: public key, RSA key, digital signature.

Computational Geometry:
Line, Segment properties, Finding Intersection of pair of segments, finding convex hull, closest pair of points

Np-completeness:
Polynomial time verification, Np-completeness and reducibility, Np completeness proof and problems Approximation algorithm: Vertex cover problem, Traveling salesman problem, Set covering problem, Randomization and linear programming, Sub-set sum problems

First-Order Logic, Building a Knowledge Base: Extensions and Notational Variations, Using 10 6 First-Order Logic, Representing Change in the World

Uncertainty & Probability theory: Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Bayes' Rule and Its Use

Reference Books:

1. Introduction to algorithm, Thomas cormen, R. Rivest, PHI Publication

2. Artificial Intelligence: A Modern Approach, 3/E Stuart Russell, Prentice Hall

3. Principles of soft computing, S.N.Sivanadam, S.N.Deepa Wiley publication, 2nd edition

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

CS2101.1 Apply concepts of algorithms.
CS2101.2 Understand and apply the concept of problem solving using algorithms
CS2101.3 Apply matrix operations in solving problems
CS2101.4 Understand NP completeness
CS2101.5 Apply computational geometry for real time problems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2101.1	2	2	-	-	-
CS2101.2	2	1	3	2	--
CS2101.3	3	2	1	2	--
CS2101.4	3	2	1	-	-
CS2101.5	2	1	1	2	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2102							Course category			PC
Course Name	ADVANCED SOFTWARE ENGINEERING										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
04	--	--	04	30	10	60	2 Hrs 30 Min	--	--	100	04

Course Objectives:

To make the students aware and understand:

1. All the processes for engineering high quality software and the principles, concepts and techniques associated with software development
2. An ability to analyse and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems
3. Impart a range of skills focused on the analysis of requirements, design and implementation of reliable and maintainable software.
4. Apply strong engineering principles applied over the whole development lifecycle
5. An awareness of current research in software development, the analytical skills and research techniques for their critical and independent evaluation and their application to new problems.

Course Contents:

Introduction to Software Engineering

The evolving role of software, Changing Nature of Software, legacy software, Software myths. A Generic view of process: Software engineering - A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process.

Software Requirements

Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management. System models: Context Models, Behavioral models, Data models, Object models, structured methods.

Design Engineering:

Design process and Design quality, Design concepts, the design model, pattern based software design.Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural Design, assessing alternative architectural designs, mapping data flow into a software architecture. Modeling component-level design: Designing class-based components, conducting component-level design, Object constraint language, designing conventional components. Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Testing Strategies

A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.Product metrics: Software Quality, Framework for Product metrics, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance. Metrics for Process and Products: Software Measurement, Metrics for software quality.

Risk management

Reactive vs Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.Configuration Management: Configuration Management planning, Change management, Version and release management, System building, CASE tools for configuration management.

Text Books:

1. Software Engineering: A practitioner's Approach, Roger S Pressman, Sixth edition, McGraw Hill International Edition, 2005
2. Software Engineering, Ian Sommerville, seventh edition, Pearson education, 2004

Reference Books and Websites:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Fundamentals of Software Engineering, Rajib Mall,PHI, 2005
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
5. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.

Course Outcomes:

On completion of the course, students will be able to:

CS2102.1	Apply all concepts and techniques associated with software development processes for engineering high quality software.
CS2102.2	Analyse, evaluate and draw solutions for problems and draw on the theoretical and technical knowledge to develop solutions and systems
CS2102.3	Impart a range of skills focused on the analysis of requirements, design and implementation of reliable and maintainable software.
CS2102.4	Apply strong engineering principles applied over the whole development lifecycle

CS2102.5 An awareness of current research in software development, the analytical skills and research techniques for their critical and independent evaluation and their application to new problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2102.1	2	2	-	-	-
CS2102.2	2	1	3	-	-
CS2102.3	3	2	1	2	-
CS2102.4	3	2	3	1	-
CS2102.5	2	1	2	1	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2103							Course category			PC3
Course Name	INTELLIGENT SYSTEM										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	01	--	04	30	10	60	2 Hrs 30 Min	--	--	100	04

Course Objectives:

1. To introduce the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
2. To explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty learning from experience and following problem solving strategies found in nature
3. To demonstrate good knowledge of basic theoretical foundations of the following common intelligent systems methodologies: Rule-based systems, fuzzy inference, artificial neural networks, evolutionary computation, case-based reasoning, and probabilistic reasoning.
4. To determine which type of intelligent system methodology would be suitable for a given type of application problem.
5. To explore the practical implications of intelligent systems.

Course Content:

Data, information and knowledge: Model of an intelligent system. Models of knowledge representations: Representation and reasoning in logic.

Semantic representations: semantic networks, frames; Frame/script systems; Conceptual dependency and conceptual graphs. Ontologies. Knowledge based systems: Software architecture of a knowledge-based system, Rule-based programming and production systems, Rule chaining and inference control,

Inference: reasoning about knowledge, Temporal reasoning, Inference under uncertainty: Bayesian techniques, Fuzzy reasoning, Case-based reasoning. Intelligent agents, The agent metaphor and attributes of agent-hood, Agent theory and languages, Inter agent communication, Ontological issues.

Alternatives to the symbolic approach: Foundations of connectionist networks; their history.

Applications of AI: Example application domains, e.g. Configuration, Diagnosis, Planning, intelligent interfaces, user modeling, practical implications of choosing and applying AI solutions. Knowledge representation and the Web, Semantic Web.

Reference Books:

1. Artificial Intelligence: Structures and strategies for Complex Problem Solving, Luger G.F. and Stubblefield W.A. (2008). Addison Wesley, 6th edition.
2. Artificial Intelligence: A Modern Approach, Russell S. and Norvig P. (2009), Prentice-Hall, 3rd edition

Course Outcome:

After completion of course student will be able to

CS2103.1 Demonstrate knowledge of the fundamental principles of intelligent system.
CS2103.2 Analyze and compare the relative merits of a variety of AI problem solving techniques.
CS2103.3 Gain deep understanding of the basic artificial intelligence techniques.
CS2103.4 Apply their knowledge to design solutions to different problems.
CS2103.5 Design an intelligent system for a selected application

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2103.1	2	2	-	-	-
CS2103.2	2	1	3	2	--
CS2103.3	3	2	1	2	--
CS2103.4	3	2	1	-	-
CS2103.5	2	1	1	2	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2104							Course category			PE
Course Name	PROGRAM ELECTIVE-I (A): INFORMATION SECURITY & DIGITAL FORENSIC										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objectives:

1. To understand the basics of digital forensics and investigation
2. To understand and determine best acquisition tool and how to use them
3. To impart the technical know of digital evidences and forensics tools
4. To understand the basics of Email, Social Media, Mobile, Cloud and IOT forensics
5. To understand current computer forensic tools to identify digital evidence.

