SCHEME OF INSTRUCTION AND EXAMINATION
B. E (AIML)-Working Professionals
SEMESTER- VII

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	PC 701AI	Generative AI	3	0	-	3	3	40	60	3
2	PC 702AI	Natural Language Processing	3	0	-	3	3	40	60	3
3	PC 703AI	Information Retrieval System	3	0	-	3	3	40	60	3
4	PC 704AI	Block Chain Technologies	3	0	-	3	3	40	60	3
	Professional Elective – IV									
5	PE 710AI	Scalable Architecture for large Applications	3	0		3	3	40	60	3
	PE 711AI	Augmented Reality and Virtual Reality								
	PE 712 AI	Explainable AI								
Practicals										
6	PC751AI	Natural Language Processing Lab	-	-	2	-	3	25	50	1
7	PC752AI	Seminar -1	-	-	6	-	-	25	50	3
8	PW761AI	Project Work – I			14	-	-	50	-	7
			21	--	22	21	24	380	520	26

PC 701AI	GENERATIVE AI					
CORE						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
1	Understand and implement modern generative models for text, images, and other modalities
2	Adapt foundation models using prompting and fine-tuning techniques
3	Analyze scaling laws, attention mechanisms, and diffusion processes
4	Develop applied generative AI solutions with real-world impacts
5	Explore ethical considerations, risks, and interpretability challenges of generative AI

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Build and evaluate generative models like RNNs, Transformers, GANs, and VAEs
CO-2	Apply in-context learning, parameter-efficient tuning, and reinforcement learning from human feedback (RLHF)
CO-3	Analyze the architecture and optimization of large foundation models for diverse modalities
CO-4	Explore cutting-edge applications such as text-to-image generation, code generation, and autonomous agents
CO-5	Evaluate ethical, safety, and interpretability issues in generative AI systems

UNIT– I

Text Generation & Language Models :
- Introduction to RNN, LSTM, and Transformer-based language models
- Decoding strategies (sampling, beam search)
- Pre-training & fine-tuning
- Foundation models (e.g., GPT, T5, BERT)
- Applications: Chatbots, text completion, summarization

UNIT – II

Generative Models for Images & Diffusion
- CNNs and Vision Transformers
- Generative Adversarial Networks (GANs)
- Diffusion models: Denoising Score Matching, DDPM
- Variational Autoencoders (VAEs)
- Applications: Text-to-image (DALL·E), image inpainting

UNIT – III
Adaptation & Control of Generative Models - In-context learning - Prompt engineering and Prompt-to-Prompt - Fine-tuning: LoRA, Adapter tuning - Reinforcement Learning from Human Feedback (RLHF) - Applications: Instruction tuning, controlled generation

UNIT– IV
Scaling Laws & Efficient Training - Scaling laws in deep learning - Mixture-of-Experts (MoE) - Efficient attention: Flash Attention, Long former - Parallel and distributed training - Applications: Efficient deployment of large models

UNIT –V
Multimodal, Ethical & Emerging Applications - Multimodal models: CLIP, Flamingo, Video Generation - Generative models for code (Codex), agents (Auto GPT) - Interpretability and hallucinations - AI alignment, safety, and bias mitigation

Suggested Reading:

1	Vaswani et al. (2017), Radford et al. (2019) for Unit-I topics
2	Goodfellow et al. (2014), Ho et al. (2020), Kingma & Welling (2014) for Unit-II topics
3	Ouyang et al. (InstructGPT), DPO (2023) for Unit-III topics
4	Kaplan et al. (2020), Shazeer et al. (MoE), DAO models for Unit-IV topics
5	OpenAI Codex, DeepMind's Flamingo, Survey on Hallucination in LLMs for Unit-V topics

PC 702AI	NATURAL LANGUAGE PROCESSING					
CORE						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives

1. Learn elementary probability and information theory
2. Study the linguistic essentials
3. Comprehend statistical inference and word sense disambiguation
4. Understand evaluation measures and markov models
5. Learn probabilistic context free grammars

Course Outcomes – Learners on completion of the course, be able to

1. Explain elementary probability and information theory
2. Discuss the linguistic essentials
3. Describe statistical inference and word sense disambiguation
4. Elaborate evaluation measures and markov models
5. Elucidate probabilistic context free grammars

UNIT I
Introduction of Elementary Probability Theory, Essential Information Theory. Linguistic Essentials Corpus-Based Work Collocations.
UNIT II **Statistical Inference:** Bins: Forming Equivalence Classes, Reliability vs. Discrimination, n-gram models, Building ngram models, An Information Theoretic Approach.
UNIT III **Word Sense Disambiguation:** Methodological Preliminaries, Supervised and unsupervised learning, Pseudo words, Upper and lower bounds on performance, Supervised Disambiguation, Bayesian classification.
UNIT IV **Evaluation Measures, Markov Models:** Hidden Markov Models, Use, General form of an HMM Part-of-Speech Tagging
UNIT-V **Probabilistic Context Free Grammars:** Introduction of Clustering **Information Retrieval:** Background, The Vector Space Model.

Suggested Reading

1. Christopher D. Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
2. James Allan, Natural Language Understanding, Pearson Education, 1994.
3. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

PC 703AI	INFORMATION RETRIEVAL SYSTEM					
Prerequisites	Machine Learning		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To understand indexing and querying in information retrieval systems.
2.	To learn the different models for information retrieval.
3.	To expose the students to text classification and clustering.
4.	To learn about web searching.
5.	**To understand Web crawling and Indexes.**

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the algorithms and techniques for information retrieval (document indexing and retrieval, query processing).
2.	Quantitatively evaluate information retrieval systems.
3.	Classify and cluster documents.
4.	Understand the practical aspects of information retrieval such as those in web search engines.
5.	Expertise in matrix decompositions and latent semantic indexing.

UNIT – I

Boolean Retrieval: example information, Building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, determining the vocabulary of terms, faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, spelling correction.

Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, dynamic indexing, Other types of indexes.

UNIT – II

Index Compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, and Variant tf-idf functions.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.

UNIT – III

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

XML retrieval: Basic XML concepts, Challenges in XML retrieval, a vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

P**robabilistic information retrieval:** Basic probability theory, The Probability Ranking Principle. The Binary Independence Model.

Language models for information retrieval: Language models, the query likelihood model.

