Gurugram University Gurugram

Curriculum for UG Degree Course in

Computer Science and Engineering (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

Gurugram University, Gurugram

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Category	Breakup of Credits (Total 160)
1	Humanities and Social Sciences, including Management courses	11
2	Basic Science courses	16
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	34.5
4	Professional core courses	63
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Environmental Sciences, Induction training, Constitution of India, Essence of Indian Traditional Knowledge]	Non-credit
	Total	**164.5**

SEMESTER-WISE SUMMARY OF THE PROGRAM

S. No.	Semester	No. of Contact Hours	Credits	Marks
1.	I	25	19.5	900
2.	II	25	22	900
3.	III	28	22	1000
4.	IV	26	22	1000
5.	V	29	22	1000
6.	VI	26	22	900
7.	VII	27	21	900
8.	VIII	22	14	500
	Total		164.5	7100

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences, including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PT	Practical Training
PROJECT	Project

7TH SEMESTER

B. Tech. (Computer Science and Engineering- Artificial Intelligence & Machine Learning)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VII

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)			
				L	T	P			Marks of classwork	Theory	Practical	Total
1.	**PCC**		Intelligent and Expert System	3	0	0	3	3	30	70		100
2.	**PEC**		Professional Elective Course - IV	3	0	0	3	3	30	70		100
3.	**PEC**		Open Elective Course - III	3	0	0	3	3	30	70		100
4.	**OEC**		Open Elective Course - IV	3	0	0	3	3	30	70		100
5.	**HSMC**		Organizational Behaviour	3	0	0	3	3	30	70		100
6.	**LC**		Intelligent and Expert System Lab	0	0	2	2	1	50		50	100
7.	**PROJECT**		Project - II	0	0	8	8	4	100		100	200
8.	**PT**		Practical Training - II	0	0	2	2	1	50		50	100
			Total	**15**	**0**	**12**	**27**	**21**	**350**	**350**	**200**	**900**

NOTE:

1. **The evaluation of Practical Training – II will be based on the seminar, viva-voice, and report submitted by the students.**
2. **Choose any one from Professional Elective Course – IV**
3. **Choose any one from Open Elective Course – III & IV**

Professional Elective Course – IV

1. Cyber Security Threats
2. Advanced Computer Architecture
3. Web Mining
4. Natural Language Processing
5. Image Analytics
6. Information Hiding Techniques

INTELLIGENT AND EXPERT SYSTEM

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Intelligent and Expert System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understanding AI programming as base of Intelligent System.
2. Understand the Expert system architecture and its development cycle.
3. Understand problem with Expert system.
4. Gaining knowledge of tools and their implementation.
5. Building expert system for a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT - I

Introduction to Intelligent System: AI programming, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Minmax algorithms, game playing – Alpha-beta pruning.

Introduction to Expert Systems: Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

UNIT - II

Expert system development life cycle: Problem selection, Prototype construction, Formalization, Implementation, Evaluation, Knowledge acquisition: Knowledge engineer, Cognitive behavior, Acquisition techniques.

Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts, difficulties during development

UNIT – III

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems.

Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process.

UNIT – IV

Expert Systems and their Applications: Justification, structure, knowledge sources; Expert knowledge acquisition; Expert system languages; ES building tools/shells; Applications of AI in CAD, CAPP, process selection, GT, MRP II, adaptive control, robotics, process control, fault diagnosis, failure analysis, etc

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the fundamentals of Intelligent System and the main research activities in this field.

CO2: Emphasizing knowledge on various Artificial Intelligence algorithms.

CO3: Understanding the architecture of an expert system and its tools for real-world applications.

CO4: Understand the importance of building an expert system

CO5: Understanding the various challenges involved and problems with an expert system.

TEXT AND REFERENCE BOOKS:

1. Elain Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, New Delhi.
2. Waterman D.A., "A Guide to Expert Systems", Addison Wesley Longman.
3. Stuart Russel and other Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice-Hall.
4. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley.
5. Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999.
6. Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley
7. Weiss S.M. and Kulikowski C.A., "A Practical Guide to Designing Expert Systems", Rowman & Allanheld, New Jersey.

ORGANIZATIONAL BEHAVIOR

Semester	VII				
Course code					
Category	HSMC				
Course title	Organizational Behavior				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

UNIT - II

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - II

Introduction of organization: - Meaning and process of Organization, Management v/s Organization;

Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.