Course Content:

Program Security:

Secure software architecture design, architectural risk analysis, threat analysis, attack patterns, common software code vulnerabilities, software security testing, non-malicious program errors, virus and other malicious code, control against threats.

Database Security:

Vulnerabilities in database, security requirements, reliability and integrity, sensitive data, inference, multilevel database, proposal for multilevel security, defense mechanism, data mining and security

Web Security: web security: obfuscation , web sites , web servers , web browsers , attacking application logic , attacking users: sql injection, cross-site scripting , a web application hackers methodology, attacks and defense mechanisms, Attacking web authorization , Attacking web authentication ,Attacking web application ,Web hacking tools

System Security:

Protection in general-purpose operating system: vulnerabilities in operating system ,security and controls , protected objects and methods of protection ,memory and address protection , control of access to general objects , local access control (case study - linux) , user authentication, os hardening

Network Security: vulnerabilities in network and web, network security controls, firewalls, intrusion detection systems, network layer, transport layer, application layer vulnerabilities, routing protocol vulnerabilities, Security protocols vulnerabilities ,attacks and defense mechanisms

Digital Forensic Analysis : Forensic terminology and developing forensic science capabilities: traditional problems in computer investigations , processing crimes and incident scenes , working with dos and windows systems , current computer forensic tools , recovering graphic files , network forensic , email investigations , Processing of Evidence and Report Preparation

Processing crimes and incident scenes- Identifying Digital Evidence, Preparing for a Search, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing a case study.

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques.

Reference Books:

1. Network Attack and Defense Mechanisms, Kamini C. Nalavade, Dr. B. B. Meshram, Research India Publications
2. Guide to Computer Forensics and Investigations, Nelson, B, Phillips, A, Enfinger, F, Stuart, C. 6th Edition, Cengage Learning
3. Computer Forensics: Computer Crime Scene Investigation, John Vacca, Laxmi Publications.

Course Outcome

Student would be able to

CS2104 (A).1 Understands the concept of threats, vulnerability and control

CS2104 (A).2 Security in programs, including applications, operating systems, database management systems and networks.

CS2104 (A).3 Understands the fundamental concepts of web security

CS2104 (A).4 Computer forensics and digital detective and various processes, policies and procedures.

CS2104 (A).5 Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2104 (A).1	2	2	-	-	-
CS2104 (A).2	2	1	3	2	3
CS2104 (A).3	3	2	1	2	-
CS2104 (A).4	3	2	1	-	-
CS2104 (A).5	2	1	1	2	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2104							Course category			PE
Course Name	PROGRAM ELECTIVE-I (B): ADVANCED MACHINE LEARNING										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objective:

1. To demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
2. Critically evaluate data visualizations based on their design and use for communicating stories from data.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.
5. To design deep learning model for real time issue.

Course Content:

Kernel Methods:

Review of SVM, Classification and Regression using SVM, Properties of Kernels, Non-Mercer Kernels, Kernel Selection, Multiple Kernel Learning, Kernel PCA; Probabilistic Graphical Models: Bayesian networks, undirected models, Bayesian learning, structure learning, Inference on graphical models, exponential families;

Deep Learning:

Review of Multi-layer Perceptron, Backpropagation Algorithms, Stochastic Gradient Descent, Loss and Activation functions, Regularization strategies, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory Units (LSTM), Auto encoders;

Reinforcement Learning: Introduction to Reinforcement Learning, Multi-armed Bandit Problem, Finite Markov Decision Processes, Dynamic Programming, Eligibility Traces, Policy Gradient Methods, Deep-Q Learning;

Applications and Case Studies.

Reference Books:

1. Kernel Methods for Pattern Analysis, J. Shawe-Taylor and Nello Cristianini, Cambridge University Press, 2004.

2. Probabilistic Graphical Models – Principles and Techniques, D. Koller and N. Friedman, MIT Press, 2009.
3. Deep Learning, I. Good fellow, Y. Bengio , A. Courville, MIT Press, 2017
4. Reinforcement Learning – An Introduction, R. Sutton, MIT Press, 1998

Course Outcome:

After completion of this course student will be able to

CS2104 (B).1 Understand the practical approach of machine learning techniques to solve the problem.
CS2104 (B).2 Evaluate the data visualization techniques.
CS2104 (B).3 Apply various algorithms of machine learning and deep learning for finding solution
CS2104 (B).4 Implement the latest state of the art techniques in the field to solve various NLP and CV problems.
CS2104 (B).5 Design and evaluate intelligent expert models for perception and prediction from intelligent environment.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO5	PSO1
CS2104 (B).1	2	2	-	-	-
CS2104 (B).2	2	1	3	2	3
CS2104 (B).3	3	2	1	2	2
CS2104 (B).4	3	2	1	-	-
CS2104 (B).5	2	1	1	2	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2104							Course category			PE
Course Name	PROGRAM ELECTIVE-I (C): PARALLEL PROGRAMMING										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objectives:

1. To expose students to basic techniques of parallel algorithm development and programming on different parallel platform
2. To overview of the architectures and communication networks employed in parallel computers.
3. To analyze and implement the foundations for development of efficient parallel algorithms, including examples from relatively simple numerical problems, sorting, and graph problems.
4. To perform adaption of algorithms to special computer architectures
5. To program efficiency on parallel computers, addresses the modelling, analysis and measurement of program performance.

Course Content:

Fundamental Concepts: Introduction to Parallel Processing, Types of Parallelism: A Taxonomy, Roadblocks to Parallel Processing ,Effectiveness of Parallel Processing, GPU computing , Multiprocessor Systems, Performance of Parallel Computers, Architectural Classification Schemes: Multiplicity of Instruction Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining

A Taste of Parallel Algorithms: Some Simple Computations, Architectures, Algorithms for a Linear Array, Binary Tree, 2D Mesh, Shared Variables. Asymptotic Complexity, Algorithm Optimality and Efficiency, Complexity Classes, Parallelizable Tasks and the NC Class, Parallel Programming Paradigms.