UNIT – IV

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbour, Linear versus nonlinear classifiers.

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete- link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT – V

Matrix decompositions and latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.

Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.

Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers. Link analysis: The Web as a graph, Page Rank, Hubs and Authorities.

References:

1.	Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England, 2008.
2.	David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2 nd Edition (Distributed by Universities Press), 2004.

Suggested Readings:

1.	Gerald J Kowalski, Mark T Maybury. Information Storage and Retrieval Systems, Springer, 2000.
2.	Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann Publishers, 2002.

PC 704AI	BLOCKCHAIN TECHNOLOGIES					
Prerequisites	Computer Security, Cryptography, Networking		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To Introduce the Theoretical Foundations of blockchain through bitcoin.
2.	To Introduce the Theoretical Foundations of blockchain through bitcoin.
3.	To Study Algorithms for Mining and Consensus implementation.
4.	To Study Ethereum and Smart contracts concepts.
5.	To Learn the concepts of Oracles and Decentralized Applications (DApps).
Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the principles of blockchain technologies and bitcoin.
2.	Be familiar with hash functions with wallets.
3.	Understand mining and consensus strategies.
4.	Understand Ethereum and tockens.
5.	Understand smart contracts of ethereum.

UNIT – I

Introduction: Bitcoin Uses, Use, Getting Started, Getting your first bitcoins, Sending and receiving bitcoins, Transactions, Blocks, Mining, The Genesis Block, Merkle Trees,Block Header Hash and the Blockchain.

Keys, Addresses, Wallets

Introduction of Crptography, Public key cryptography and crypto-currency, Private and Public Keys, Elliptic Curve Cryptography Explained Generating a public key, Bitcoin Addresses, Base58 and Base58Check Encoding Key Formats, Implementing Keys and Addresses, Wallets, Non-Deterministic (Random) Wallets, Deterministic (Seeded) Wallets, Mnemonic Code Words, Hierarchical Deterministic Wallets (BIP0032/BIP0044), Advanced Keys and Addresses, Encrypted Private Keys (BIP0038), Pay To Script Hash (P2SH) and Multi-Sig Addresses, Vanity Addresses, Paper Wallets.

UNIT – II

Transactions

Introduction of Transaction Lifecycle, Creating Transactions, Broadcasting Transactions to the Bitcoin Network, Propagating Transactions on the Bitcoin Network, Transaction Structure, Transaction Outputs and Inputs, Transaction Outputs, Transaction Inputs, Transactio fees, Adding Fees to Transactions.

Transaction Chaining and Orphan Transactions, Transaction Scripts and Script Language, Script Construction (Lock + Unlock), Scripting Language, Turing Incompleteness, Stateless Verification, Standard Transactions, Pay to Public Key Hash (P2PKH), Pay-to-Public-Key, Multi-Signature, Data Output (OP_RETURN) Pay to Script Hash (P2SH)

Mining and Consensus

De-centralized Consensus, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Transaction Age, Fees, and Priority, The Generation Transaction, Coinbase Reward and Fees ,Structure of the Generation Transaction, Coinbase Data, Constructing the Block Header ,Mining the Block ,Proof-of-Work Algorithm ,Difficulty Representation ,Difficulty Target and Re-Targeting ,Successfully Mining the Block ,Validating a New Block, Assembling and Selecting Chains of Blocks, Blockchain Forks, Mining and the Hashing Race, The Extra Nonce Solution ,Mining Pools, Consensus Attacks.

UNIT – III

What Is Ethereum

Compared to Bitcoin, Ether Currency Units, Choosing an Ethereum Wallet Control and Responsibility, Getting Started with MetaMask, Creating a Wallet Switching Networks, Getting Some Test Ethe, Sending Ether from MetaMask Exploring the Transaction History of an Address, Introducing the World Computer

Externally Owned Accounts (EOAs) and Contracts, A Simple Contract: A Test Ether Faucet.

Cryptography

Ethereum‘s Cryptographic Hash Function: Keccak-256 , Ethereum Addresses, Ethereum Address Formats ,Inter Exchange Client Address Protocol, Hex Encoding with Checksum in Capitalization (EIP-55)

The Ethereum Virtual Machine

What Is the EVM? Comparison with Existing Technology ,The EVM Instruction Set (Bytecode Operations), Ethereum State, Compiling Solidity to EVM Bytecode, Contract Deployment Code, Disassembling the Bytecode

UNIT – IV

Transactions

Transmitting Value to EOAs and Contracts, Transmitting a Data Payload to an EOA or Contract,Special Transaction: Contract Creation, Digital Signatures, The Elliptic Curve Digital Signature Algorithm, How Digital Signatures Work, Verifying the Signature, ECDSA Math ,Transaction Signing in Practice, Raw Transaction Creation and Signing, Raw Transaction Creation with EIP-155, The Signature Prefix Value (v) and Public Key Recovery, Separating Signing and Transmission (Offline Signing) ,Transaction Propagation ,Recording on the Blockchain, Multiple-Signature (Multisig) Transactions

Tokens

How Tokens Are Used, Tokens and Fungibility, Counterparty Risk, Tokens and Intrinsicality, Using Tokens: Utility or Equity, ERC223: A Proposed Token Contract Interface Standard, ERC777: A Proposed Token Contract Interface Standard, ERC721: Non-fungible Token (Deed) Standard

UNIT – V

Oracles: Why Oracles Are Needed, Oracle Use Cases and Examples, Oracle Design, Patterns Data Authentication, Computation Oracles, Decentralized Oracles, Oracle Client Interfaces in Solidity

Decentralized Applications (DApps): Introduction, Backend (Smart Contract), Frontend (Web User Interface), Data Storage, Decentralized Message Communications Protocols, A Basic DApp Example: Auction DApp, Auction DApp: Backend Smart Contracts, Auction DApp: Frontend User Interface, Further Decentralizing the Auction DApp, Storing the Auction DApp on Swarm, Preparing Swarm, Uploading Files to Swarm. The Ethereum Name Service (ENS) ,History of Ethereum Name Services, The ENS Specification, Bottom Layer: Name Owners and Resolvers, Middle Layer: The eth Nodes, Top Layer: The Deeds, Registering a Name, Managing Your ENS Name, ENS Resolver, Re solving a Name to a Swarm Hash (Content), From App to DApp

References:

1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies, Princeton University Press and Oxford, 2016
2.	Andreas M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, O‘Reilly, 2017.