Individual Processes and Behavior-Personality- Concept, determinants and applications; **Perception-** Concept, process and applications,

Learning- Concept (Brief Introduction);

Motivation- Concept, techniques and importance.

UNIT - III

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group,

Conflict- Concept, sources, types, management of conflict;

Leadership: Concept, function, styles & qualities of leadership.

Communication – Meaning, process, channels of communication, importance and barriers of communication.

UNIT - IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior;

Organizational culture - Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Students will be able to apply the managerial concepts in practical life.

CO2: The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.

CO3: Students will be able to understand the behavioral dynamics in organizations.

CO4: Students will be able to understand the organizational culture and change.

CO5: To develop creative and innovative ideas that could positively shape the organizations.

CO6: To accept and embrace in working with different people from different cultural and diverse background in the workplace.

TEXT AND REFERENCE BOOKS:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, OrganisationalBehaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding OrganisationalBehaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., OrganisationalBehaviour, Prentice Hall of India, New Delhi.
7. GhumanKarminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi

INTELLIGENT AND EXPERT SYSTEM LAB

Semester	VII				
Course code					
Category	Laboratory course				
Course title	Intelligent and Expert System Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

Note:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 5 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

CONTENTS

Implementation / development of programs using Python or any suitable Programming Language.

1. Developing agent programs for real world problems
2. Implementation and Analysis of DFS and BFS for an application
3. Developing Best first search and A* Algorithm for real world problems
4. Implementation of minimax algorithm for an application
5. Implementation of uncertain methods for an application
6. Implementation of block world problem
7. Implementation of learning algorithms for an application
8. Development of ensemble model for an application
9. Expert System case study
10. Implementation of NLP programs
11. Applying deep learning methods to solve an application.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Apply AI techniques and technologies to solve real world business problems

CO2: Understand the fundamentals of theorem proving using AI tools

CO3: Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

CO4: Identify and apply the suitable Expert models for the given real-world problem.

CO5: Undertake problem identification, formulation and solution in Expert System

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PRACTICAL TRAINING – II

Semester	VII				
Course code					
Category	Practical Training (PT)				
Course title	Practical Training - II				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50				
Exam	50				
Total	100				
Duration of Exam	02 Hours				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students.

PROJECT - II

Semester	VII				
Course code					
Category	Project				
Course title	Project - II				
Scheme and Credits	L	T	P	Credits	
	0	0	8	4	
Classwork	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE

1. To allow students to demonstrate a wide range of the skills by working on PROJECT-I that has passed through the design, analysis, testing and evaluation.
2. To encourage problem solving skills.
3. To allow students to develop problem solving, synthesis and evaluation skills.
4. To encourage teamwork and leadership.
5. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation.

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

1. Synopsis submission (10 marks)
2. 1st mid-term progress evaluation (10 marks)
3. 2nd mid-term progress evaluation (10 marks)
4. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project solution.
CO2: Undertake problem solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Conduct the remaining engineering project.
CO5: Communicate with team members at large in written an oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

Professional Elective Course - IV

CYBER SECURITY THREATS

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Cyber Security Threats				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. The learner will gain knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.
2. The learner will understand key terms and concepts in cyber law, intellectual property and cybercrimes, trademarks and domain theft.
3. The learner will be able to examine secure software development practices.
4. The learner will understand principles of web security.
5. The learner will be able to incorporate approaches for risk management and best practices.
6. The learner will gain an understanding of cryptography, how it has evolved, and some key encryption techniques used today.

UNIT - II

Introduction: Security threats - Sources of security threats- Motives - Target Assets and vulnerabilities – Consequences of threats- E-mail threats - Web-threats - Intruders and Hackers, Insider threats, Cyber crimes. Network Threats: Active/ Passive – Interference – Interception – Impersonation – Worms –Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels – Backdoors – Bots – IP, Spoofing - ARP spoofing - Session Hijacking - Sabotage-Internal treats Environmental threats - Threats to Server security.

UNIT - II

Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation –Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools –Threat identification - Threat Analysis - Threat Modelling - Model for Information Security Planning.

UNIT - III

Security Elements: Authorization and Authentication - types, policies and techniques – Security certification - Security monitoring and Auditing - Security Requirements Specifications – Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots

UNIT - IV

Access control, Trusted Computing and multilevel security - Security models, Trusted Systems, Software security issues, Physical and infrastructure security, Human factors – Security awareness, training, Email and Internet use policies.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.