PRAM and Basic Algorithms: PRAM Sub-models and Assumptions, Data Broadcasting, Semi-group or Fan-In Computation,Parallel Prefix Computation ,Ranking the Elements of a Linked List , Matrix Multiplication

MPI Programming : Introduction to MPI Principles of Message - Passing Programming, The Building Blocks (Send and Receive Operations), MPI (the Message Passing Interface), Collective Communication and Computation Operations, Examples of Matrix - Matrix multiplication, One dimensional Matrix Vector Multiplication using MPI. 10 10. CUDA /

Open CL Programming : GPUs as Parallel Computers, Architecture of a Modern GPU, Data Parallelism,, CUDA Program Structure, Importance of Memory Access Efficiency, CUDA THREADS: CUDA Thread Organization, singblockIdx and threadIdx, Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance.

Reference Books:

1. Introduction to Parallel Processing Algorithms and Architectures, BehroozParhami, KLUWER ACADEMIC PUBLISHERS
2. Programming Massively Parallel Processors, David B. Kirk and Wen-mei W. Hwu
3. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn
4. Computer Architecture & Parallel Processing, Kai Hwang & Briggs McGraw Hill Publication

Course Outcome:

After learning the course students will be able to

2104 (C).1 Optimize sequential code for fastest possible execution.
2104 (C).2 Analyze sequential programs and determine if they are worthwhile to parallelize.
2104 (C).3 Develop, analyze, and implement algorithms for parallel computer applied on both computers with shared memory and distributed memory.
2104 (C).4 Analyze and perform development work related to the use of parallel computers
2104 (C).5 Demonstrate advanced knowledge of the elements of parallel programming, parallel communication and system implementation

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2104 (C).1	2	2	2	1	3
CS2104 (C).2	2	1	1	2	1
CS2104 (C).3	2	2	3	2	2
CS2104 (C).4	3	2	1	1	1
CS2104 (C).5	2	1	1	2	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2104							Course category			PE
Course Name	PROGRAM ELECTIVE-I (D): INTERNET OF THINGS										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objectives:

1. To learn the concepts of Sensors, Wireless Network and Internet
2. To learn and implement use of Devices in IoT technology.
3. To understand how to make sensor data available on the Internet (data acquisition)
4. To learn basic python programming for IoT applications
5. To understand how to analyse and visualize sensor data of real life application

Course Contents:

Introduction to IoT: Definition, Characteristics, Applications, Evolution, Enablers, Connectivity Layers, Addressing, Networking and Connectivity Issues, Network Configurations, Multi-Homing, Sensing: Sensors and Transducers, Classification, Different Types of Sensors, Errors, Actuation: Basics, Actuator Types-Electrical, Mechanical Soft Actuators

IoT Networking, and Communication Protocol: Basics of Networking, Communication Protocols, Sensor Network, Machine to Machine Communication IoT Components, Inter-Dependencies, SoA, Gateways, Comparison Between IoT & Web, Difference Protocols, Complexity of Networks, Wireless Networks, Scalability, Protocol Classification, MQTT & SMQTT, IEEE 802.15.4, Zigbee

Arduino Programming: Interoperability in IoT, Introduction To Arduino Programming, Integration Of Sensors And Actuators With Arduino

Python Programming and Raspberry Pi: Introduction to Python Programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi, Implementation of IoT with Raspberry Pi

Industrial IoT and Case Studies: Agriculture, Healthcare, Activity Monitoring, Applications and Challenges

Reference Books

1. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).
2. Internet of Things: A Hands-on Approach", by A Bahga and Vijay Madisetti (Universities Press)
3. Introduction to IoT. S. Misra, A. Mukherjee, and A. Roy, 2020. Cambridge University Press.
4. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Misra, C. Roy, and A. Mukherjee, 2020.
5. https://nptel.ac.in/courses/106105166

Course Outcomes:

Student should be able to understand the basic concepts of IoT

CS2104 (D).1 Student should be able to understand the basic concepts of IoT
CS2104 (D).2 Ability to explore the Arduino Programming
CS2104 (D).3 Ability to explore the implement the concept of Arduino Programming
CS2104 (D).4 Ability to explore the concept of python Programming and apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
CS2104 (D).5 Ability to create practical and contemporary real life applications of IoT

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2104 (D).1	3	1	-	-	-
CS2104 (D).2	1	2	3	1	-
CS2104 (D).3	-	1	3	1	1
CS2104 (D).4	-	1	3	1	2
CS2104 (D).5	-	1	2	3	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2105							Course category			PC
Course Name	LABORATORY PRACTICE-I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
--	--	06	06	--	--	--	---	50	50	100	03

Course Objective:

1. To understand the basic programming problems.
2. To analyse the various tools and techniques of machine learning to solve critical problems.
3. To design and implement simulation examples for network problems.
4. To analyze and implement the foundations for development of efficient parallel algorithms, including examples from relatively simple numerical problems, sorting, and graph problems.
5. To perform adaption of algorithms to special computer architectures

Course Content:

It is representative list of Practical's. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise.

Minimum 08 experiments should be performed

1. Machine Learning Approach to Knowledge Acquisition.
2. deep learning
3. Basic Parallel Algorithmic Techniques - Pointer Jumping, Divide-and-Conquer
4. Basic Parallel Algorithmic Techniques - Partitioning, Pipelining
5. Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
6. Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
7. Data Modelling – Use work products – data dictionary.
8. Software Designing - Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.

9. Prototype model – Develop the prototype of the product.

Course Outcome:

After the completion of course student will be able to

CS2105.1 Understand various concepts of networking, machine learning and parallel processing.

CS2105.2 Implement the machine learning algorithms for various computational problems.

CS2105.3 Provide exposure to a broad range of programming areas including multi-threaded programs, Communication between processes, and interacting with databases.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2105.1	3	1	-	-	-
CS2105.2	1	2	3	1	-
CS2105.3	-	1	3	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2106							Course category			PC
Course Name	Seminar-I										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
--	--	04	04	--	--	--	---	50	---	50	02

1) **Student shall select a topic for seminar which is not covered in curriculum. Student shall complete the conceptual study of the selected topic and expected to know functional and technical details of selected topic**
2) **Before end of semester students shall deliver a seminar and submit seminar report in proper format consisting of**

- Literature survey
- Concept
- Functional and Technical detail
- Present status
- Future scope
- Application
- Comparison with similar technique
- References

3) **Student shall deliver a seminar on report submitted which shall be assessed by two examiner (one should be guide) appointed by HOD**

Course Code	CS2201							Course category		PC
Course Name	ADVANCED DATABASE MANAGEMNET SYSTEM									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objective:

1 To Study the needs of different databases.
2 To Get familiarized with transaction management of the database
3 To Gain knowledge about web and intelligent database.
4 To provide an introductory concept about the way in which data can be stored in geographical information systems.
5 To provide a current trends in Data warehousing and Data Mining.