Suggested Readings:

1.	Dr. Gavin Wood, Andreas M. Antonopoulos, Mastering Ethereum: Building Smart Contracts and Dapps, O‘Reilly, 2018.

PE710AI	SCALABLE ARCHITECTURES FOR LARGE APPLICATIONS					
CORE						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives:

- To introduce the idea of difference between implementing Machine learning algorithms and large scale Machine Learning.
- To understand and implement the specific libraries useful for Running ML applications using Spark.
- To learn the importance of processing using streaming data

Course Outcomes:

After completion of course, students will be able to:

1. Build architectures suitable for scaling across different kinds of applications
2. Understand and suggest the mechanisms in building scalable systems

UNIT –I

Introduction to Scalable applications, Challenges with running applications using Machine Learning with scaling, Algorithms for Large scale Learning, Overview of Hadoop and Current Big Data Systems.

UNIT- II

How Programming for Data Flow Differs, Basic Spark, Working with Vectors and Matrices in Spark, Brief tour of Spark ML, Beyond parallelization , Practical Big Data.

UNIT - III

Anatomy of Fast Data Applications, SMACK Stack – Functional Decomposition , Message Backbone- Understanding messaging requirements, Data ingestion, Fast data& low latency, Message Delivery Semantics, Distributing Messages.

UNIT - IV

Compute Engines- Micro Batch Processing, One-at-a time Processing, Choice of processing engine, Storage as the Fast Data Borders, The message backbone as Transition Point

UNIT V

Sharing Stateful Streaming State, Data Driven Micro-services, State and Micro-services.
Deployment environments for Fast Data Applications, Application containerization, resource scheduling, Apache Mesos, Kubernetes, Cloud Deployments.

Suggested Readings:

1. Jan Kunigk, Ian Buss, Paul Wilkinson & Lars George," *Architecting Modern Data Platforms*", O"reilly, 2019.
2. Gerard Maas, Stavros Kontopoulos, Sean Glover , "*Designing Fast Data Application Architectures*", O'Reilly Media, Inc., *June 2018.*
3. Bill Chambers, Matei Zaharia "*Spark- The definitive Guide*" , O'Reilly Media, Inc., *June 2019.*

PE711 AI	AUGMENTED REALITY AND VIRTUAL REALITY					
CORE						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
1	Introduce the fundamental concepts, characteristics, and applications of AR and VR technologies.
2	Equip students with skills in storytelling, design thinking, 3D modeling, and immersive content creation.
3	Teach principles of stereoscopic vision, haptics, and animation techniques for AR/VR experiences.
4	Train students in using game engines like Unity, C# scripting, and deploying VR applications
5	Enable students to apply design principles and iterative prototyping for developing immersive AR/VR experiences.

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Explain core principles, applications, and trends in AR and VR.
CO-2	Develop engaging AR/VR narratives using design thinking and storytelling methods
CO-3	Use stereoscopic rendering and haptic feedback in immersive systems.
CO-4	Build and deploy basic AR/VR applications using Unity and C# scripting.
CO-5	Apply UI/UX design and prototyping techniques for functional AR/VR product development

UNIT– I

Introduction to AR-VR: Characteristics of VR, Characteristics of AR, Applications of VR and AR, Future Trends and Considerations

Fundamentals Of AR/VR Content Creation:

Immersive Storytelling ,Design Thinking Process ,3D Modelling ,Interface Design Principles of AR and VR Content Creation ,Collaboration and Iteration

UNIT – II

Stereoscopic Vision & Haptic Rendering :

Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.

Fundamentals of Storytelling:

Foundational Principles of Storytelling, Storytelling in Immersive Mediums, Interactive and Emerging Narrative, Opportunity and Challenges

UNIT – III

Development Of Document For AR/VR Immersive Experience:

Fundamentals of Project Planning, Three Level Process, Project Planning Technical and Phase-wise Communication, Planning for Experiences

3d Graphics and Animation:

Introduction to Setting Up the Lighting and Rendering, Introduction to Animation, Visual Effects

Basics of Unity or Unreal :

Introduction to Game Engine, Game Objects, Asset Development, Idea and Script Development Layout Planning, Audio Design

UNIT– IV

AR-VR Development : Overview of AR/VR Development Tools and scripts- C# programming and scripting for AR and VR

C# programming introduction – data types and classes – programming logic – using C# to write scripts for Unity 3D – Using C# to animate and add advanced interactions to AR and VR models.

Creating Basic AR/VR Experiences- Virtual Reality Application essentials -

Virtual Reality fundamentals – VR design considerations – Using Unity 3D and C# programming to create VR applications – Oculus Quest VR headset fundamentals – User interface considerations - Creating a VR application and publishing to the Oculus VR headsets.

Optimisation Techniques

UNIT –V

Design Principles:

Fundamental Design Principles, Spatial Design Considerations

User Interface Design Inclusion , Visual Storytelling Techniques

Immersive Experience and Game Development With AR-VR:

Introduction to Immersive Technology , Industry Applications, Future Trends, and Innovations

Prototyping:

Understanding Prototyping ,Prototyping Tools and Techniques, Iterative Design Process,

Importance of AR/VR Product Development

Suggested Reading:

1	Augmented Reality, Virtual Reality, and Computer Graphics by byLucioTommaso De Paolis& Patrick Bourdot, 2019
2	Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing, By Erin Pangilinan, Steve Lukas, Vasanth Mohan, 2019

PE712AI	Explainable AI (XAI)					
CORE-IV						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
1	This course provides an Introduction to Explainable AI (XAI) through practical applications and real-world examples.
2	Students will gain a basic proficiency in interpreting and explaining the decisions of ML and AI systems, in a transparent and understandable manner to humans.
3	The course will cover various XAI techniques and algorithms, including rule-based models, feature importance analysis, model-agnostic approaches, and post-hoc explanations.

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Understand what Explainable AI is, its scope, and impact on various domains.
CO-2	Understand Global vs Local Explanations and their applications.
CO-3	Identify and evaluate the most used XAI techniques and algorithms.
CO-4	Use Python to apply Explainer algorithms/methods and interpret the results
CO-5	Critically evaluate and contextualize the performance and reliability of Explanations, and identify their limitations and biases.