CO2: Design, develop, test and evaluate secure software.

CO3: Develop policies and procedures to manage enterprise security risks.

CO4: Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.

CO5: Interpret and forensically investigate security incidents.

TEXT AND REFERENCE BOOKS:

1. Swiderski, Frank and Syndex, “Threat Modeling”, Microsoft Press, 2004.
2. William Stallings and Lawrie Brown, “Computer Security: Principles and Practice”, Prentice Hall, 2008.
3. Joseph M Kizza, “Computer Network Security”, Springer Verlag, 2005
4. Thomas Calabres and Tom Calabrese, “Information Security Intelligence: Cryptographic Principles & Application”, Thomson Delmar Learning, 2004.

ADVANCED COMPUTER ARCHITECTURE

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Advanced Computer Architecture				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To make students know about the Parallelism concepts in Programming.
2. To give the students an elaborate idea about the different memory systems and buses.
3. To introduce the advanced processor architectures to the students.
4. To make the students know about the importance of multiprocessor and multicomputer.
5. To study about data flow computer architectures.

UNIT - II

Architecture And Machines: Some definition and terms, interpretation and microprogramming. The instruction set, Basic data types, Instructions, Addressing and Memory. Virtual to real mapping. Basic Instruction Timing.

UNIT - II

Cache Memory Notion: Basic Notion, Cache Organization, Cache Data, adjusting the data for cache organization, write policies, strategies for line replacement at miss time, Cache Environment, other types of Cache. Split I and D-Caches, on chip caches, Two level Caches, write assembly Cache, Cache references per instruction, technology dependent Cache considerations, virtual to real translation, overlapping the Tcycle in V-R Translation, studies. Design summary.

UNIT - III

Memory System Design: The physical memory, models of simple processor memory interaction, processor memory modeling using queuing theory, open, closed and mixedqueue models, waiting time, performance, and buffer size, review and selection of queuing models, processors with cache.

UNIT - IV

Concurrent Processors: Vector Processors, Vector Memory, Multiple Issue Machines, Comparing vector and Multiple Issue processors.

Shared Memory Multiprocessors: Basic issues, partitioning, synchronization and coherency, Type of shared Memory multiprocessors, Memory Coherence in shared Memory Multiprocessors.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the Concept of Parallel Processing and its applications.
CO2: Implement the Hardware for Arithmetic Operations.
CO3: Analyze the performance of different scalar Computers.
CO4: Develop the Pipelining Concept for a given set of Instructions.
CO5: Distinguish the performance of pipelining and non-pipelining environment in a processor.

TEXT AND REFERENCE BOOKS:

1. Advance computer architecture by Hwang & Briggs, 1993, TMH.
2. Pipelined and Parallel processor design by Michael J. Fiynn – 1995, Narosa

WEB MINING

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Web Mining				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand the architecture of web, mining the data, issues, challenges.
2. To study the methods of extracting knowledge from web data, text and unusual data.
3. To understand and use data mining language like R, Python etc.
4. To understand the optimization of web and its applications.

UNIT - II

Data Mining Foundations: Basic concepts in data Mining, Web mining versus Data mining, discovering knowledge from Hypertext data; An overview of web mining: What is Web mining, Web mining taxonomy, Web mining subtasks, issues, challenges

UNIT - II

Web Search and Information Retrieval: Information Retrieval Models, Web Search and IR, Text Mining, Latent Semantic Indexing, Web Spamming, Clustering and Classification of Web Pages, Information Extraction, Web Content Mining;

UNIT - III

Optimization: Introduction to Models and Concept of Computational Intelligence, Social Behavior as Optimization: Discrete and Continuous Optimization Problems, Classification of Optimization Algorithms, Evolutionary Computation Theory and Paradigm, Swarm and Collective intelligence

UNIT - IV

Swarm Intelligence Techniques: Particle Swarm Optimization, Ant Colony Optimization, Artificial Bees and Firefly Algorithm etc., Hybridization and Comparisons of Swarm Techniques, Application of Swarm Techniques in Different Domains and Real-World Problems

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Analyse the power of web search engine by classifying the web documents and identifying the web pages

CO2: Learn how the Web mining helps to improve the power of web search engine by classifying the web documents and identifying the web pages.
CO3: How to predict user behaviour in the web.
CO4: For a given data set how the optimization will be performed.
CO5: Understand the working logic of swarm intelligence techniques.