Course Contents:

Parallel Databases Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – - Case Studies.

Object Oriented Databases Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

Web Databases Web Technology And Dbms – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages.

Intelligent Databases Enhanced Data Models For Advanced Applications – Active Database Concepts And Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases.

Current Trends Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining.

Textbook(s):

1. R. Elmasriand S. Navathe, Fundamentals of Database Systems, Benjamin- Cummings.

2. AviSilberschatz, Hank Korth, and S. Sudarshan, Database System Concepts, McGraw Hill.

Reference(s):

1. Databases: A TourPrentice, S. Shekhar and S. Chawla, Title Spatial Hall.

2. Database Systems, Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, Pearson.

3. Web Data Warehousing and Knowledge Management, Mattison, Rob Mattison, MGH.

4. Database Systems - A Practical Approach to Design, Implementation, and Management, Thomas M. Connolly, Carolyn E. Begg, Third Edition , Pearson Education, 2003.

Course Outcomes At end of the course Student will be able to

CS2201.1 Understand advanced database techniques for storing a variety of data with various database models.
CS2201.2 To apply various database techniques/functions with Object Oriented approach to design database for real life scenarios.
CS2201.3 Analyze the problem to design database with appropriate database model.
CS2201.4 Evaluate methods of storing, managing and interrogating complex data.
CS2201.5 Implement web application API's, distributed databases with the integration of various programming languages.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2201.1	3	1	-	-	-
CS2201.2	1	2	3	1	-
CS2201.3	-	1	3	1	1
CS2201.4	-	1	3	1	2
CS2201.5	-	1	2	3	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2202							Course category			PC
Course Name	CYBER SECURITY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hrs 30 Min	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. The basic terminologies related to cyber security and current cyber security threat landscape and develop understanding about the Cyber warfare and necessity
2. The cyber-attacks that target computers, mobiles and persons. They will also develop understanding about the type and nature of cyber crimes
3. The legal framework that exist in India for cybercrimes and penalties and punishments for such crimes
4. The aspects related to personal data privacy and security
5. The main components of cyber security plan

Course Contents:

Overview of Cyber security

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machines, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.

Cyber crimes

Cybercrimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cybersquatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cyber crime against persons – cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

Cyber Law

Cybercrime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cybercrime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.

Data Privacy and Data Security

Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.

Cyber security Management, Compliance and Governance

Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press

Reference Books and Websites:

1. WebInformation Warfare and Security by Dorothy F. Denning, Addison Wesley.
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
3. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
4. Auditing IT Infrastructures for Compliance by Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

Course Outcomes:

On completion of the course, students will be able to:

CS2202.1	Understand and strengthen the cyber security of end user machines, critical IT and national critical infrastructure.
CS2202.2	Develop understanding about the type and nature of cybercrimes and as to how to report these crimes through the prescribed legal and Government channels.
CS2202.3	Expose students to limitations of existing IT Act, 2000 legal framework that is followed in other countries and legal and ethical aspects related to new technologies.
CS2202.4	Insight into the Data Protection Bill, 2019 and data privacy and security issues related to Social media platforms.

CS2202.5 Analyse risk based assessment, requirement of security controls and need for cyber security audit and compliance.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2202.1	3	1	-	-	-
CS2202.2	1	2	3	1	-
CS2202.3	-	1	3	1	1
CS2202.4	-	1	3	1	2
CS2202.5	-	1	2	3	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2203	Course category	PC
Course Name	CLOUD COMPUTING		

Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hrs 30 Min	--	--	100	03

Course objective:

1. Describe cloud computing
2. To learn and implement Cloud Computing service model
3. To learn about Data Centre
4. To learn and implement Cloud software environment
5. To learn the working of existing cloud computing system

Course Content:

Introduction to Cloud Computing:

Enabling Technologies and System Models for Cloud computing; Benefits, Challenges and Risks in Cloud Computing;

Cloud Computing Service Models:

Infrastructure/Platform/Software – as-a-service; Cloud Architectures including Federated Clouds; Public, Private and Hybrid clouds; Cloud Operating System; Scalability, Performance and QoS in Cloud Computing;

Data Center:

Data-Center Architectures for Cloud Computing; Principles of Virtualization platforms; Virtual machine migration and Load balancing; Security and Privacy issues in Cloud;

Cloud programming and software environments (Workflow Systems, MapReduce, Spark, Google App Engine, Amazon AWS, Microsoft Azure, and OpenStack), grid computing and resource management, P2P computing with overlay networks. Simulation tools: CloudSim.

Case studies: Cloud computing systems from Amazon, Microsoft and IBM

Reference Books:

1. Cloud Computing Bible Barrie, Sosinsky: "", Wiley-India, 2010

2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski Wiley, 2011
3. Cloud Computing: Principles, Systems and Applications, Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines Wiley-India, 2010
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumara swamy, Shahed Latif, O'Reilly Media, 2009.

Course Outcome:

After successful completion of this course, student will be able to

CS2203.1 Student should be able to understand the basic concepts of Cloud Computing
CS2203.2 Ability to explore the Cloud Service model
CS2203.3 Ability to implement the concept of Data centre in cloud computing
CS2203.4 Ability to explore the concept of cloud programing environment
CS2203.5 Ability to create practical and contemporary applications Cloud

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2203.1	3	2	-	-	-
CS2203.2	1	2	2	1	-
CS2203.3	-	1	3	1	1
CS2203.4	-	1	3	2	2
CS2203.5	-	1	2	3	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2204	Course category	PE
Course Name	PROGRAM ELECTIVE- II (A): INFORMATION RETRIEVAL & MINING FOR HYPERTEXT & WEB		

Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objective:

1. Enable students to understand the various aspects of an Information retrieval system and its evaluation and to be able to design.
2. This module aims to give students an understanding of the fundamental techniques for hypermedia architectures, design and usability, document management and retrieval, metadata management, and searching the web.
3. Analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
4. Analyze ranked retrieval of a very large number of documents with hyperlinks between them.
5. Design and implement parts of an information retrieval system.