UNIT– I :
Introduction to Explain ability : Course Overview and Introduction, Explaining Explainable AI, Overview of Python Data Stack, ML and AI Refresher

UNIT – II : Supervised Learning

Supervised Learning : Pre-model Explain ability, Partial Dependence Plots, Permutation Feature Importance Lime
Intro to Shapley: More on Shapley: Tree Models and other applications
Rule Based Methods: Anchors, Counterfactual Explanations, Summary of Structured Data Explainers.

UNIT – III : Images

Region of Interest(ROI), Lime for Images; Gradcam, Summary of Image Explainers

UNIT– IV : Unsupervised Learning

Pre-model Explain ability, Unsupervised Learning for Clustering, Summary of Unstructured Data Explainers

UNIT –V : Natural Language Programming(NLP)
Explaining Sentiment Analysis, Layer Integrated Gradients, Explaining Industry Classifier Model, Layer-Wise Relevance Propagation

Suggested Reading:

1	Textbook: Christoph Molnar, “Interpretable Machine Learning”. (2022)
2	Arrieta, Alejandro Barredo, et al. "Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI." Information fusion 58 (2020): 82-115.
3	Rudin, Cynthia, et al. "Interpretable machine learning: Fundamental principles and 10 grand challenges." Statistics Surveys 16 (2022): 1-85.

PC751AI	NATURAL LANGUAGE PROCESSING LAB					
Prerequisites			L	T	P	C
			0	0	2	1
Evaluation	CIE	50 Marks	SEE		25 Marks	

Natural Language Processing Lab – Problem Statements

This document outlines 14 NLP Lab problem statements aligned with the enhanced undergraduate syllabus. These labs provide hands-on exposure to classical NLP, deep learning, transformer models, prompting, and ethical AI evaluation.

Classical NLP and Language Modeling

Text Preprocessing and Analysis:

Write a Python program that performs tokenization, stemming, lemmatization, and frequency analysis on a large text corpus. Visualize the most frequent tokens using a word cloud.

POS Tagging and Named Entity Recognition:

Implement rule-based and statistical POS tagging and NER using NLTK and spaCy. Compare the performance across multiple datasets (news, legal, tweets).

N-gram Language Modeling:

Build a unigram and bigram language model from a given text corpus. Evaluate the models using perplexity and generate random sentences.

Text Classification using Traditional ML:

Design a text classification pipeline using TF-IDF and Logistic Regression or Naive Bayes for spam detection or sentiment analysis.

Deep Learning for NLP

Sequence Modeling with RNN and LSTM:

Train an LSTM model for next-word prediction using a Shakespeare or Wikipedia dataset. Visualize training loss and sample predictions.

Neural Machine Translation:

Implement a sequence-to-sequence model with attention to translate English to a low-resource language (e.g., Hindi or Telugu). Use BLEU score for evaluation.

Text Summarization using Encoder-Decoder:

Build a simple abstractive text summarizer using an attention-based encoder-decoder model. Compare with extractive summaries using ROUGE.

Transformers and Pretrained Models

Fine-tuning BERT for Text Classification:

Fine-tune a pretrained BERT model using Hugging Face Transformers for sentiment classification on IMDB or Amazon Reviews dataset.

Question Answering with Transformer Models:
Build a QA system using SQuAD dataset with a fine-tuned BERT or DistilBERT model. Evaluate accuracy and response time.
Named Entity Recognition with Transformer Embeddings:
Compare spaCy NER with BERT-based NER fine-tuned on the CoNLL-2003 dataset. Visualize token importance using attention heatmaps.

LLMs, Prompting, and NLP Agents

Prompt Engineering for Few-shot Classification:
Use OpenAI GPT or similar LLM to classify short texts (e.g., political speeches or tweets) using prompt templates (zero-shot, few-shot, CoT prompts). Analyze accuracy vs. prompt complexity.
Retrieval-Augmented Question Answering (RAG):
Implement a domain-specific question-answering system (e.g., Medical or Legal FAQs) using LangChain + OpenAI + vector database (FAISS). Test different retrieval strategies.

Ethics, Multimodal NLP, and Explain ability

Hallucination and Bias Analysis in LLMs:
Evaluate generated text from LLMs (GPT-3.5 or Claude) on a set of prompts for hallucination, stereotypes, or toxicity. Document findings using Prompt Eval or similar tools.
Image Captioning using CLIP or BLIP:
Build a basic multimodal model that generates image captions or performs text-based image retrieval using CLIP embeddings. Extend it to detect mismatched captions.

PC752AI	SEMINAR - I					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	3
Evaluation	**SEE**	50	**CIE**		25 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for systematic independent study of state of the art topics in broad area of his/her specialization.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Learn the Basic mechanism of doing research
CO-2	Learn identifying shortcomings of existing solutions from research
CO-3	Execution of present problems with suitable programming language and tools
CO-4	Suggest new approaches based on Research and execution.

Seminar topics can be chosen by the students with the advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

Literature survey

Organization of material

Preparation of Power point Presentation slides

Technical writing

Each student is required to

1. Submit one page of synopsis of the seminar talk two days before for display on notice board.

2. Give 20 minutes presentation through MS-PowerPoint Presentation Slides followed by 10 minutes discussion.

3. Submit a report on the seminar topic with a list of references and slides used within a week.

Seminars are to be scheduled from the 3rd week of the last week of the semester and any change in schedule should be discouraged. The CIE marks will be awarded to the students by atleast 2 faculty members on the basis of oral presentation and report as well as their involvement in the discussion.