TEXT AND REFERENCE BOOKS:

1. Witton Frank, Data Mining, Morgan Kauffan Publishers.
2. Kennedy, J. and Eberhart, R.C., Swarm Intelligence, Morgan Kaufmann Publishers, 2001
3. Bonabeau, E., Dorigo, M. and Theraulaz, G., Swarm Intelligence: From Natural to Artifical Systems, Oxford University Press, 1999
4. Dorigo, M., Stutzle, T., Ant Colony Optimization, MIT Press, 2004
5. Parsopoulos, K.E., Vrahatis, M.N., Particle Swarm Optimization and Intelligence: Advances and Applications, Information Science Reference, IGI Global, 2010
6. Clerc, M., ParticleSwarm Optimization, ISTE, 2006
7. Nature Inspired Metaheuristic Algorithms, Xin-She Yang, Luniver Press, 2010

NATURAL LANGUAGE PROCESSING

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Natural Language Processing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.
2. Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.
3. Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis).
4. Evaluate the performance of NLP tools and systems.

UNIT - I

Introduction: A computational framework for natural language, description of English or an Indian language in the framework lexicon, algorithms and data structures for implementation of the framework, Finite state automata, the different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.

UNIT - II

Word level and syntactic analysis

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of-Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine-readable dictionaries and lexical databases, RTN, ATN.

UNIT - III

Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.

Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG.

Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.

UNIT - IV

Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation

Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- **CO1:** Understand language and the tools that are available to efficiently study and analyse large collections of text.
- **CO2:** Understand the concepts of linguistic foundations that underlie natural language processing, which would provide the knowledge for building components of NLP systems.
- **CO3:** Learn computational frameworks for natural language processing.
- **CO4:** Demonstrate the concepts of morphology, syntactic analysis, semantic interpretation and pragmatics of the language, and understanding them to apply in different research areas.
- **CO5:** Recognize the significance of research in natural language processing for common NLP tasks such as text classification, spam filtering, spell checking, machine learning, etc. to engage in lifelong learning.
- **CO6:** Understand the concepts of linguistic foundations that underlie natural language processing, which would provide the knowledge for building components of NLP systems.

TEXT AND REFERENCE BOOKS:

1. Natural Language understanding by James Allen, Pearson Education, 2002.
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.
3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
5. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley
6. https://www.coursera.org/specializations/natural-language-processing

IMAGE ANALYTICS

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Image Analytics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

5. Learn Fundamentals of Image Processing.
6. Understand the morphology of image processing.
7. Understand Image segmentation, feature extraction and feature selection.
8. Understand and implementation of Image pattern classification.

UNIT – I

Introduction – Fundamental steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – Mathematical Tools Used in Digital Image Processing. Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, Power-Law Transformations - Histogram Processing. Color Fundamentals - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters.

UNIT - II

Morphological Image Processing:

Morphological Image Processing: Fundamentals - Erosion and Dilation - Opening and Closing – Hit or Miss Transform - Some Basic Morphological Algorithms – Morphological Reconstruction – Grayscale Morphology

UNIT - III

Image Segmentation

Introduction - Point, Line, and Edge Detection – Thresholding: Foundation, Basic Global thresholding, Optimum Global Thresholding using Otsu's Method, Multiple Thresholds, Variable Thresholding – Segmentation by Region Growing and by Region Splitting and Merging – Image Segmentation: Active Contours: Snakes and Level Sets.

Feature Extraction

Background - Representation – Boundary Preprocessing – Boundary Feature Descriptors: Some Basic Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments - Regional Feature Descriptors: Some Basic Descriptors, Topological and Texture Descriptors, Moment Invariants – Principal Components as Feature Descriptors – Whole-image Features Object – Scale-Invariant Feature Transform (SIFT).

UNIT - IV

Image Pattern Classification

Background -Patterns and Pattern Classes – Pattern Classification by Prototype Matching: Minimum-Distance Classifier, Using Correlation for 2-D prototype matching, Matching SIFT Features, Matching Structural Prototypes - Optimum (Bayes) Statistical Classifiers – Neural Networks and Deep Learning: Background - The Perceptron - Multilayer Feedforward Neural Networks - Deep Convolutional Neural Networks

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Infer the basics and fundamentals of digital image processing

CO2: Apply the various techniques for intensity transformations functions. Implement color image smoothing and sharpening.