Course Content:

Traditional information retrieval: Inverted indices, vector space model. Recall and precision. The Internet, Web, HTTP and HTML. Need for further research. Models for hypertext and semi structured data. Distinctions between data-centric and document-centric views.

Supervised learning for text: Kinds of classifiers, strengths and weaknesses. Feature selection, motivations, models, and algorithms. Bayesian learners. Modelling feature dependence. Exploiting topic hierarchies. Parameter estimation, smoothing and shrinkage. Maximum entropy and support-vector classifiers.

Unsupervised learning for text: Definitions of clustering problems. Distance measures and their weaknesses. Top-down and bottom-up methods. Problems of high dimensionality. Projection-based speedup techniques. Probabilistic formulations, expectation maximization (EM) approach. Incorporating hyperlink information and user feedback. Semi-supervised learning. Application of EM. Exploiting hyperlink information for relaxation labelling and co-training. Performance implications. Reinforcement learning.

Social network analysis: Citation indexing. Notions of prestige and centrality. Applications to the Web. Incorporating textual information and hypertext tag structure. Generalized proximity search. Models of evolution of social networks. Sampling and measurement techniques for the web. Resource discovery. Content-based goal-directed crawling. Topical locality and its use in resources discovery. Learning context

graphs. Information extraction. Pattern matching vs. Probabilistic models. Markov models. Hierarchical models. Record segmentation. Use of dictionaries and lexical networks and knowledge bases for better accuracy.

Referenced Books:

1. Serge Abiteboul, Peter Buneman, Dan Suciu, Data on the Web : From Relations to Semistructured Data and XML, Morgan Kaufmann Publishers, october 1999.
2. Berthier Ribeiro-Neto, Ricardo Baeza-Yates, Modern Information Retrieval (ACM Press Series) Addison-Wesley Pub Co, May 1999.
3. Ian H. Witten, Alistair Moffat, Timothy C.Bell, Managing Gigabytes : Compressing and Indexing Documents and Images, Morgan Kaufmann Publishers, May 1999.
4. Karen Sparck Jones (Editor), Peter Willet (Editor), Peter Willett(Editor), Readings in Information Retrieval, Morgan Kaufmann Publishers, July 1997.

Course Outcome:

CS2204 (A).1 Understanding the basics of Information Retrieval
CS2204 (A).2 Realize the data structures like Inverted Indices used in Information retrieval systems.
CS2204 (A).3 Learn the different techniques for compression of an index including the dictionary and its posting list.
CS2204 (A).4 Developing the ability of develop a complete IR system from Scratch.
CS2204 (A).5 Understanding the data structures like Inverted Indices used in Information retrieval systems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2204 (A).1	3	2	-	-	-
CS2204 (A).2	1	2	2	1	-
CS2204 (A).3	-	1	3	1	1
CS2204 (A).4	-	1	3	2	2
CS2204 (A).5	-	1	2	3	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2204							Course category			PE
Course Name	PROGRAM ELECTIVE- II (B): ADVANCED COMPILER										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objective:

1. Know the most common machine independent optimizations.
2. Know scheduling techniques and register allocation for exploiting Instruction Level Parallelism
3. Know the most common memory locality optimizations.
4. Learn the concept and compiler techniques for exploiting fine-grained parallelism
5. Compiler techniques and tools for exploiting coarse-grained parallelism

Course Content:

Overview: Introduction to code optimization, efficient code generation and parallelizing compilers.

Data-flow analysis: Classical theory, bi-directional flows, unified algorithms etc.

Efficient code generation: Algorithms, register allocation heuristics and automated tools.

Parallelism detection: Data dependence, control dependence, various restructuring transformations on loops.

Inter-procedural analysis: Constant propagation, data dependence etc. Selected case studies.

References

1. Steven S. Muchnick. Advanced Compiler Design and Implementation. Harcourt Asia Private Ltd, 2000.
2. Y. N. Srikant and P. Shankar (Ed.) The Compiler Design Handbook : Optimizations and Machine Code Generation. CRC Press, 2002.
3. F. Nielson, H. R. Nielson and C. Hankin. Principles of Program Analysis. Springer Verlag, 1999.
4. R. Morgan. Buliding an Optimizing Compiler. Digital Press, 1998.
5. Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures. Morgan Kaufmann Publishers, 2002.

Course Outcome:

CS2204 (B).1	Demonstrate concepts of parallelism in hardware/software.
CS2204 (B).2	Discuss memory organization and mapping techniques.
CS2204 (B).3	Describe architectural features of advanced processors.

CS2204 (B).4 Interpret performance of different pipelined processors.
CS2204 (B).5 Explain data flow in arithmetic algorithms.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2204 (B).1	2	2	3	1	3
CS2204(B).2	2	1	2	2	1
CS2204(B).3	2	2	2	2	2
CS2204(B).4	3	3	3	1	1
CS2204(B).5	1	2	1	2	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2204							Course category			PE
Course Name	PROGRAM ELECTIVE- II (C): ADVANCED COMPUTER ARCHITECTURE										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

Course Objective:

1. Interpret the performance of a processor based on metrics such as execution time, cycles per instruction (CPI), Instruction count etc
2. Predict the challenges of realizing different kinds of parallelism (such as instruction, data, thread, core level) and leverage them for performance advancement
3. Apply the concept of memory hierarchy for efficient memory design and virtual memory to overcome the memory wall
4. Explore emerging computing trends, computing platforms, and design trade-offs.
5. To understand computational intensive problems.

Course Content:

Parallel Computer Models:
Evolution of Computer architecture, system attributes to performance, Multi processors and multi computers, Multi-vector and SIMD computers, PRAM and VLSI models-Parallelism in Programming, conditions for Parallelism-Program Partitioning and Scheduling-program flow Mechanisms-Speed up performance laws-Amdahl‘s law, Gustafson‘s law-Memory bounded speedup Model.

Memory Systems and Buses:
Memory hierarchy-cache and shared memory concepts-Cache memory organization-cache addressing models, Aliasing problem in cache, cache memory mapping techniques-Shared memory organization-Interleaved memory organization, Lower order interleaving, higher order interleaving. Backplane bus systems-Bus addressing, arbitration and transaction.