PW761AI	PROJECT WORK - I					
Prerequisites			L	T	P	C
			0	0	6	7
Evaluation	CIE	25 Marks	SEE		50 Marks	

Course Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation • To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes: Student will be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management 4. Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

- Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
- Grouping of students (max 3 in a group) ➢ Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

B. E (AIML)-Working Professionals
SEMESTER- VIII

SNo	Code	Course Title	Scheme of			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P		Hrs	CIE	SEE	
			Theory							
1		Mandatory Course I	3	0		3	3	40	60	3
2		Mandatory Course II	3	0		3	3	40	60	3
3		Mandatory Course III	3	0		3	3	40	60	3
4	PC 801AI	Computer Vision	3	0		3	3	40	60	3
5	PC 802AI	Cyber Security	3	0		3	3	40	60	3
6	PC 803AI	Reinforcement Learning	3	0		3	3	40	60	3
Practicals										
7	PC 851 AI	Computer Vision-LAB			2x2	4	3	25	50	2
8	PW 861 AI	Project -II			12	12	3	50	50	8
			18		16	34		315	460	28

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	----	----	16	17	17	17	26	28	120

Mandatory Courses

S.No.	Code	Course Title
1	MC801CE	Environmental Science
2	MC802HS	Intellectual Property Rights
3	MC803HS	English for Technical Paper Writing
4	MC804HS	Constitution of India
5	MC805HS	Essence of Indian Traditional Knowledge
6	MC806HS	Stress Management by Yoga
7	MC807HS	Sports

MC-I MC801CE	ENVIRONMENTAL SCIENCE					
Pre-requisites	Water Resources Engineering Subjects		**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Comprehend the need of environmental science, ethics and issues
2.	Realize the availability and utilization of various natural resources
3.	Illustrate the characteristics and functions of Ecosystem
4.	Study various environmental pollution effects, prevention and control acts
5.	Understand the concepts of Biodiversity and its conservation needs

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Application and awareness of various environmental issues for sustainable society
CO-2	Acquaintance with utilization of various natural resources
CO-3	Capacity to understand and practice for sustainability of ecosystem.
CO-4	Knowledge of social and environment related issues and their preventive measures
CO-5	Ability in conserving and protecting the biodiversity

UNIT-I

Multidisciplinary nature of Environmental studies:

Definition, scope and importance, Need for public awareness, Environmental ethics: issues and possible solutions,

Global Warming and Climate change, Acid rain, Ozone layer depletion. Environment and human health, Population growth, Sustainable development and SDGs

UNIT-II

Natural Resources:

Types of Natural Resources, Role of individual in conservation of natural resources, Equitable use of resources for sustainable life styles, Natural resources and associated problems.

Land Resources: Land as a resource, land degradation, soil erosion and desertification.

Forest resources: Use and Overexploitation, Deforestation, Timber Extraction, Mining, Dams, and their Effects on Forests and Tribal People

Water resources: Water Resources: Use and Overutilization of Surface and Ground Water, Floods, Drought, Conflicts over Water, Dams – Benefits and problems

Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and using Mineral Resources

Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Energy Resources.

UNIT-III Ecosystems:

Concept of an Ecosystem, Types, Structure and function of an ecosystem, Producers, consumers, decomposers. Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and functions - Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT-IV

Environmental Pollution:

Definition, Causes, effects and control measures - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards,

Environmental Protection: Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife conservation and protection act, Forest conservation and protection act, Role of an individual's, communities and NGOs in prevention of pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes

UNIT-V

Biodiversity and its Conservation: Definition: genetics, species and ecosystem diversity, Spatial Patterns of Species Richness, Shannon's, Simpson's Diversity Index. Bio-geographically classification of India. Value of biodiversity – consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as a mega diversity nation. Hot-spots of biodiversity,

Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts. Endangered and endemic spaces of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity, Biological Diversity Act, 2002.

Suggested Reading:

1.	Erach Bharucha., Textbook of Environmental Studies, UGC, New Delhi and Bharathi Vidyapeeth Institute of Environment Education and Research, Pune.
2.	**Mahua Basu and Xavier Savarimuthu SJ., Fundamentals of Environmental Studies,** Cambridge University Press, New Delhi, 2017.
3.	Mishra D D., Fundamental Concepts in Environmental Studies, S Chand & Co Ltd., New Delhi, 2010.
4.	Botkin and Keller., Environmental Science, Wiley India Pvt., Ltd., New Delhi, 2012.
5.	Gilbert, M. Masters., Introduction to Environmental Engineering and Science, Prentice- Hall of India Pvt., Ltd., New Delhi, 1995.
6.	Sasi Kumar, K. and Sanoop Gopi Krishna., Solid waste Management, Prentice-Hall of India Pvt., Ltd., New Delhi, 2009.
7.	Daniel D. Chiras, Environmental Science, Jones & Bartlett Learning Publishers Inc, Burlington, MA, 2014.

MC802HS	INTELLECTUAL PROPERTY RIGHTS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Acquaint the students with basics of intellectual property rights with special reference to Indian Laws and its practices.
2	Compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
3	Provide an overview of the statutory, procedural, and case law underlining these processes and their interplay with litigation.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Understand the concept of intellectual property rights.
CO-2	Develop proficiency in trademarks and acquisition of trade mark rights.
CO-3	Understand the skill of acquiring the copy rights, ownership rights and transfer.
CO-4	Able to protect trade secrets, liability for misappropriations of trade secrets.
CO-5	Apply the patents and demonstration of case studies.

UNIT – I
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – II
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer**.**

UNIT – IV
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT –V
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading:

1	Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
2	“Mayall, “Industrial Design”, McGraw Hill,1992
3	“Niebel, “Product Design”, McGraw Hill,1974.
4	“Asimov, “Introduction to Design”, Prentice Hall,1962.
5	“Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”,2016.
6	T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand,2008

MC 803 HS	ENGLISH FOR TECHNICAL PAPER WRITING				
Pre-requisites			**L**	**T**	**P**
			3	-	-
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks

Course Objectives:	
1.	Understand that how to improve your writing skills and level of readability. Learn about what to write in each section.
2	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

Course Outcomes:	
1.	Able to plan and prepare paragraphs, avoiding ambiguity and grammatical errors
2.	Writing of abstracts, paraphrasing and plagiarism
3.	Providing critical and thorough review of literature, discussions and conclusions
4.	Able to exhibit key skills for writing titles, introduction, abstract.
5.	Able to show key and necessary skills for paper writing, phrases, results.