CO3: Illustrate Morphological operation and apply Some Basic Morphological Algorithms.

CO4: Apply image segmentation techniques such as Optimum Global Thresholding, Active Contours: Snakes and Level Sets for various real-time applications.

CO5: Analysis various Feature Extraction methods and implement for various real-time applications.

CO6: Apply and Analysis various Image Pattern Classification methods such as Minimum-Distance Classification, Optimum (Bayes) Statistical Classification, and Neural Network

TEXT AND REFERENCE BOOKS:

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, 4th Edition, Pearson, 2018.
2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. Anil K.Jain, “Fundamentals of Digital Image Processing”, Person Education, 2003.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

INFORMATION HIDING TECHNIQUES

Semester	VII				
Course code					
Category	Professional Elective Courses				
Course title	Information Hiding Techniques				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To learn about data hiding applications and their techniques.
2. To learn about hacking.
3. To learn security-based protocols, attacks and intrusions.
4. To work with advance data hiding techniques.

UNIT - II

Introduction to Information Hiding: Types of Information Hiding, Applications, Importance & Significances. Differences between cryptography and steganography, Wisdom from Cryptography, types of steganography their application and significances. Past present and future of steganography

UNIT - II

Framework for Secret Communication, Security of Steganography System, Information Hiding in Noisy Data, Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text, Steganographic system, Study of Different methods of insertion and retrieval of message using image steganography, Study of histrogram analysis using MATLAB of original image and stegno image

UNIT - III

Basics of watermarking, Watermarking process, Watermarking applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking, Bit plane of an Image, study of noises in stego images and their comparisons, Robustness of watermarking schemes on different attacks like blurring, cropping , compression of theimage. PSNR calculation of the images.

UNIT - IV

Use of image steganography in biometric sciences, Study of security enhancement of biometric template using steganographic Frame proof codes:-Definition, Introduction of frame proof codes, Methods to obtain 2- frame proof codes using mutually orthogonal latin squares. Use of frame proof codes in ownership and software piracy.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain information security.

CO2: Give an overview of access control of relational databases.

CO3: State the basic concept in information systems security, including security technology and principles, software security and trusted systems and IT security management.

CO4: Learn advance data hiding techniques.

CO5: Understand how to apply these data hiding techniques in real-life projects.

TEXT AND REFERENCE BOOKS:

1. Recent Advancesin Information Hiding and Applications, Pan, J.-S., Huang, H.-C., Jain, L.C., Zhao, Y., Springer (2013).
2. Information Hiding Techniques for Steganography and Digital Watermarking, Stefan Katzenbeisser, Fabien A. P. Petitcolas, Artech House, 2000.

8TH SEMESTER

B.Tech. (Computer Science and Engineering- Artificial Intelligence & Machine Learning)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VIII

S. No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	**ESC**		MOOC – 1 (Essential)	3	-	-	-	3	-	-	-	100	-
2.	**ESC**		MOOC – 2 (Essential)	3	-	-	-	3	-	-	-	100	-
3.	**PROJECT**		Project – III/Industrial Training	0	0	16	16	8	150		150	300	3
			Total	**6**	**0**	**16**	**22**	**14**	**150**	**-**	**150**	**500**	

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

PROJECT – III

Semester	VIII				
Course code					
Category	Project				
Course title	Project - III				
Scheme and Credits	L	T	P	Credits	
	0	0	16	8	
Classwork	150 Marks				
Practical	150 Marks				
Total	300 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE

1. To allow students to demonstrate a wide range of the skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation
   To encourage multidisciplinary research through the integration learned in a number of courses.
2. To allow students to develop problem solving, analysis, synthesis and evaluation skills.
3. To encourage teamwork.
4. To improve students' communication skills by asking them to produce both a professional report and a professional poster and to give an oral presentation

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

5. Synopsis submission (10 marks)
6. 1st mid-term progress evaluation (10 marks)
7. 2nd mid-term progress evaluation (10 marks)
8. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Demonstrate a sound technical knowledge of their selected project topic.
CO2: Undertake problem identification, formulation and solution.
CO3: Design engineering solutions to complex problems utilising a systems approach.
CO4: Conduct an engineering project.
CO5: Communicate with engineers and the community at large in written an oral form.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

MOOC - I

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - I				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

MOOC - II

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - II				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCS courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.