Advanced Processors:
Instruction set architectures-CISC and RISC scalar processors-Super scalar processors-VLIW architecture-Multivector and SIMD computers-Vector processing principles-Cray Y-MP 816 system-Inter processor communication

Multi-Processor and Multi Computers:

Multiprocessor system interconnects- Cross bar switch, multiport memory-Hot spot problem, Message passing mechanisms-Pipelined processors-Linear pipeline, on linear pipeline Instruction pipeline design-Arithmetic pipeline design.

Data Flow Computers and Vlsi Computations:
Data flow computer architectures-Static, Dynamic-VLSI Computing Structures-Systolic array architecture, mapping algorithms into systolic arrays, Reconfigurable processor array-VLSI matrix arithmetic processors-VLSI arithmetic models, partitioned matrix algorithms, matrix arithmetic pipelines.

Reference Books:

1. Computer Architecture: A Quantitative Approach J. Hennessy, and D. Patterson. Morgan Kaufmann, 5th edition onwards
2. Parallel Computer Architecture: A Hardware/Software Approach David Culler and Jaswinder Pal Singh. Morgan Kaufmann

Course Outcome:

CS2204 (C).1	Interpret the performance of a processor based on metrics such as execution time, cycles per instruction (CPI), Instruction count etc
CS2204 (C).2	Predict the challenges of realizing different kinds of parallelism (such as instruction, data, thread, core level) and leverage them for performance advancement
CS2204 (C).3	Apply the concept of memory hierarchy for efficient memory design and virtual memory to overcome the memory wall
CS2204 (C).4	Explore emerging computing trends, computing platforms, and design trade-offs
CS2204 (C).5	Development of software to solve computationally intensive problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2204 (C).1	2	2	3	1	3
CS2204(C).2	2	1	2	2	1
CS2204(C).3	2	2	2	2	2
CS2204(C).4	3	3	3	1	1
CS2204(C).5	1	2	1	2	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2204	Course category	PE
Course Name	PROGRAM ELECTIVE- I (D): OPTIMIZATION TECHNIQUES		

Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 Hrs 30 Min	--	--	100	03

COURSE OBJECTIVE

1. To provide insight to the mathematical formulation of real world problems.
2. To optimize these mathematical problems using nature based algorithms.
3. To find the solution that is useful especially for NP-Hard problems.
4. To solve constraints and unconstraint problem.
5. Understand to solve optimization problems.

Course Content:

Introduction:
Maximization and minimization problems- examples. Basic concept of optimization – Convex and concave functions, Necessary and sufficient conditions for stationary points. Degree of freedom. Formulation: Economic objective function. Formulation of various process optimization problems and their classification.

Optimization of unconstrained and constrained search:
Optimization of one dimensional function, unconstrained multivariable optimization direct search methods. Indirect first order and second order methods, constrained multivariable optimization - necessary and sufficient conditions for constrained optimum.

Linear programming and applications: Geometry of linear programs, Simplex Algorithm its applications. Nonlinear programming with constrained and its applications: Quadratic programming, generalized reduced gradients methods, Successive linear and successive quadratic programming, Dynamic programming, Integer and mixed integer programming.

Application of optimization in chemical engineering:
Optimization of staged and discrete processes, optimal shell-tube heat exchanger design, optimal pipe diameter, optimal design of an Ammonia reactor. Nontraditional optimization techniques: Introduction and application areas.

Reference Books:

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.

4. Optimization over integers. Dynamic Ideas, Dimitris Bertsimas; Robert Weismantel (2005), ISBN 978-0-9759146-2-5.
5. Integer programming: theory and practice, John K. Karlof (2006), CRC Press. ISBN 978-0-8493-1914-3.

COURSE OUTCOMES

After completion of course, students would be:

CS2204 (D).1	Formulate optimization problems.
CS2204 (D).2	Understand and apply the concept of optimality criteria for various types of optimization problems.
CS2204 (D).3	Solve various constrained and unconstrained problems in Single variable as well as multivariable.
CS2204 (D).4	Apply the methods of optimization in real life situation.
CS2204 (D).5	Implement programming to solve optimization problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2204 (D).1	2	-	-	1	3
CS2204(D).2	-	1	2	-	1
CS2204(D).3	2	2	-	2	-
CS2204(D).4	-	-	-	1	-
CS2204(D).5	1	2	1	-	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2105							Course category			PC
Course Name	LABORATORY PRACTICE-II										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
--	--	06	06	--	--	--	---	50	50	100	03

Course Objective:

1. To understand the basic programming problems.
2. To analyse the various tools and techniques of machine learning to solve critical problems.
3. To design and implement simulation examples for network problems.
4. To analyse network simulation problem.
5. To design predictive and SLR parser.

It is representative list of Practicals. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise.
Minimum 08 experiments should be performed

Course Outcome:

1. Data comparative statistics
2. Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email)
3. requirements for preservation of network data
4. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)
5. Analysis of the security vulnerabilities of E-Mail Applications
6. Analysis of the security vulnerabilities of E-commerce services.
7. Implementation of Predictive Parser
8. Implementation of SLR Parser

Course Outcome

After the completion of course student will be able to

CS2205.1 Understand various concepts of networking, machine learning and parallel processing.

CS2205.2 Provide exposure to a broad range of programming areas including multi-threaded programs, Communication between processes, and interacting with databases.

CS2205.3 Improve the programming ability by requiring them to program a number of large, interesting problems.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2205.1	2	2	-	1	-
CS2205.2	3	2	1	2	--
CS2205.3	3	2	1	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	CS2206							Course category			ISS
Course Name	Seminar-II										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
--	--	04	04	--	--	--	---	50	---	50	02

Student shall select a topic for seminar which is not covered in curriculum. Student shall complete the conceptual study of the selected topic and expected to know functional and technical details of selected topic

Before end of semester students shall deliver a seminar and submit seminar report in proper format consisting of

- Literature survey
- Concept
- Functional and Technical detail
- Present status
- Future scope
- Application
- Comparison with similar technique
- References

Student shall deliver a seminar on report submitted which shall be assessed by two examiner (one should be guide) appointed by HOD

Course Code	SH2201							Course category		RM	
Course Name	RESEARCH METHODOLOGY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
02	--	--	02	30	20	--	---	--	---	50	02

Course Objectives:

To make the students aware and understand:

1. Research problem formulation and methods
2. Data collection methods and analyze research related information
3. Research reports, and thesis writing
4. Research Ethics and Intellectual Property Right
5. Research paper writing and publishing

Course Contents:

Introduction to Research: Definition of research, Characteristics of research, Types of research- Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical, Steps of research methodology

Research Problem Formulation and Methods:

Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution. Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models. Developing a research plan: Exploration, Description, Diagnosis and Experimentation

Data collection:

Sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.