UNIT-I

Root Words, Synonyms and Antonyms, One word substitutes, importance of Punctuation, Sentence Structure, Subject Verb Agreement, Noun Pronoun Agreement, Redundancy, Cliche

UNIT-II

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness ,

UNIT-III

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-IV

Describing, Defining, Classifying, Providing examples or evidence, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check,

UNIT-V

Key skills are needed when writing a Title, Abstract, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions -Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Reading:

1. Norman Lewis, Word Power Made Easy, Anchor Books, New York, Reprint Edition, 2014.
2. C.R. Kothari and Gaurav Garg, Research Methodology: Methods and Techniques, 4th Edition, New Age International Publishers, New Delhi, 2019.
3. P.C. Wren and H. Martin, A Comprehensive Grammar of the English Language, Revised and Updated by N.D.V. Prasada Rao, S. Chand Publishing, New Delhi, Latest Edition.
4. Goldbort R, Writing for Science, Yale University Press (available on Google Books), 2006.
5. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
6. Highman N Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book. 1998
7. Adrian Wallwork English for Writing Research Papers, Springer New York Dordrecht Heidelberg London. 2011.

MC804HS	CONSTITUTION OF INDIA					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-	-	0
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:

1.	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
2.	To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role
3.	Entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

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

1.	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2.	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3.	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru
4.	The eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
5.	Discuss the passage of the Hindu Code Bill of 1956.

UNIT – I
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.
UNIT – II
Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
UNIT – III

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions.
UNIT – IV
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayat raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.
UNIT – V
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1	*"The Constitution of India",* 1950 (Bare Act), Government Publication.
2	Dr. S. N. Busi, *"Dr. B. R. Ambedkar framing of Indian Constitution",* 1st Edition, 2015.
3	M. P. Jain, "*Indian Constitution Law",* 7th Edn., Lexis Nexis, 2014.
4	D.D. Basu, *"Introduction to the Constitution of India",* Lexis Nexis, 2015.

MC 805HS	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Cou rse Objectives:

The course aims at enabling the students to

1. Comprehend the Basic fundamental aspects of Society, Culture and Heritage.
2. Understand the significant aspects of Traditional Hindu Social Organization and vedic literature both at individual level and societal level.
3. Inculcate a philosophical insight through shad darshanas and a spiritual outlook through Yoga Sutras.
4. Realize the significance and the utilitarian aspect of the traditional knowledge system through case studies.
5. Appreciate the significance and necessity for the preservation of traditional knowledge system.

Course Outcomes: Student will be able to

1. Know the fundamental concepts of Society with regard to values, norms, cultural and nature of Indian culture.
2. Understand the connect between the vedic literature and the traditional structural organization guiding at the various phases of life of an individual.
3. Recognize the importance of Darshanas and significance of Yoga sutra in building up a holistic life perspective.
4. To inculcate a pursuit of looking deeper into IKS for addressing the multi faceted contemporary issues both at local and global platform.
5. Analyze the significance and the measures for the preservation of Traditional Knowledge System.

UNIT - I

Fundamental Concepts : Society, Definition and its Characteristics; Values- Norms, Role-Status, Order and Stability, Habits, Custom; Understanding difference between Belief and Ritual, Tradition and Heritage; Culture : Definition and its Characteristics; Characteristics of Indian Culture; Concept of Unity in Diversity;.

UNIT - II

Indian Traditional System: Traditional Hindu Organization: Purusharthas, Varna Dharma and Ashrama Dharma. Indian Traditional Scriptures and their Classification; General Understanding of Vedas : Rig veda, Samaveda, Yajur Veda, and Atharvaveda, Upanishads; Smritis : Itihasa, Puranas, Agamas, Upvedas, and Vedangas.

UNIT - III

Traditional Philosophies / School of thoughts: Darshanas : philosophies of 6 Schools : Nyaya, Vaisheshika, Samkhya, Yoga, Mimamsa and Vedanta; Nastika School of Philosophy : Charvaka, Jainism and Bhuddhism; Yoga and Spirituality.

UNIT - IV

Traditional Knowledge System : Definition of Traditional knowledge, Indigenous Knowledge System; Case studies of Ancient traditional Knowledge System Astronomy, Vastu-Shatras, Wootz Steel lost technology of IKS, Water Management, and Agriculture.

UNIT - V

Protection of Traditional Knowledge - Significance and Need of Protection of Traditional Knowledge and measure for protection of TK, Role of the Government to harness TK. Documentation and Preservation of IKS, Approaches for conservation and Management of nature and bio-resources, protection and conservation of IKS.

Suggested Books for Reference:

1. V.Sivaramnkrishna (Ed.). Cultural Heritage of Course Material, Bharatiya Vidya Bhavan, Mumbai.5thEdition, 2014 Approaches and strategies to India-
2. Swami Jirntman and. Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritz of Capra. Tao of Physics
4. Fritz of Capra, The wave of Life
5. VNJba (Eng.Trans.) Tarkasangraha of Annam Bhana, international Chinmay Foundation, Velliamad.Amaku.am
6. Yoga Sutra of Patanjali, Ramakrishna Mission. Kolkatta
7. GNJha (Eng.Trans.) Ed.RNJha,Yoga-darshanamwithVyasaBhashya.VidyanidhiPrakasham,Delhi,2016
8. RNJha. Science of Consciousness Psychotherapy and Yoga Practices. Vidyanidhi Prakasham, Delhi. 2016
9. PRSha. Min (English translation).Shodashang Hridayam

MC 806HS	STRESS MANAGEMENT BY YOGA					
Pre-requisites			**L**	**T**	**P**	**C**
			2	-		0
Evaluation	**SEE**	60Marks		**CIE**	40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	Creatingawarenessaboutdifferenttypesofstressandtheroleofyogainthemanagementof stress.
2	Promotionofpositivehealthandoverallwellbeing(Physical,mental,emotional,socialan d spiritual).
3	Prevention of stress related health problems by yoga practice.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	To understand yoga and its benefits.
CO-2	Enhance Physical strength and flexibility.
CO-3	Learn to relax and focus.
CO-4	Relieve physical and mental tension through As an as
CO-5	Improve work performance and efficiency.

UNIT– I
Meaning and definition of Yoga-Historical perspective of Yoga-Principles of Astanga Yoga by Patanjali.

UNIT– II
Meaning and definition of Stress-Types of stress-Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management-

UNIT– III
Concept of Stress according to Yoga-Stress assessment methods-Role of Asana, Pranayama and Meditation in the management of stress.

UNIT– IV
Asanas- (5Asanasin each posture)-Warmup –Standing Asanas-Sitting Asanas-Prone Asanas-Supineasanas-Surya Namaskar.

UNIT– V
Pranayama-Anulom and Vilom Pranayama -Nadishudhi Pranayama–Kapalabhati-Pranayama-Bhramari Pranayama-Nadanusandhana Pranayama.
Meditation techniques: Om Meditation-Cyclic meditation: Instant Relaxation technique (QRT),QuickRelaxationTechnique(QRT),DeepRelaxationTechnique(DRT).

Suggested Reading:

1	"Yogic Asanas for GroupTraining -Part-I": Janardhan Swami Yoga bhyasi Mandal, Nagpur
2	"Rajayogaor Conquering the Internal Nature "by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3	Nagendra H.R and Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Web resource:

1	https://online courses.nptel.ac.in/noc16_ge04/preview
2	https://free video lectures.com/course/3539/indian-philosophy/11

MC 807HS	SPORTS					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-		0
Evaluation	**SEE**	-	**CIE**		50 Marks	

Course Objectives:

1. To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
2. To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
3. To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
4. To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
5. To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

1) Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
2) Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
3) Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
4) Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
5) Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

I. Requirements:

i) Track Pants (students should bring)
ii) Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50

i) 20 marks for internal exam (continuous evaluation)
  a) 8 marks for viva
  b) 12 marks for sports & fitness

ii) 30 marks for end exam
  a) 10 marks for viva
  b) 20 marks for sports & fitness

PC801AI	COMPUTER VISION					
CORE						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
1	Introduce fundamental techniques in image filtering, pyramids, Hough transforms, and feature detection
2	Provide knowledge on 2D transformations, camera models, homographies, and two-view geometry
3	Familiarize students with image classification, neural networks, CNNs, and optical flow techniques
4	Teach modern alignment, tracking methods, and optical flow in video sequences
5	Cover advanced deep learning models, point cloud processing, and address societal impacts of vision systems

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Perform image filtering, feature detection, and frequency-domain transformations.
CO-2	Compute homographies, model camera geometry, and estimate pose and depth
CO-3	Implement image classification using traditional ML and deep learning methods like CNNs
CO-4	Use optical flow and tracking algorithms for video-based applications.
CO-5	Work with modern neural network architectures, 3D data, and generative models like GANs and VAEs

UNIT– I

Introduction, Image Filtering: Image transformations, point image processing, linear shift-invariant image filtering, convolution, image gradients

Image Pyramids and Frequency Domain: Image down sampling, aliasing, Gaussian image pyramid, Laplacian image pyramid, Fourier series, frequency domain, Fourier transform, frequency-domain filtering, sampling

Hough Transform: Finding boundaries, line fitting, line parameterization, Hough transform, Hough circles

Detecting Corners : Visualizing quadratics, Harris corner detector, multi-scale detection,

Feature Detectors and Descriptors: Designing feature descriptors, MOPS descriptor, GIST descriptor, Histogram of Textons descriptor, HOG descriptor, SIFT

UNIT – II

2D Transformations: 2D transformations, projective geometry, classification of 2D transformations, determining unknown 2D transformations

Image Homographies: Panoramas, Image homographies, Computing with homographies, direct linear transform (DLT), random sample consensus (RANSAC))

Geometric Camera Models: Pinhole camera, accidental pinholes, camera matrix, Review of camera matrix, perspective, other camera models, pose estimation

Two-View Geometry: Triangulation, epipolar geometry, essential matrix, fundamental matrix, 8-point algorithm

UNIT – III

Stereo: Revisiting triangulation, disparity, stereo rectification, stereo matching, improved stereo matching,

Image Classification: Introduction to learning-based vision, image classification, bag-of-words, K-means clustering, classification, K-nearest neighbors, naive Bayes, support vector machines,

Neural Networks: Perceptron, neural networks, training perceptrons, gradient descent, backpropagation, stochastic gradient descent

Convolutional Neural Networks: convolutional neural networks, training ConvNets

Optical Flow: Intro to vision for video, optical flow, constant flow, Horn-Schunck flow

UNIT– IV

Alignment and Tracking: Motion magnification using optical flow, image alignment, Lucas-Kanade alignment, Baker-Matthews alignment, inverse alignment, KLT tracking, mean-shift tracking, modern trackers, Deep Tracking,

Deep Optical Flow / Deep Stereo; Generative Adversarial Networks (GANs), Variational Auto Encoders (VAEs) / Diffusion / Societal Impacts

UNIT –V

Advanced architectures: Batch Norm, Res Net, RNN, Transformer,
Deep 3D Point Cloud Processing

Suggested Reading:

1	Computer Vision: Algorithms and Applications, 2nd ed. © 2022 Richard Szeliski, The University of Washington
2	Deep Learning by Ian Good fellow, Bengio and Courville
3	Hartley and Zisserman, " Multiple View Geometry in Computer Vision", Cambridge University Press 2004

PC802AI	CYBER SECURITY					
Prerequisites			L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To learn the various threats in networks and security concepts.
2.	To apply authentication applications in different networks.
3.	To understand security services for email.
4.	To awareness of firewall and IT laws and policies.
5.	To understand different IT Policies.

Course Outcomes : At the end of the course the student will be able to:	
1.	Understand the various network threats.
2.	Analyze the forensic tools for evidence collection.
3.	Apply the firewalls for threat analysis.
4.	Understand OS artifact.
5.	Evaluate Different IT Acts.

UNIT – I

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNIT – II

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis

UNIT III
Investigation Tools, e discovery, EDRM Models, digital evidence collection and preservation, email investigation, email tracking, IP tracking, email recovery, search and seizure of computer systems, password cracking.

UNIT – IV
Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts, Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences, social media analysis, data retrieval, Email analysis from mobile phones.

UNIT – V
Ethics, Policies and IT Act. Basics of Law and Technology, Introduction to Indian Laws, Scope and Jurisprudence, Digital Signatures, E Commerce-an Introduction, possible crime scenarios, law coverage, data interchange, mobile communication development, smart card and expert systems Indian Laws, Information Technology Act 2000, Indian Evidence Act, India Technology Amendment Act 2008, Indian Penal Code, Computer Security Act 1987, National Information Infrastructure Protection Act 1996, Fraud Act 1997, Children Online Protection Act 1998, Computer Fraud and Abuse Act 2001, Intellectual Property, IP Theft, Copyright, Trademark, Privacy and Censorship, ,Introduction to Cyber Ethics, rights over intellectual property, Corporate IT Policy Formulations, Compliance Auditing.