Research reports and Thesis writing

Introduction: Structure and components of scientific reports, types of report, Thesis writing: different steps and software tools in the design andpreparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

Research Ethics, IPR and Publishing:

Ethics: Ethical issues.

IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual propertyrights,

Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Reference Books and websites:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2022
2. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
3. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd,2004.
4. S.D. Sharma , "Operational Research", KedarNath Ram Nath&Co.,2972
5. B.L. Wadehra, "Law Relating to Patents, Trademarks, Copyright Designs and Geographical Indications", Universal Law Publishing,2024.

Course Outcomes:

On completion of the course, students will be able to:

SH2201.1 Differentiate between various methods / types of research.
SH2201.2 Formulate research problem
SH2201.3 Collect and analyze research related information
SH2201.4 Describe ethics and IPR and its significance.
SH2201.5 Describe thesis report and research paper writing and publishing

CO – PO Mapping:

Course Outcomes	Program Outcomes				
	PO2	PO2	PO3	PO4	PO5
SH2201.1	3	1	1	3	1
SH2201.2	1	3	1	1	-
SH2201.3	1	1	3	1	-
SH2201.4	1	1	1	1	3
SH2201.5	1	1	1	1	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2301							Course category			PE
Course Name	PROGRAM ELECTIVE-III (A) ADVANCED DATA SCIENCE										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hr 30 min	--	---	100	03

Course objective:

1. To provide you with the knowledge and expertise to become a proficient data scientist.
2. To demonstrate an understanding of statistics and machine learning concepts that are vital for data science
3. Produce Python code to statistically analyze dataset
4. Critically evaluate data visualizations based on their design and use for communicating stories from data
5. To implement data science techniques for real time problems.

Course Content

Introduction to Data Science: Selecting rows/observations, rounding numbers, selecting columns, merging data, data aggregation, and data munging techniques.

Python basics: Python basics, python packages, importing data, manipulating data

Basics of Statistics: Central Tendency, Probability basics, Standard Deviation, Bias Variance Tradeoff, Distance Metrics, Outlier analysis, Missing Value Treatment, Correlation

Error Metrics: Classification, Regression- MSE, RMSE, MAPE

Data Visualization using Python: Read complex JSON files, Distribution of Data, Data Visualization methods.

Data Visualization tools: Power BI- Basics of Power BI, creating, managing and filtering data, and Basic plots in Power BI. Tableau- Introduction to Tableau, connecting, managing and aggregating data, Visual Analytics in Tableau, Simple predictive analytics using tableau.

Text Books:

1. Cathy O'Neil and Rachel Schutt. , Doing Data Science, Straight Talk from The Frontline. O'Reilly.

2. Jure Leskovek Anand Rajaraman and Jeffrey Ulman. Mining of Massive Datasets. v2.1, Cambridge University press.

Course Outcomes:

Upon successful completion of this course, students will be able to

CS2301(A).1	Explain how data is collected, managed and stored for data science
CS2301(A).2	Implement data science tools for data analysis and data visualization
CS2301(A).3	Implement Power BI for real-world problems
CS2301(A).4	Apply the various plotting tools for data science
CS2301(A).5	Implement Tableau for data plotting and visualization.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2301 (A).1	2	-	-	1	3
CS2301(A).2	-	1	2	-	1
CS2301(A).3	2	2	-	2	-
CS2301(A).4	-	-	-	1	-
CS2301(A).5	1	2	1	-	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2301							Course category		PE
Course Name	PROGRAM ELECTIVE-III (B) HUMAN COMPUTER INTERACTION									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hr 30 min	--	---	100	03

Course Objectives:

1. Students will gain theoretical knowledge of and practical experience in the fundamental aspects of designing and implementing user interfaces.
2. Students will learn to analyze interaction problems from a physiological, perceptual, technical, cognitive, and functional perspective.
3. Students will develop an awareness of the range of general human-computer interaction issues that must be considered when designing information systems.
4. Students will learn about multimodal displays for conveying and presenting information.
5. Students will know and have practiced a variety of simple methods for designing and evaluating the quality of user interfaces and spatial displays.

Course Contents:

HCI foundation: history, human abilities, state of the art in computing technology, interaction styles and paradigms;

Design process: interaction design basics, HCI in software process, design rules and guidelines, implementation support (UI software), universal design;

Interaction styles: direct manipulation, WIMP, web interface, natural language interaction; Evaluation techniques;

Models in HCI: formal models, linguistic models, cognitive models (KLM/GOMS), cognitive architectures, hybrid models; Task analysis; Dialogue design;

Advanced topics: (overview) pervasive computing, CSCW, virtual reality, tangible user interface, multimedia.

Text Book:

1. A. Dix, J. Finlay, G. D. Abowd and R. Beale, Human Computer Interaction, 3rd edition, Pearson Education, 2005.

References:

1. J. Preece, Y. Rogers, H. Sharp, D. Baniyon, S. Holland and T. Carey, Human Computer Interaction, Addison-Wesley, 1994.
2. C. Stephanidis (ed.), User Interface for All: Concepts, Methods and Tools. Lawrence Erlbaum Associates, 2001.
3. J. M. Caroll (ed.), HCI Models, Theories and Frameworks: Towards a Multidisciplinary Science (Interactive Technologies), Morgan Kauffman, 2003.
4. W. O Galitz, The Essential Guide to User Interface Design, John Wiley & Sons, Inc, 2002 (Indian Edition).
5. B. Shneiderman, Designing the User Interface, Addison Wesley, 2000 (Indian Reprint).

Course Outcomes:

CS2301(B).1 Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.

CS2301(B).2 Apply an interactive design process and universal design principles to designing HCI systems.

CS2301(B).3 Describe and use HCI design principles, standards and guidelines.

CS2301(B).4 Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.

CS2301(B).5 Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2301 (B).1	2	-	-	1	3
CS2301(B).2	-	1	2	-	1
CS2301(B).3	2	2	-	2	-
CS2301(B).4	-	-	1	2	-
CS2301(B).5	1	2	2	-	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2301							Course category		PE
Course Name	PROGRAM ELECTIVE-III (C) NATURAL LANGUAGE PROCESSING									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hr 30 min	--	---	100	03

Course Objectives:

1. To be familiar with the concepts and tasks in natural language processing.

2. To gain a foundational understanding about the methods and evaluation metrics for various natural language processing tasks.