Suggested Readings:	
1.	William Stallings, “Cryptography and Network Security”, Prentice Hall, New Delhi, 2006.

References:	
1.	Charles P. Fleeger, "Security in Computing", Prentice Hall, New Delhi, 2009.
2.	BehrouzA.Forouzan, “Cryptography & Network Security”, Tata McGraw Hill, India, New Delhi, 2009.

PC805AI	REINFORCEMENT LEARNING					
CORE-IV						
Pre-requisites			L	T	P	C
			3	-	-	3
Evaluation	SEE	60 Marks	CIE		40 Marks	

Course Objectives :	
1	Fundamental RL terminology and mathematical formalism; a brief history of RL and its connection to neuroscience and biological systems
2	RL methods for discrete action spaces, e.g. deep Q-learning and large-scale Monte Carlo Tree Search
3	Methods for exploration, modelling uncertainty, and partial observability for RL
4	Modern policy gradient and actor-critic methods
5	Concepts needed to construct model-based RL and Model Predictive Control methods
6	Approaches to make RL data-efficient and ways to enable simulation-to-reality transfer
7	Examples of fine-tuning foundation models and large language models (LLMs) with human feedback; safe RL concepts; examples of using RL for safety validation
8	Examples of using RL for scientific discovery

Course Outcomes :	
On completion of this course, the student will be able to:	
CO-1	Gain experience with analysing RL methods to uncover their strengths and shortcomings, as well as proposing extensions to improve performance.
CO-2	Also gain skills needed to develop the ability to produce a critical analysis of current RL limitations.
CO-3	Prompt students to propose novel solutions that address shortcomings of existing methods.

UNIT– I

Introduction and Fundamentals

Overview of RL: foundational ideas, history, and books; connection to neuroscience and biological systems, recent industrial applications and research demonstrations

Mathematical fundamentals: Markov decision processes, Bellman equations, policy and value iteration, temporal difference learning.

UNIT – II

RL in Discrete Action Spaces: Q-learning, function approximation and deep Q-learning; nonstationarity in RL and its implications for deep learning; example applications (video games; initial example: Atari),Monte Carlo Tree Search; example applications (AlphaGo)

Exploration, Uncertainty, Partial Observability: Multi-armed bandits, Bayesian optimisation, regret analysis**,** Partially observable Markov decision process; belief, memory, and sequence modelling (probabilistic methods, recurrent networks, transformers)**.**

UNIT – III
Policy Gradient and Actor-critic Methods for Continuous Action Spaces: Importance sampling, policy gradient theorem, actor-critic methods (SPG, DDPG)**,** Proximal policy optimisation; example applications **Model-based RL and Model Predictive Control:** Learning dynamics models (graph networks, stochastic processes, diffusion models, physics-based models, ensembles); planning with learned models**,** Model predictive control; example applications (real-time control)

UNIT– IV
Data-efficient RL and Simulation-to-reality Transfer: Data-efficient learning with probabilistic methods from real data (e.g. policy search in robotics), real-to-sim inference and differentiable simulation, data-efficient simulation-to-reality transfer**,** RL for physical systems (successful examples in locomotion, open problems in contact-rich manipulation, applications to logistics, energy, and transport systems); examples of RL for healthcare.

UNIT –V
RL with Human Feedback ; Safe RL and RL for Validation: Fine-tuning large language models (LLMs) and other foundation models with human feedback (TRLX,RL4LMs, a light-weight overview of RLHF), A review of SafeRL, example: optimising commercial HVAC systems using policy improvement with constraints; improving safety using RL for validation: examples in autonomous driving and autonomous flying and aircraft collision avoidance **RL for Scientific Discovery; Student Presentations**: Examples of RL for molecular design and drug discovery, active learning for synthesising new materials, RL for nuclear fusion experiments, Student presentations (based on essays and mini-projects) for other topics in RL, e.g. multi-agent RL, hierarchical RL, RL for hyper parameter optimisation and NN architecture search, RL for multi-task transfer, lifelong RL, RL in biological systems, etc.

Suggested Reading:

1	Reinforcement Learning: An Introduction (second print edition). Richard S. Sutton, Andrew G. Barto. [Available from the book's website as a free PDF updated in 2022]
2	Algorithms for Reinforcement Learning. Csaba Szepesvari. [Available from the book's website as a free PDF updated in 2019]
3	Algorithms for Decision Making. Mykel J. Kochenderfer Tim A. WheelerKyle H. Wray. [Available from the book's website as a free PDF updated in 2023]
4	Reinforcement Learning and Optimal Control. Dimitri Bertsekas. [Available from the book's website as a free PDF updated in 2023]

PC851AI	COMPUTER VISION LAB					
Prerequisites	Deep Learning		L	T	P	C
			0	0	4	2
Evaluation	CIE	25 Marks	SEE		50 Marks	

1. Get a basic understanding of performance improvements from using **higher-level representations** as opposed to raw pixels, e.g. color histograms, Histogram of Oriented Gradient (HOG) features, etc.
2. Implement **Batch Normalization** and **Layer Normalization** for training deep networks.
3. Implement **Dropout** to regularize networks.
4. Understand the architecture of **Convolutional Neural Networks** and get practice with training them.
5. Gain experience with a major deep learning framework, **PyTorch**.
6. Understand and implement RNN networks. Combine them with CNN networks for image captioning.
7. Understand and implement Transformer networks. Combine them with CNN networks for image captioning.
8. Understand how to leverage self-supervised learning techniques to help with image classification tasks.
9. Implement and understand diffusion models (DDPMs) and apply them to image generation.
10. Implement and understand CLIP and DINO, two self-supervised learning methods that leverage large amounts of unlabeled data to learn visual representations.

PW861AI	PROJECT WORK -II					
Prerequisites			**L**	**T**	**P**	**C**
			0	**0**	**12**	**8**
Evaluation	**CIE**	**50**	**SEE**		**100 Marks**	

Course Objectives

- To enhance practical and professional skills
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and teamwork.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstratetheabilitytosynthesizeandapplytheknowledgeandskillsacquiredin the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The aim of project stage –II is to implement and evaluate the proposal made as part of project stage - II. Students can also be encouraged to do full time industrial internship as part of project stage -II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of Project Work-I
2. Re-Allotment of internship students to project guides Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII-Semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.