3. To learn how to evaluate the strength and weaknesses of various NLP technologies and frameworks.

4. To gain practical experience in the NLP toolkits available.

5. To gain basic skills for conducting NLP research, including reading and analyzing research papers, analyzing results, and how to improve the approaches.

Course Contents:

Introduction: What is NLP, Fundamental and Scientific goals, Engineering goals, stages of NLP, problems in NLP, Applications of NLP, Empirical Laws of language, zipf's law, Heap's law.

Basic Text Processing: Tokenization, word token, word type, sentence segmentation, feature extraction, issues in tokenization for different languages, word segmentation, text segmentation, normalization, case folding, Spelling Correction, Morphology, Stemming, Porters Algorithm, , lemmatization, spelling correction - dynamic programming approach for finding edit distance, N-gram Language Modeling- context sensitive spelling correction, probabilistic language model, auto completion prediction, Evaluation and perplexity, Smoothing techniques.

POS Tagging: Sequence labeling tasks of NLP, POS tagging, POS tag sets, Hidden Markov Model Introduction, Markov Processes, HMM characterization -Likelihood of a sequence (Forward Procedure, Backward Procedure), Best state sequence (Viterbi Algorithm), Re-estimation(Baum Welch - Forward-Backward Algorithm) , Models for Sequential tagging – Maximum Entropy, Conditional Random Field.

Syntax Constituency and dependency parsing: Constituency parser -Syntactic structure, Parsing methodology, Different parsing algorithms, Parsing in case of ambiguity, Probabilistic parsing, CKY

algorithm, Issues in parsing, Dependency parsing- Syntactic structure, Parsing methodology, Transition-Based Dependency Parsing, Graph-Based dependency parsing, Evaluation, Co-reference resolution, Named-entity recognition. Unit V: Knowledge Base and Semantics

WordNet: Word Senses, Word relations, Word similarity and thesaurus methods, Word sense disambiguation, WordNet. Lexical and Distributional Semantics - Introduction, models of semantics, applications.

Word Embedding's: Introduction, one-hot vectors, methods of generating word embedding's, Skip-gram, CBOW, Glove model, Fast Text model, evaluation measures-rough scores.

Text Books:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Second Edition, Prentice Hall, 2008, ISBN: 978-0131873216.
2. Allen James, "Natural Language Understanding", Second Edition, Benjamin/Cumming, 1994, ISBN: 978-0805303346.
3. Chris Manning and Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", MIT Press, ISBN: 978-0262133609

Course Outcome:

CS2301(C)1. Apprehend the wide spectrum of problem statements, tasks, and solution approaches within NLP.
CS2301(C)2. Implement and evaluate different NLP applications and apply machine learning and deep learning methods for this process.
CS2301(C)3. Evaluate various algorithms and approaches for the given task, dataset, and stage of the NLP product.
CS2301(C)4. Understand best practices, opportunities, and the roadmap for NLP from a business and product leader's perspective.
CS2301(C)5. Perform POS tagging for a given natural language and Select a suitable language modelling technique based on the structure of the language.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2301 (C).1	3	1	-	1	3
CS2301(C).2	-	2	2	-	2
CS2301(C).3	2	2	-	2	1
CS2301(C).4	-	1	1	2	-
CS2301(C).5	2	2	3	-	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	CS2301							Course category			PE
Course Name	PROGRAM ELECTIVE-III (D) IMAGE PROCESSING										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory				Practical		Total	
				MSE	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	30	10	60	2 hr 30 min	--	---	100	03

Course Objectives:

1. To gain the adequate background knowledge about image processing.

2. To implement practical knowledge and skills about image processing.

3. To acquire necessary knowledge to design and implement a prototype of an image processing and pattern recognition application.

4. To understand image analysis algorithm.

5. To study image restoration procedures.

Contents:

Introduction: Digital Image, Pixels, Representation of Digital Images, Resolution, Light, Brightness adaptation and discrimination, Image sensing and acquisition, Image sampling and quantization, Pixel Relationships, Distance Measures, Image Interpolation

Image Enhancement: Spatial Domain Methods: Arithmetic and logical operations, pixel or point operations. **Histogram based image enhancement:** Histogram modelling, and equalization. Basics of spatial filtering, smoothening and sharpening spatial filters. Image Enhancement in the Frequency Domain. Gaussian filters, Homomorphic filtering **Fundamental of color image processing:** color models, RGB, CMY, YIQ, HIS. Pseudo Color Image processing

Image Segmentation: Some Basic Relationships between pixels, point, line and edge detection. SOBEL, PREWITT, ROBERT, Gradient operators, canny edge detection and Chain codes. Thresholding, Region based segmentation, Region growing, region splitting and merging. Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images.

Image Restoration and Image Compression: Restoration Process, Noise Models, Restoration in Presence of Noise Only, Periodic Noise, Reduction by Frequency Domain Filtering, Estimating the Degradation Function, Degradation model, Algebraic Approach to Restoration Inverse filtering, Wiener filter, Constrained

Least Square Restoration Data redundancies, Elements of information, variable-length coding, predictive coding, Transform coding, Huffman Coding.

Morphological Image Processing: Basics, Structure Element, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, ―Digital Image Processing‖, Pearson Reprint, 2001
2. S. Theodoridis, K. Koutroumbas, Pattern Recognition, 4th edition, Academic Press, 2009.

Referenced Books:

1. R. O. Duda, P. E. Hart, D. G. Stork, Pattern Classification, 2nd edition, John Wiley & Sons, Inc., 2000
2. Anil K. Jain, ―Fundamentals of Digital Image Processing‖, Prentice-Hall of India, New Delhi, 2001. 3. Latest Relevant Research Papers

Course Outcome

CS2301(D).1	To define the basic terminologies of image processing.
CS2301(D).2	To apply intensity transformation and spatial filtering
CS2301(D).3	Understand the methodology for image segmentation and restoration techniques.
CS2301(D).4	Apply image processing algorithms in practical applications.
CS2301(D).5	Implement the morphological image processing.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5
CS2301(D).1	3	1	-	1	3
CS2301(D).2	-	2	2	-	2
CS2301(D).3	2	2	-	2	1
CS2301(D).4	-	1	1	2	-
CS2301(D).5	2	2	3	-	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated