NEW HORIZON COLLEGE OF ENGINEERING

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Academic Year 2025 - 2026 Onwards

7th and 8th Semesters Scheme & Syllabus

CREDITS: 160(NEP)

[2022 Scheme]

INSTITUTION

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.

To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

Quality Policy

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level

Values

- Academic Freedom
- Innovation
- Integrity
- Professionalism
- Inclusiveness
- Social Responsibility

DEPARTMENT OF AI & ML

Vision

To develop an outstanding AI and ML professionals with profound practical, research & managerial skills to meet ever changing Industrial Social and Technological needs of the Society

Mission

To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.

To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation.

To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.

Program Educational Objectives (PEOs)

PEO1	Graduates will build successful careers in Artificial Intelligence and Machine Learning by applying strong theoretical foundations, analytical skills, and modern tools to solve complex industrial and societal problems.
PEO2	Graduates will pursue higher education, research, entrepreneurship, or leadership roles in emerging AI technologies through continuous learning, innovation, and industry collaboration.
PEO3	Graduates will demonstrate ethical responsibility, environmental awareness, and social consciousness while developing and deploying AI solutions for sustainable societal impact.

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3
To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.	✓	✓	-
To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation	✓	✓	-
To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.	-	-	✓

Program Outcomes (POs) with Graduate Attributes

PO1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems in reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design / Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and Sustainability**: Understand the impact of the professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.

PO9 **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication Skills**: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

A graduate of the Artificial Intelligence and Machine Learning Program will demonstrate:

PSO1: Ability to design, develop, and deploy intelligent systems using machine learning algorithms, deep learning architectures, data analytics, and AI frameworks to address real-world applications.

PSO2: Ability to analyze large-scale data, interpret model outcomes, and implement responsible, secure, and ethical AI solutions aligned with industry standards and societal needs.

Scheme General Structure

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

VII Semester

S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PCC	22AIM71	Advanced Machine Learning	AIML	3	0	0	0	3	3	50	50	**100**
2	PCCL	22AIL71	Advanced Machine Learning Lab	AIML	0	0	1	0	1	2	50	50	**100**
3	PCC	22AIM72	Generative AI	AIML	3	0	0	0	3	3	50	50	**100**
4	PCCL	22AIL72	Generative AI Lab	AIML	0	0	1	0	1	2	50	50	**100**
5	PCC	22AIM73	Reinforcement Learning	AIML	3	0	0	0	3	3	50	50	**100**
6	PROJ	22AIM74	Project Phase - II	AIML	0	0	10	0	10	20	100	100	**200**
7	OEC	23NHOP7XX	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	**100**
								Total	**24**	**36**	**400**	**400**	**800**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Industrial Open Elective Courses-II:
Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Phase-II:
The objective of the Project work is:
(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batchmates.
(2) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

Scheme General Structure

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

VIII Semester

S. No	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PEC*	22AIM81X	Professional Elective Courses -III	AIML	3	0	0	0	3	3	50	50	**100**
2	PEC*	22AIM82X	Professional Elective Courses -IV	AIML	3	0	0	0	3	3	50	50	**100**
3	INT	22AIM83	Internship	AIML	0	0	10	0	10	20	100	100	**200**
4	NCMC	22IKK84	Indian Knowledge Systems	AIML	0	0	0	0	0	1	50	-	**50**
								Total	**16**	**27**	**250**	**200**	**450**

PEC*: Professional Elective Course (Online/Hybrid), **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **INT**: Industry Internship/Research Internship/Rural Internship, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. NCMC: Online Assessment.

Professional Elective Course-III

22AIM811	Recommender System	22AIM814	Optimization Techniques
22AIM812	Quantum Computing	22AIM815	Cryptography and Network Security
22AIM813	Agentic AI		

Professional Elective Course-IV			
22AIM821	AI Ethics for AIML Engineers	22AIM824	Pattern Recognition
22AIM822	Social Network Analysis	22AIM825	Blockchain Technologies
22AIM823	Mobile Computing		

Elucidation:
At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Internship.

Internship: The mandatory Internship is for **14 to 20 weeks**. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements. If the students are opting for the 8th semester, the following internship options are available:

- Industry Internship
- Research Internship
- Skill Enhancement Courses
- Post-Placement Training as Internship
- Online Internship

Industry internship: It is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints. Students undertaking industry internships must ensure the organization is listed on the VTU Internship Portal. If not, request the organization to register on the portal.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research. Research internships must be carried out in recognized research centers. Ensure that these centers are registered on the portal.

Skill Enhancement Courses: Students can take Skill-based courses with credits totalling the same as those of the internship. Students must be taken from registered providers listed on the VTU Internship Portal.

Post-Placement Training as Internship: The post-placement training is also considered an internship. For students placed during their 6th/7th semester and willing to take the training during their final year, colleges must inform the recruiting companies in advance to register on the VTU Internship Portal.

Online Internship: Reputed online internship platforms, including those identified by NSDC, are already listed on the VTU Internship portal. If colleges come across other eligible organizations not yet listed, they are informed to ask the organization to register on the VTU Internship portal.

Scheme General Structure

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship. With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.	
Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

VII SEMESTER

ADVANCED MACHINE LEARNING			
Course Code	**22AIM71**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM71.1	Apply fundamental concepts of linear algebra, probability, and statistics to design robust machine learning models
22AIM71.2	Investigate how multiple kernel learning and Kernel Principal Components Analysis can optimize feature extraction and dimensionality reduction for non-linear data.
22AIM71.3	Design Ensemble learning technique to predict model decisions to ensure performance and robustness in machine learning models.
22AIM71.4	Develop the ability to tackle advanced inference challenges to estimate posterior distributions in settings with many variables.
22AIM71.5	Analyze models based on both quantitative and qualitative criteria, ensuring that models are optimal, interpretable, and aligned with real-world requirements.
22AIM71.6	Evaluate the performance of ML models and entire end-to-end ML pipelines.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM71.1	3	-	-	-	-	-	-	-	-	-	-	-	2	3
22AIM71.2	-	3	-		2	-	-	-	-	-	-	-	3	3
22AIM71.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
22AIM71.4	-	-	3	-	2	-	-	-	-	-	-	-	3	3
22AIM71.5	-	3	-	3	-	-	-	-	-	-	-	2	3	3
22AIM71.6	-	-	-	3	2	-	-	-	-	-	2	-	3	3

MODULE-1	**MATHEMATICAL FOUNDATIONS AND OPTIMIZATION FOR ML**	**22AIM71.1**	**8 Hours**

Rote Learning, Convex optimization: gradient descent, stochastic gradient descent (SGD), Regularization techniques: L1, L2, dropout. Bias-variance tradeoff, Advanced loss functions: hinge, cross-entropy, custom loss. Overfitting and underfitting in complex models.

Text Book	Text Book 1: Chapter 2, 3

MODULE-2	**KERNEL METHODS**	**22AIM71.2 22AIM71.6**	**8 Hours**

Support Vector Machine (SVM): Classification and Regression using SVM, SVM Kernel: Linear, Polynomial, Gaussian, RBF. Properties of Kernels, Non-Mercer Kernels, Kernel Selection, Multiple Kernel Learning, Kernel PCA.

Text Book	Text Book 1: Ch 14. Text Book 2: Ch12

MODULE-3	**ENSEMBLE AND TREE-BASED METHODS**	**22AIM71.3 22AIM71.6**	**8 Hours**

Decision Trees – Hyper parameter tuning, and pruning, Ensemble learning techniques: Bagging, Boosting, Stacking, Random Forests, Gradient Boosting Machines, XGBoost, Light GBM, CatBoost.

Text Book	Text Book 1: Ch 16 Text Book 2: Ch 14

MODULE-4	**BAYESIAN MACHINE LEARNING**	**22AIM71.4**	**8 Hours**

Topic models: Latent Semantic Analysis, Latent Dirichlet Allocation. Graphical models: Hidden Markov Models and Conditional Random Fields, Markov Chain Monte Carlo Methods. variational inference, Gaussian processes: correlation, inference, regression.

Case Study	Understanding Public Health Trends from Social -Media Using Probabilistic Graphical Models and Topic Modelling
Text Book	Text Book 2: Ch 9, Ch 10

MODULE-5	**MACHINE LEARNING ENGINEERING**	**22AIM71.5 22AIM71.6**	**8 Hours**

Building an ML pipeline for the real world: data collection, metrics, model building, model deployment, updating. Use cases from companies, Model interpretability and SHAP/feature importance.

Self-study	Building an End-to-End Machine Learning Pipeline for Predicting Customer Churn in a Telecom Company
Text Book	Text Book 3: Ch:12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford University Press, 2021.ISBN:978-9391050504
2) Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, ISBN:9780262018029
3) "Designing Machine Learning Systems: An Iterative Process for Production-Ready Applications", Chip Huyen, O'Reilly Media ,2022, ISBN**:** 978-1098107963

Reference Books:

1) Tom Mitchell, "Machine Learning", McGraw Hill, 1997. ISBN 9780071154673, 0071154671 2.
2) Machine Learning for Engineers: Using Data to Solve Problems for Physical Systems by Ryan G. Mc Clarren , 2021, Springer Nature, ISBN: 978-3030703875.
3)Machine Learning Theory and Practice, Jugal Kalita,2023, CRC Press, ISBN: 978-0-367-43354-3

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://biodesign.berkeley.edu/bioinspired-design-course/
- https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group discussion on real-world problems.
- Class Presentation

ADVANCED MACHINE LEARNING LAB			
Course Code	**22AIL71**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs./Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

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

22AIL71.1	Apply advanced regression and classification models to evaluate their performance, interpret feature importance, Regularization, kernel selection on model behavior.
22AIL71.2	Design optimized ensemble models use stacking and gradient boosting to enhance model performance, and interpret results
22AIL71.3	Analyze probabilistic models such as Hidden Markov Models and Bayesian models using Gibbs sampling, Viterbi algorithm, and inference diagnostics to solve the estimation problems.
22AIL71.4	Evaluate machine learning models for overfitting and underfitting using bias-variance analysis and use logging frameworks and interpretability tools to ensure model reproducibility and transparency

MappingofCourseOutcomestoProgramOutcomesandProgramSpecificOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIL71.1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
22AIL71.2	-	-	3	-	2	-	-	-	-	-	-	-	3	3
22AIL71.3	-	3	-	-	2	-	-	-	-	-	-	3	3	3
22AIL71.4	-	-	-	3	3	-	-	-	-	-	-	-	3	3

Pgm .No.	List of Experiments/Programs	Hours	COs
	Pre-requisite Experiments/Programs/ Demo		
	• Basic Python libraries for Machine Learning Algorithm • Read and write a CSV file using python		NA
	PART-A		
1	Build and compare advanced regression models for Daily-Temperature / Weather dataset using **Lasso (L1), Ridge (L2), and ElasticNet regularization**, and evaluate their performance against standard linear regression. Analyze how each regularization technique affects model performance, overfitting, and feature importance.	2	**22AIL71.1 22AIL71.3**
2	Train SVM classifiers with **different kernels**: linear, polynomial, and RBF, on real-world dataset. Compare their training time, accuracy, and confusion matrix and visualize how decision boundaries differ for each kernel in a 2D feature space for given dataset.	2	**22AIL71.1 22AIL71.4**
3	Build a stacking ensemble model and cross-validate against individual models for given dataset.	2	**22AIL71.2 22AIL71.4**
4	Perform hyperparameter tuning on Decision Tree Model by conducting a grid search over parameters like max-depth and min_samples_ split, then plot validation curves to identify signs of overfitting for given Breast Cancer Wisconsin dataset.	2	**22AIL71.2 22AIL71.4**
5	Develop a Hidden Markov Model (HMM) for sequence labeling tasks such as weather prediction. Train the model, using the Viterbi algorithm, visualizing transitions and emissions, and evaluating predictions against actual labels for Weather History dataset.	2	**22AIL71.2 22AIL71.3**
6	Implement a logging system using logging or mlflow that tracks model training metrics, hyperparameters, and runtime, information. Store results in structured logs or a database, and plot training performance over time for given MNIST dataset.	2	**22AIL72.3 22AIL71.4**
	PART-B		
7	Train polynomial regression models of degrees 1 to 15 on a given dataset to observe how model complexity affects performance. Plot the training and validation errors to identify regions of underfitting, overfitting, and the optimal model complexity. Analyze the results in the context of the bias-variance tradeoff for the given dataset.	2	**22AIL71.3 22AIL71.4**
8	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs	2	**22AIL71.3 22AIL71.4**

9	Perform kernel selection using cross-validation on a classification dataset. Test multiple kernels and kernel parameters (gamma, degree, etc.) using Grid Search CV. Report the best-performing kernel and parameter combination.	2	**22AIL71.3 22AIL71.4**
10	Experiment with XGBoost, LightGBM, CatBoost for the visualize feature importance, tune hyperparameters and compare runtime to standard Gradient Boosting Machines (GBMs) for Heart- Disease dataset.	2	**22AIL71.2 22AIL71.3**
11	Apply Gibbs Sampling to estimate the posterior distribution of parameters in a simple Bayesian model. Visualize trace plots, analyze convergence using diagnostics, and interpret the accuracy of the inferred parameters for the given dataset.	2	**22AIL71.1 22AIL71.3 22AIL71.4**
12	Apply SHAP for interpretability on a Random Forest Model trained with UCI repository Breast Cancer dataset. Report each feature's name and its corresponding SHAP contribution weight.	2	**22AIL71.1 22AIL71.2, 22AIL71.4**

PART-C

Beyond Syllabus Virtual Lab Content

1. SVM https://vlab.spit.ac.in/ai/#/experiments//5
2. Multi- Linear https://vlab.spit.ac.in/ai/#/experiments//10
3. Random Forest https://vlab.spit.ac.in/ai/#/experiments//12
4. Bayesian Network https://ai1-iiith.vlabs.ac.in/exp/inference-bayesian-network/

CIE Assessment Pattern (50Marks– Lab)

RBT Levels		Test(s) (20)	Weekly Assessment (30)
L1	**Remember**	**-**	**-**
L2	**Understand**	5	10
L3	**Apply**	5	10
L4	**Analyze**	5	10
L5	**Evaluate**	5	-
L6	**Create**	-	-

SEE Assessment Pattern(50Marks–Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1. Tom Mitchell, "Machine Learning", McGrawHill,1997ISBN:9780071154673
2. E.Alpaydin, "Introduction to Machine Learning", MIT
3. Press, 2020, ISBN:9780262043793

GENERATIVE AI			
Course Code	**22AIM72**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM72.1	Understand the core designs and operational mechanics behind LLMs.
22AIM72.2	Apply advanced approaches to get better outcomes from LLMs.
22AIM72.3	Investigate the production of false information in LLMs using various mitigation techniques.
22AIM72.4	Develop LLM models that incorporate adaptive agent workflows.
22AIM72.5	Analyze a process that uses LLMs for vulnerabilities, failures, and unsafe behaviors.
22AIM72.6	Evaluate the effectiveness of various LLM applications in solving complex real-world problems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM72.1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
22AIM72.2	3	-	-	-	-	-	-	-	-	-	-	2	3	3
22AIM72.3	-	-	3	-	2	-	-	-	-	-	-	-	-	-
22AIM72.4	-	-	-	3	3	-	-	-	-	-	-	-	-	-
22AIM72.5	-	3	-	-	-	-	-	-	-	-	-	2	-	-
22AIM72.6	-	-	-	3	3	-	--	2	-	--	-	-	-	-

MODULE-1	**BASICS OF LLMS AND TRANSFORMERS**	**22AIM72.1, 22AIM72.2**	**8 Hours**

Transformer overview: attention, encoder–decoder structure. BERT, T5, Mistral 7B, Phi-3 – comparison & use cases. Tokenization: BPE, WordPiece. Embeddings and positional encodings. Pre-training vs fine-tuning (instruction/domain tuning). Parameter-efficient tuning: LoRA, QLoRA, PEFT.Prompt engineering: zero-shot, few-shot, CoT, ReAct.

Case-study	Evaluation: BLEU, ROUGE, perplexity, human evaluation
Text Book	Text Book 1: Ch 1,2

MODULE-2	**ADVANCED RETRIEVAL AUGMENTED GENERATION(RAG)**	**22AIM72.2**	**8 Hours**

Vector DBs: FAISS, Weaviate, Pinecone. Semantic search, hybrid search: BM25 + RRF. Chunking and indexing strategies. RAG pipeline integration with LLMs- using structured data: tables and graphs. Multi-hop retrieval, graph-based querying

Text Book	Text Book 2: Ch 3,4

MODULE-3	**MULTI AGENT SYSTEMS FOR GENAI**	**22AIM72.2, 22AIM72.3, 22AIM72.6**	**8 Hours**

Multi-agent basics: Definition of multi-agent systems and how multiple AI agents can collaborate or specialize in tasks. Agent types and roles: Planners, executors, evaluators – how different agent roles (e.g. a reasoning agent vs. a tool-using agent) work together. Agent orchestration: Using frame works LangChain and CrewAI to coordinate multiple LLM agents (task decomposition, result synthesis). Adaptive workflows: Designing agents that can handle errors or changing goals, and dynamically adjust their plans: self-healing loops, error recovery.

Self-study	Evaluation and monitoring: Metrics for multi-agent systems (task success rate, cooperation efficiency) and methods to monitor agent performance and safety in deployments.
Text Book	Text Book 3: Ch 3

MODULE-4	**LLM ALIGNMENT AND SAFETY**	**22AIM72.3, 22AIM72.4**	**8 Hours**

Alignment principles: Aligning LLM behaviour with human values and intent – criteria of helpfulness, honesty, harmlessness. Reinforcement Learning from Human Feedback (RLHF) and from AI feedback (RLAIF) as techniques to tune models towards preferred outputs. Hallucination mitigation: Understanding why LLMs hallucinate (produce false information) and strategies to reduce it – truthfulness conditioning, retrieval augmentation (providing context), and confidence calibration of responses. Bias and fairness: Recognizing biases in LLM training data and outputs. Techniques for bias mitigation (dataset balancing, model fine-tuning with fairness constraints) and ensuring fairness across user demographics.

Self-study	Discussion of ethical AI guidelines and Responsible AI frameworks for bias control.
Text Book	Text Book 3: Ch 5,6 Text Book 4: 3

MODULE-5	**LLM TESTING AND EVALUATION**	**22AIM72.4, 22AIM72.5, 22AIM72.6**	**8 Hours**

Red-teaming and adversarial testing: Methods for stress-testing LLMs by trying to elicit failures or unsafe behaviour. Red team exercises have become a cornerstone of trustworthy AI practice – involving creative attacks to probe model limits (jailbreak prompts, adversarial inputs) and improve model safety before deployment. LLM evaluation benchmarks: Key benchmarks for language models – MMLU, BIG-bench, HELM. Task-specific evaluation: truthfulness tests (TruthfulQA), reasoning: BBH, coding : HumanEval.

Case-study	**AI governance:** Overview of standards and regulations (company AI policies, model cards, GDPR/EU AI Act principles) for safe and responsible AI deployment. Auditing models for compliance and establishing human oversight were needed
Text Book	Text Book 4: Ch 5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Denis Rothman,"Transformers for Natural Language Processing" , January 2021Publisher(s): Packt Publishing, ISBN: 9781800565791
2. "AI-Powered Search- Trey Grainger" December 2024 ISBN 9781617296970
3. Ben Auffarth ,"Generative AI with LangChain", Packt Publishing, 2023 : ISBN: 9781835083468
4. Akshay Kulkarni, Adarsha Shivananda, "Applied Generative AI for Beginners: Practical Knowledge on Diffusion Models", ChatGPT, and Other LLMs", Apress, 2023. ISBN: 9781484299944

Web links and Video Lectures (e-Resources):

https://learn.microsoft.com/en-us/training/modules/explore-foundation-models-in-model-catalog/ (learn.microsoft.com)
https://huggingface.co/learn/llm-course/chapter1/1 (huggingface.co)
https://developers.google.com/machine-learning/resources/intro-llms (developers.google.com)
https://aws.amazon.com/what-is/large-language-model/ (aws.amazon.com)
https://skillsbuild.org/college-students/course-catalog/introduction-to-large-language-models (skillsbuild.org)
https://www.microsoft.com/en-us/microsoft-cloud/blog/2025/02/04/common-retrieval-augmented-generation-rag-techniques-explained/ (microsoft.com)
https://learn.microsoft.com/en-us/azure/search/retrieval-augmented-generation-overview (learn.microsoft.com)
https://learn.microsoft.com/en-us/azure/developer/ai/advanced-retrieval-augmented-generation (learn.microsoft.com)

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online Class using Jeopardy Lab
- Group Discussion on research topics on GenAI
- Class Presentation.

GENERATIVE AI LAB			
Course Code	**22AIL72**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIL72.1	Apply basic Transformer principles, use software tools, and current state-of-the-art techniques to Large Language Models to build powerful generative AI applications.
22AIL72.2	Develop Large Language Models capable of handling complex queries using diverse strategies
22AIL72.3	Optimize the retrieval performance of LLMs for advanced contextual understanding.
22AIL72.4	Evaluate the performance of LLMs using different benchmark strategies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIL72.1	3	-	-	-	3	-	-	-	-	-	-	-	3	3
22AIL72.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
22AIL72.3	-	-	3	-	2	-	-	-	-	-	-	2	3	3
22AIL72.4	-	-	-	3	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Experiments / Programs	Hrs	COs
	Prerequisite Experiments / Programs / Demo		
	• Deep Learning / Machine Learning Concepts • Basic Python Programming concepts		NA
	PART-A		
1	Using the Hugging Face Transformers library, apply a pre-trained model to perform abstractive summarization on news articles from the dataset, and include constraints on input length during summarization. Evaluate the generated summaries using ROUGE scores.	2	**22AIL72.1 22AIL72.4**
2	Utilize a pre-trained transformer model from Hugging Face's Transformers library to perform sentiment analysis. Evaluate real-world review datasets and interpret the model's predictions.	2	**22AIL72.1 22AIL72.4**
3	Develop a retrieval-augmented question answering (QA) system for biomedical queries by combining domain-specific document retrieval with a large language model (LLM). Fetch relevant information from PubMed abstracts and use it to generate accurate answers to clinical questions.	2	**22AIL72.2**
4	Implement a legal document question-answering and summarization system that retrieves relevant case law content using FAISS and generates multi-level summaries or answers using a language model like T5 or LLaMA.	2	**22AIL72.2**
5	Develop a collaborative planning system in which multiple specialized agents interact and coordinate to generate a cohesive, budget-conscious travel itinerary using CrewAI or LangChain's multi-agent frameworks.	2	**22AIL72.2 22AIL72.3**
6	Apply Parameter-Efficient Fine-Tuning (PEFT) using LoRA to adapt a pre-trained Transformer model for text classification on an equivalent domain-specific corpus	2	**22AIL72.1 22AIL72.3**
	PART-B		
7	Create a multi-agent system that simulates a customer support interaction involving product queries, placing orders, and payment processing. Show how agents can specialize, collaborate, and handle different steps in a realistic end-to-end workflow.	2	**22AIL72.1 22AIL72.3**
8	Use a group of specialized AI agents to summarize sections of a lengthy document and unify their outputs into a coherent summary with the help of a Coordinator Agent.	2	**22AIL72.3**
9	Build a simple text classification system to detect bias in news headlines or sentences using a pre-trained Transformer model.	2	**22AIL72.1 22AIL72.4**
10	Build and evaluate a text classification model to identify hate speechortoxic content in online user comments using a pre-trained Transformer model.	2	**22AIL72.1 22AIL72.4**

11	Use a LLM to answer fact-based questions and evaluate how truthful its responses are using the Truthful QA dataset.	2	**22AIL72.2 22AIL72.3**
12	Develop a RAG-based conversational agent that can handle multi-turn queries, such as booking a trip, where the user asks sequential questions (e.g., about flights, hotels, attractions), and the system retrieves and generates context-aware responses using prior conversation history.	2	**22AIL72.1 22AIL72.3 22AIL72.4**

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

Online Study Material Link:

1. https://colab.research.google.com/github/alberwan/LLM/blob/main/Generative_AI.ipynb/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	-	5
L3	**Apply**	10	10
L4	**Analyze**	5	10
L5	**Evaluate**	5	5
L6	**Create**		-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**-**
L3	**Apply**	**20**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1) Ben Auffarth ,"Generative AI with LangChain", Packt Publishing, 2023: ISBN: 9781835083468
2). Akshay Kulkarni, Adarsha Shivananda, "Applied Generative AI for Beginners: Practical Knowledge on Diffusion

REINFORCEMENT LEARNING			
Course Code	**22AIM73**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM73.1	Understand basic concepts of Reinforcement Learning
22AIM73.2	Apply multi-armed bandit algorithms to solve exploration-exploitation trade off.
22AIM73.3	Analyze how the Monte Carlo method and Temporal-Difference Learning use experience to drive the learning process.
22AIM73.4	Develop reinforcement learning applications based on the Finite Markov Decision Process framework
22AIM73.5	Investigate the performance of prediction problems through the principle of optimality.
22AIM73.6	Evaluate the real-world problems by designing and using Reinforcement learning concepts.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM73.1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
22AIM73.2	3	-	-	-		-	-	-	-	-	-	-	3	3
22AIM73.3	-	3	-	-	-	-	-	-	-	-	-	2	3	3
22AIM73.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
22AIM73.5	-	-	-	3	2	-	-	-	-	-	-	2	3	3
22AIM73.6	-	-	-	3	2	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION TO REINFORCEMENT LEARNING**	**22AIM73.1**	**8 Hours**

Introduction: Reinforcement Learning-Examples, Early History of Reinforcement Learning Elements of Reinforcement Learning. Limitations and Scope- An Extended Example: Tic-Tac-Toe.

Text Book	Textbook1: Chapter:1

MODULE-2	**MULTI-ARMED BANDITS**	**22AIM73.1, 22AIM73.2**	**8 Hours**

A k-armed Bandit Problem- Action- value Methods -Incremental Implementation - Tracking a Nonstationary Problem- Optimistic Initial Values -Upper- Confidence-Bound Action Selection- Gradient Bandit Algorithms.

Text Book	Textbook 2: Chapter:2

MODULE-3	**FINITE MARKOV DECISION PROCESSES & DYNAMIC PROGRAMMING**	**22AIM73.3, 22AIM73.4**	**8 Hours**

The Agent–Environment Interface -Goals and Rewards -Returns and Episodes - Unified Notation for Episodic and Continuing Tasks -Policies and Value Functions -Optimal Policies and Optimal Value Functions- Optimality and Approximation. Dynamic Programming-Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration -Value Iteration.

Text Book	Text Book13: Chapter:3

MODULE-4	**MONTE CARLO METHODS AND TEMPORAL-DIFFERENCE LEARNING**	**22AIM73.4, 22AIM73.5 22AIM73.6**	**8 Hours**

Monte Carlo Prediction - Monte Carlo Estimation of Action Values -Monte Carlo Control - Monte Carlo Control without Exploring Starts -Off-policy Prediction via Importance Sampling -Incremental Implementation - Off-policy Monte Carlo Control. TD Prediction -Advantages of TD Prediction Methods - Optimality of TD (0)- Sarsa: On-policy TD Control -Q-learning: Off-policy TD Control.

Text Book	Text Book1: Chapter:4

MODULE-5	**APPROXIMATE SOLUTION METHODS:**	**22AIM73.4, 22AIM73.5, 22AIM73.6**	**8 Hours**

Policy Gradient-Policy Approximation and its Advantages - The Policy Gradient Theorem - Monte Carlo Policy Gradient - REINFORCE with Baseline -Actor–Critic Methods - Policy Gradient for Continuing Problems - Policy Parameterization for Continuous Actions.

Case Study	Smart Retail Shelf Management RL Project – Learn Reinforcement Learning Algorithms through Real-World Retail Simulation
Text Book	Textbook 1: Chapter:5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction, second edition". The MIT Press Cambridge, Massachusetts London, England, 2018. ISBN: 9780262039246

Reference Books:

1)Warren B. Powell,"Reinforcement Learning and Stochastic Optimization", Wiley, 2022.ISBN:978-1119815037.
2)Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan & Claypool, 2010. ISBN: 978-1608454921

Web links and Video Lectures (e-Resources):

1) nptel.ac.in/courses/106106143
2) https://www.coursera.org/specializations/reinforcement-learning

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online Class using Jeopardy Lab
- Group discussion on research topics of Reinforcement Learning
- Class Presentation.

PROJECT WORK II			
Course Code	**22AIM74**	**CIE Marks**	**100**
L:T:P:S	**0:0:10:0**	**SEE Marks**	**100**
Hrs / Week	**20**	**Total Marks**	**200**
Credits	**10**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM74.1	Apply the Domain knowledge, technical skill set and software engineering principles for solving industry and research problems
22AIM74.2	Analyze algorithms to define modules for a given solution
22AIM74.3	Design a new innovation method based on real-world requirements, utilizing various Information and Communication Technology tools.
22AIM74.4	Evaluate the modules using testing methodologies and tools to identify their technology readiness level and prove the performance of the implemented project
22AIM74.5	Demonstrate project management skills by allocating resources and assigning tasks to meet deadlines
22AIM74.6	Synthesize project work into a detailed technical report and a technical paper, showcasing the findings and their significance.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM74.1	3		-	-	-	3		-	-	-	-	3	3	2
22AIM74.2		3	-	-	-	-	-	3	-	-	-	-	3	2
22AIM74.3	-	-	3	-	3	3	3	-	-	-	3	-	3	2
22AIM74.4	-	-	-	3	-	-	-	-	-	-	-	-	3	2
22AIM74.5		3	-		3				3	-	3	3	3	2
22AIM74.6	-	-	3	-	3	-	-	3	3	3	3	3	3	2

Objective

- Students to gain domain knowledge and technical skills to solve potential business problems, research problems, collect requirements, design suitable software solutions, and evaluate them.
- Students work as a small team and understand the processes and practises in the industry.
- Encourage independent learning and the innovative attitude of the students.
- Implement, test, and deploy solutions for target platforms.
- Adhere to punctuality, setting and meeting deadlines.
- Develop their interactive attitude, communication skills, organization, time management, and presentation skills.
- Preparing project reports and presentations

This course will be conducted largely as group of 2-4 student members under the direct supervision of a member of academic staff. The specific project topic undertaken will reflect the common interests and expertise of the student and supervisor.

Students will be required to:

1. Students form their own team, preferably combined with other departments (interdisciplinary team or Project).
2. Preparation of detailed design for the project.
3. Implementation of the sub-modules and their integration.
4. Testing and validation.
5. Publish the work carried out on the project in the referred journal.
6. Prepare and submit the major project report.

CIE Assessment Pattern (100 Marks)

RBT Level		Qualitative Assessment (s) - 100
L1	**Remember**	**-**
L2	**Understand**	**20**
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	**20**

SEE Assessment Pattern (100 Marks)		
RBT Levels		Exam Marks Distribution (100)
L1	**Remember**	**-**
L2	**Understand**	**20**
L3	**Apply**	**20**
L4	**Analyze**	**20**
L5	**Evaluate**	**20**
L6	**Create**	**20**

VIII SEMESTER

RECOMMENDER SYSTEMS			
Course Code	**22AIM811**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM811.1	Understanding of the fundamental concepts, goals, and domain-specific challenges of recommender system models.
22AIM811.2	Design model-based collaborative filtering techniques for building intelligent recommendation systems.
22AIM811.3	Analyze the structure and workflow of content-based recommender systems with collaborative filtering methods.
22AIM811.4	Evaluate content-based recommender system to propose strategies for building attack-resistant systems.
22AIM811.5	Create systems using suitable paradigms, accuracy metrics, and by identifying limitations to ensure user-centric reliability.
22AIM811.6	Investigate recommender systems through case studies by identifying key offline evaluation challenges and using strategies to enhance reliability and robustness.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM811.1	2	-	-	-	-	-	-	-	-	-	-	-	2	3
22AIM811.2	-	-	3	-	-	-	-	-	-	-	-	-	-	3
22AIM811.3	-	3	-	-	2	-	-	-	-	-	-	3	-	3
22AIM811.4	-	-	-	3	2	-	-	-	-	-	-	-	-	3
22AIM811.5	-	-	3			-	-	-	-	-	-	-	-	3
22AIM811.6	-	3	-	-	2	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION**	**22AIM811.1, 22AIM811.4**	**8 Hours**

Goals of Recommender System, Basic models of Recommender Systems: Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Demographic Recommender Systems, Evaluation of Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications: The Cold-Start Problem in Recommender Systems, Attack-Resistant Recommender Systems.

Self-study	Privacy in Recommender Systems
Text Book	Text Book 1: 1.1 to 1.5

MODULE-2	**MODEL-BASED COLLABORATIVE FILTERING**	**22AIM811.2, 22AIM811.3**	**8 Hours**

Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models: Geometric Intuition for Latent Factor Models, Low-Rank Intuition for Latent Factor Models, Basic Matrix Factorization Principles, Unconstrained Matrix Factorization

Text Book	Text Book 1: 3.1 to 3.6

MODULE-3	**CONTENT-BASED RECOMMENDER SYSTEMS**	**22AIM811.3**	**8 Hours**

Basic Components of Content-Based Systems, Pre-processing and Feature Extraction, Feature Representation and Cleaning, Collecting User Likes and Dislikes, Supervised Feature Selection and Weighting, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations.

Text Book	Text Book 2: 4.1 to 4.5

MODULE-4	**ATTACK-RESISTANT RECOMMENDER SYSTEMS**	**22AIM811.4, 22AIM811.6**	**8 Hours**

Basic Components of Content-Based Systems, Pre-processing and Feature Extraction, Feature Representation and Cleaning, Collecting User Likes and Dislikes, Supervised Feature Selection and Weighting, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations.

Case Study	Preventing Fake Account Creation in Recommender Systems Using CAPTCHA Mechanisms
Text Book	Text Book 1: 12.1 to 12.5

MODULE-5	**EVALUATING RECOMMENDER SYSTEMS**	**22AIM811.4, 22AIM811.5, 22AIM811.6**	**8 Hours**

Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures.

Case Study	Design Issues in Offline Recommender Evaluation – A Case Study of the Netflix Prize Dataset
Text Book	Text Book 2: 7.1 to 7.6

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Charu C. Aggarwal, "Recommender Systems: The Textbook" , Springer publisher, 2016. ISBN 978-3-319-29657-9, ISBN 978-3-319-29659-3.
2) Dietmar Jannach, "Recommender Systems: An Introduction" , Cambridge University Press, 2011, ISBN 978-0-521-49336-9.

Reference Books:

1) Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press (2011), 1st Ed., ISBN 978-0-521-49336-9
2) Francesco Ricci, Lior Rokach, Bracha Shapira, Recommender Systems Handbook, 1st edition, Springer (2011), ISBN: 978-0387858203

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc24_ge35/preview
- https://www.nvidia.com/en-in/glossary/recommendation-system
- https://www.geeksforgeeks.org/machine-learning/what-are-recommender-systems/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Open Book Discussions
- Organizing Group wise discussions on issues
- Seminars on latest Research concepts on Recommender Systems.

QUANTUM COMPUTING			
Course Code	**22AIM812**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs/Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM812.1	Apply the basic principles of quantum computing
22AIM812.2	Design the architecture and working of quantum bits, quantum gates, and quantum circuits.
22AIM812.3	Analyze the different quantum algorithm to solve real world computing
22AIM812.4	Investigate the different computation models.
22AIM812.5	Evaluate the performance of computing system with different operations and security
22AIM812.6	Develop the circuits using quantum computation environment.

MappingofCourseOutcomestoProgramOutcomesandProgramSpecificOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM812.1	3	-	-	-	-	-	-	-	-	-	-		-	3
22AIM812.2	-	-	3	-	-	-	-	-	-	-	-		-	3
22AIM812.3	-	3	-	-	-	-	-	-	-	-	-	3	-	3
22AIM812.4	-	-	3	-	-	-	-	-	-	-	-		-	3
22AIM812.5	-	-	-	3	-	-	-	-	-	-	-	-	-	3
22AIM812.6	-	-	3	3	-	3	-	-	2	3	-	3	-	3

MODULE-1	**INTRODUCTION**	**22AIM812.1**	**8Hours**
Quantum Computing Basic Concepts: Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Super positions.			
Text Book	TextBook1:2.1,2.2,2.3&TextBook2:1.1-1.5,2.1-2.3		
MODULE-2	**QUANTUM GATES AND CIRCUITS**	**22AIM812.2,22AIM812.5**	**8Hours**
Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development-Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring, Quantum error correction.			
Text Book	TextBook1:3.1,3.3,3.4, TextBook2:4.5.1,4.5.3,4.5.4,4.5.6,5.1-5.4,6.4.1,6.4.3,6.4.4		
MODULE-3	**QUANTUM ALGORITHMS**	**22AIM812.3,22AIM812.4**	**8Hours**
Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm			
Text Book	TextBook1:4.1,4.2,4.4,4.5,4.8		
MODULE-4	**QUANTUM INFORMATION THEORY**	**22AIM812.4, 22AIM812.5**	**8Hours**
Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels			
Text Book	TextBook1:5.1,5.2,5.3,5.4,5.5,5.6. TextBook2:10.1,10.3,10.5,10.7		
MODULE-5	**QUANTUM CRYPTOGRAPHY**	**22AIM812.5, 22AIM812.6**	**8Hours**
Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.			
Case Study	How can quantum approaches be applied to solve complex problems in the automotive, energy, finance, and insurance sectors?		
Text Book	TextBook1:6.1,6.2,7.1,8.1,8.2 TextBook2:10.1,10.2		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution,		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	-	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern(50Marks–Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	5
L5	**Evaluate**	5
L6	**Create**	--

Suggested Learning Resources:

Text Books:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition, 2020.ISBN: 9390385261
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010. ISBN: 978-1-107-00217-3

Reference Books:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013. ISBN:978-0521199568
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007. ISBN: 978-0521876582

Web links and Video Lectures(e-Resources):

- https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
- https://aws.amazon.com/what-is/quantum-computing/
- https://nptel.ac.in/courses/106106232
- https://www.cl.cam.ac.uk/teaching/0910/QuantComp/notes.pdf

Activity-Based Learning (Suggested Activities in Class)

- Case Studies
- Problem Solving using Computing Concepts
- Qubit Gate Puzzle Game
- Debate on Quantum Errors

AGENTIC AI			
Course Code	**22AIM813**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs/Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM813.1	Understand the principles of Agentic AI and its distinctions from traditional AI then how it is applied in real-world scenarios
22AIM813.2	Apply theoretical knowledge of Large Language Models and prompt engineering.
22AIM813.3	Analyze the functioning of LangChain, reactive agents and decision-making frameworks in AI systems.
22AIM813.4	Design diverse agent orchestration strategies using different methods and graph-based workflows.
22AIM813.5	Evaluate Agentic AI techniques such as Retrieval-Augmented Generation and multi-agent collaboration then tool-calling mechanisms.
22AIM813.6	Develop the solution for real world problem using Agentic AI.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM813.1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
22AIM813.2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
22AIM813.3	-	3	-	-	-	-	-	-	-	-	-	3	2	-
22AIM813.4	-		3	-	2	-	-	-	-	-	-	-	2	-
22AIM813.5	-	-		3	2	-	-	-	-	-	-	-	2	3
22AIM813.6	-	--	3		2	-	-	2	-	3		2	2	3

MODULE-1	**INTRODUCTION TO AGENTIC AI**	**22AIM813.1**	**8Hours**

Definition and Concept of Agentic AI, Key differences from traditional AI and generative AI, Motivation: Multi-step reasoning, autonomy, goal-driven behavior, Real-world applications and use cases

Text Book	TextBook1: Ch:1,2

MODULE-2	**FOUNDATIONS OF LARGE LANGUAGE MODELS (LLMS)**	**22AIM813.1,22AIM813.2**	**8Hours**

Introduction to Transformers, Attention Mechanism, Prompt Engineering: Basic and advanced techniques, Role of LLMs in building AI agents, Ethical considerations in LLM usage

Text Book	Text Book 1: Ch:1,5

MODULE-3	**LANGCHAIN AND REACTIVE AGENTS**	**22AIM813.3,22AIM813.4**	**8Hours**

LangChain fundamentals: Chains, Tools, Memory, Agents, ReAct pattern: Reasoning + Acting framework, Building basic decision-making flows in theory, Limitations and design challenges of reactive agents

Text Book	Textbook 1: Ch:7

MODULE-4	**AGENT ORCHESTRATION, PLANNING, AND REFLECTION**	**22AIM813.4,22AIM813.5**	**8Hours**

LangGraph concepts: Graph-based agent orchestration, Task decomposition and planning agents (AutoGPT-style), Reflection loops, self-evaluation, and self-correction in agents, Introduction to Constitutional AI principles

Text Book	Text Book 1: Ch:4,5

MODULE-5	**ADVANCED AGENTIC CONCEPTS**	**22AIM813.5, 22AIM813.6**	**8Hours**

Retrieval-Augmented Generation (RAG) for intelligent agents, Tools overview: FAISS, Pinecone, Chroma, Multi-agent collaboration systems (AutoGen, CrewAI), Tool calling, function calling, and interaction with external APIs

Case Study	Travel Booking Coordinator–Worker–Delegator Architecture
Text Book	Textbook1: Ch:5,6,7

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s) -25	AAT1 - 15	AAT2 - 10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	-	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern(50Marks–Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	5
L5	**Evaluate**	5
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1. Anjanava Biswas & Wrick Talukdar, "Building Agentic AI Systems: Create intelligent, autonomous AI agents that can reason, plan, and adapt", Packt Publishing,2025. ISBN: 978-1803238753, 2025.

Reference Books:

1. Denis Rothman "Transformers for Natural Language Processing and Computer Vision", 3rd Edition, 2025. ISBN: 978-1-80512-872-4

Web links and Video Lectures(e-Resources):

- https://online.stanford.edu/enhancing-your-understanding-agentic-ai-practical-guide
- https://aisera.com/blog/agentic-ai/

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Organizing Group discussions on real-world problems
- Seminars on recent topics related with Agentic AI

OPTIMIZATION TECHNIQUES			
Course Code	**22AIM814**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM814.1	Understand and classify optimization problems and formulate them mathematically.
22AIM814.2	Apply linear programming methods using graphical and simplex techniques.
22AIM814.3	Solve real-world problems using transportation and assignment models.
22AIM814.4	Create solutions using non-linear and unconstrained optimization techniques.
22AIM814.5	Analyze the constrained optimization problems using appropriate methods.
22AIM814.6	Evaluate the effectiveness of optimization techniques in addressing real-world problems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM814.1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
22AIM814.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
22AIM814.3	3	-	-	-	-	-	-	-	-	-	-	-	3	3
22AIM814.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
22AIM814.5	-	3	-	-	-	-	-	-	-	-	-	2	3	3
22AIM814.6	-	-	-	3	2	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION**	**22AIM814.1**	**8 Hours**
Applications and Classification, Problem Formulation and Optimality Criteria, Linear and Non-linear Programming, Unconstrained vs. Constrained Optimization, Introduction to Mathematical Modelling.			
Self-study	Role of Optimization in Engineering Design		
Text Book	Text Book 1: 1.1 to 1.5		
MODULE-2	**LINEAR PROGRAMMING**	**22AIM814.2**	**8 Hours**
Formulation of LP Problems, Graphical Method, Simplex Method, Big-M Method, Two-Phase Method, Duality and Sensitivity Analysis			
Self-study	Solving LP Problems using Excel Solver		
Text Book	Text Book 2: 2.1 to 2.7		
MODULE-3	**TRANSPORTATION AND ASSIGNMENT MODELS**	**22AIM814.3,22AIM814.6**	**8 Hours**
Transportation Problem – NWCR, LCM, VAM, MODI Method. Assignment Problem – Hungarian Method, Travelling Salesman Problem, Degeneracy and Unbalanced Models.			
Self-study	Vehicle Routing Problem (VRP) in logistics		
Text Book	Text Book 2: 5.1 to 5.6		
MODULE-4	**NON-LINEAR & UNCONSTRAINED OPTIMIZATION**	**22AIM814.4, 22AIM814.6**	**8 Hours**
Gradient Descent, Newton-Raphson, Golden Section, Fibonacci, Bisection, Steepest Descent, Conjugate Gradient, Convex Functions, Optimality Conditions			
Case Study	Design a mechanical spring that minimizes the total weight while meeting stress and deflection constraints. Use Steepest Descent and Conjugate Gradient methods to find the optimal wire diameter and number of coils.		
Text Book	Text Book 1: 7.1 to 7.6		
MODULE-5	**CONSTRAINED OPTIMIZATION & APPLICATIONS**	**22AIM814.5, 22AIM814.6**	**8 Hours**
Lagrange Multipliers, Kuhn-Tucker Conditions, Penalty Function Methods, Engineering Applications, Optimization using MATLAB/Python/Excel Solver			
Case Study	Given a set of power plants and loads, determine how to distribute the power to minimize cost while meeting demand constraints and generator limits.		
Text Book	Text Book 1: 8.1 to 8.5		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1. S. S. Rao, "Engineering Optimization: Theory and Practice", 4th Edition, Wiley, 2009. ISBN: 978-0470183526, e-ISBN: 978-8126548500
2. Kanti Swarup, P. K. Gupta, Man Mohan, Operations Research, Sultan Chand & Sons, 2020. ISBN: 978-8180548869

Reference Books:

1. H.A. Taha, "Operations Research: An Introduction", 9th Edition, Pearson Education, 2011.ISBN: 978-0132555937
2. R. Panneerselvam, Operations Research, 2nd Edition, PHI Learning, 2006.ISBN: 978-8120329280
3. Edwin K.P. Chong, Stanislaw H. Zak, "An Introduction to Optimization", 4th Edition, Wiley, 2013.ISBN: 978-1118279014

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112106134
- https://nptel.ac.in/courses/110106062
- https://ocw.mit.edu/courses/15-053-optimization-methods-in-management-science-spring-2013

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Solve the real time problem using different methods.
- Class presentation

CRYPTOGRAPHY AND NETWORK SECURITY			
Course Code	**22AIM815**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM815.1	Understand and apply the cryptography algorithms and its principles
22AIM815.2	Analyze the standard algorithms used to provide confidentiality, integrity and Authenticity
22AIM815.3	Apply the distinct roles and interactions of public and private keys in secure communication.
22AIM815.4	Design the authentication and hashing techniques
22AIM815.5	Develop strong password methods using different tools and methods
22AIM815.6	Evaluate the robustness of security services through the application of diverse protocols.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM815.1	2	-	-	-	-	-	-	-	-	-	-	-	3	2
22AIM815.2	-	3	-	-	-	-	-	-	-	-	-	2	3	2
22AIM815.3	3	-	-	-	-	-	-	-	-	-	-	-	3	2
22AIM815.4	-	-	3	-	-	-	-	-	-	-	-	-	3	2
22AIM815.5	-	-	3		2	-	-	-	-	-	-	-	3	2
22AIM815.6	-	-	-	3	2	-	-	-	-	-	-	-	3	2

MODULE-1	**INTRODUCTION TO SECURITY ATTACKS**	**22AIM815.1, 22AIM815.2 ,22AIM815.3**	**8 Hours**

OSI Security Architecture, Classical Encryption Techniques- Substitution ciphers and Transposition ciphers, Cryptanalysis, Stream and Block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of Confusion and Diffusion, Data Encryption Standard (DES), Block cipher modes of operations.

Self-study	Steganography
Text Book	Text Book 1: Ch:1.2 - 1.6 ,2.1-2.3,3.1-3.5,6.1-6,3

MODULE-2	**ENCRYPTION TECHNIQUE**	**22AIM815.1, 22AIM815.2 ,22AIM815.3**	**8 Hours**

AES, RC4, Random number generation. S-box theory: Boolean Function, S-box design criteria, Bent functions, Propagation and nonlinearity, construction of balanced functions, S-box design.

Self-study	Multiple Encryption and Triple DES.
Text Book	Text Book 1: Ch: 5.2, 6.3,7.4

MODULE-3	**PUBLIC KEY CRYPTOSYSTEMS**	**22AIM815.2 ,22AIM815.3,22AIM815.6**	**8 Hours**

Principles of Public Key Cryptosystems, RSA Algorithm, security analysis of RSA Modular Arithmetic. Key Management in Public Key Cryptosystems: Distribution of Public Keys, Distribution of Secret keys using Public Key Cryptosystems, Diffie-Hellman Key Exchange

Self-study	Elliptic curve cryptography
Text Book	Text Book 1: Ch: 9.1, 9.2,10.1,10.2

MODULE-4	**MESSAGE AUTHENTICATION AND HASH FUNCTION**	**22AIM815.4, 22AIM815.5,22AIM815.6**	**8 Hours**

Authentication requirements, Authentication functions, Message Authentication Code, Hash functions, Birthday attacks, Security of hash functions and MAC, MD5 message digest algorithm, Secure Hash Algorithm (SHA). Digital Signatures: Digital Signatures, authentication protocols, Digital Signature Standards (DSS), proof of digital signature algorithm

Text Book	Text Book 1: Ch:11.1 -11.5 ,12.1,13.1-13.3

MODULE-5	**SECURITY PRACTICE**	**22AIM815.5, 22AIM815.6**	**8 Hours**

PGP, S/MIME, IP Security Architecture, Authentication Header, Encapsulation Security Payload in Transport and Tunnel mode with multiple security associations. Web Security, Secure Socket Layer and Transport Layer Security.

Case Study	Secure Site-to-Site VPN Using IPSec
Text Book	Text Book 1: Ch:15.1 ,15.2,16.1-16.4, 17.1-17.3

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Stalling Williams, "Cryptography and Network Security: Principles and Practices", 4th Edition, Pearson Education, 2006.ISBN:9780131873162

Reference Books:

1. Kaufman Charlie, Radia Perlman, Mike Speciner," Network Security: Private Communication in a Public World", 2nd Ed., PHI/Pearson,2016. ISBN:978-9332578210.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc25_ee54/preview?utm_source=chatgpt.com
- https://www.geeksforgeeks.org/computer-networks/cryptography-and-network-security-principles/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Organizing Group wise discussions on issues related with Cryptography.
- Seminars

AI ETHICS FOR AIML ENGINEERS			
Course Code	**22AIM821**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs/Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course out comes: At the end of the course, the student will be able to:

22AIM821.1	Understand the legal and ethical frame works governing artificial intelligence.
22AIM821.2	Apply human rights-centered design, deliberation, and normative modes to mitigate ethics and address conflicts
22AIM821.3	Examine the oral framework of justice in AI and accountability in computer systems.
22AIM821.4	Evaluate the ethical implications of AI in health, public, legal fields.
22AIM821.5	Develop the ethical considerations of AI and its impact on society.
22AIM821.6	Collaborate with experts from various domains to build a cohesive ethical AI systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM821.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
22AIM821.2	3	-	-	-	-	-	-	-	-	-	-	2	2	-
22AIM821.3	-	3	-	-	-	-	-	-	-	-	-	2	2	-
22AIM821.4	-	-	-	3	2	-	-	2	-	-	-	2	2	-
22AIM821.5	-	-	3	-	-	-	-	3	-	-	-	2	2	2
22AIM821.6	-	-	-	-	-	3	-	3	-	2	-	3	2	3

MODULE-1	**INTRODUCTION AND OVERVIEW**	**22AIM821.1**	**8Hours**

Introduction & Overview for Law and Regulation, Ethics of the Ethics of AI, Ethical Issues in Relationship with Artificial Entities.

Text Book	TextBook1:Ch1

MODULE-2	**FRAMEWORK AND MODES**	**22AIM821.2**	**8Hours**

AI Governance by Human Rights-Centered Design, Deliberation and Oversight: End to Ethics Washing, The Incompatible Incentives of Private-Sector AI. Normative Modes: Codes and standards. The Role of Professional Norms in the Governance of Artificial Intelligence.

Applications	
Text Book	Text Book 1: Ch:4-7

MODULE-3	**CONCEPTS AND ISSUES**	**22AIM821.3, 22AIM821.4**	**8Hours**

Moral Framework of Justice in AI: on the Limits, Failing and Ethics of Fairness, Accountability in Computer Systems-Responsibility and AI, The concept of H and off as a Model for Ethical Analysis and Design.

Text Book	Textbook 1: Ch:8– 21

MODULE-4	**PERSPECTIVES AND APPROACHES**	**22AIM821.4**	**8Hours**

Perspective on Ethics of AI - Computer Science, Social Failure Modes in Technology and the Ethics of AI: An Engineering Perspective, Automating Origination: Perspectives from the Humanities, Perspectives on Ethics of AI: Philosophy

Text Book	Text Book 1: Ch:22-28

MODULE-5	**CASES AND APPLICATION**	**22AIM821.4, 22AIM821.5,22AIM821.6**	**8Hours**

Ethics of AI in Transport- Ethics of AI in Biomedical Research, Patient Care and Public Health, Ethics of AI in Law: Basics Questions, Beyond Bias: Ethical AI in Criminal Law.

Case Study	Solar Lighting Example
Text Book	Textbook1: Ch:35-39.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s) – 25	AAT1 - 15	AAT2 – 10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	**10**
L3	**Apply**	**20**
L4	**Analyze**	**5**
L5	**Evaluate**	**5**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1. Mark us D Dubber, Frank Pasquale, Sunit Das," The Oxford Handbook of Ethics of AI", Oxford Press,2020. ISBN: 978-0-19-006739-7.

Reference Books:

1. Melanie Mitchell, "Artificial Intelligence: A Guide for Thinking Humans" Farrar, Straus and Giroux,2019. ISBN:978-0374257835
2. Patrick Lin, Keith Abney, and Ryan Jenkins, "RobotEthics2.0: From Autonomous Cars to Artificial Intelligence", OUP USA,2017. ISBN:978-0190652951.

Web links and Video Lectures(e-Resources):

- https://ocw.mit.edu/courses/res-ec-001-exploring-fairness-in-machine-learning-for-international-development-spring-2020/pages/module-one-introduction/

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Group discussion on real-world problems.
- Seminars

SOCIAL NETWORK ANALYSIS			
Course Code	**22AIM822**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM822.1	Demonstrate the fundamental concepts of social media and networking platforms to explore their characteristics, uses, and societal impact.
22AIM822.2	Apply appropriate social media tools and techniques to model to interpret online social behavior and interactions.
22AIM822.3	Analyze social network structures to identify patterns of interaction along with relationship formation.
22AIM822.4	Design the structural properties of social networks using theoretical and graphical models
22AIM822.5	Conduct social media analysis using appropriate tools to gain insights into trends and patterns
22AIM822.6	Evaluate real-world problems by synthesizing solutions from graph-based models to construct, visualize, and structurally analyze social networks.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM822.1	2	-	-	-	-	-	-	-	-	-	-	-	3	2
22AIM822.2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
22AIM822.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
22AIM822.4	-	-	3	-	-	-	-	-	-	-	-	-	3	-
22AIM822.5	-	-	-	3	2	-	-	-	-	-	-	2	3	-
22AIM822.6	-	-	-	3	2	-	-	-	-	-	-	2	3	3

MODULE-1	**INTRODUCTION**	**22AIM822.1**	**8 Hours**

Understand Social Networking, Social Media Characteristics, importance of social media, Types of Social Media Advantages and Disadvantages, Future of Social Networking, Various social networking sites-FACEBOOK, INSTAGRAM, TWITTER, LINKEDIN, Tumblr, Instagram, Snapchat, Marketing, Challenges of social media.

Text Book	Text Book 1: Ch:1,1.2,1.3,1.4

MODULE-2	**BUILDING A NETWORK**	**22AIM822.2, 22AIM822.4, 22AIM822.6**	**8 Hours**

Networks as Graphs, Actors, Ties, Multiplex Networks, Weighted Ties, Group, Geodesic Distance, Graph Connectivity, Degree of an Actor -Indegree and Outdegree, Types of nodes– Carrier, Transmitter, Receiver, Isolate, Representation of Social Network Data – Socio matrix and Edge List, Matrix Permutation and Blocks, Network Relationships Reciprocity, Transitivity, Popularity Structural Equivalence, Clique, Star.

Text Book	Text Book 2: Ch:2.1-2.4,3.1.3.2

MODULE-3	**STRENGTH OF WEAK TIES & HOMOPHILY**	**22AIM822.3, 22AIM822.5**	**8 Hours**

Granovetter's strength of weak ties, Triads, Clustering Coefficient and Neighborhood Overlap, Structure of Weak Ties, Bridges and Local Bridges, Embeddedness, Structural Holes, Social Capital, Tie Strength, social media and passive. Engagement, Strong and Weak Relationship, Introduction to Homophily, Selection and Social Influence, Foci Closure and Membership Closure.

Text Book	Textbook 1: Ch;4.3,4.4, Text Book 2: Ch: 8.1,8.2,8.3

MODULE-4	**NETWORK PROPERTIES**	**22AIM822.3, 22AIM822.4**	**8 Hours**

Network Density, Properties of Nodes–Degree Centrality, Closeness Centrality, Betweenness Centrality, Centrality of a Network - Network Degree Centrality, Network Closeness Centrality, Network Betweenness Centrality, Pagerank centrality

Text Book	Text Book 2: Ch:4.1,4.2,4.3,4.4

MODULE-5	**SOCIAL MEDIA ANALYSIS**	**22AIM822.5, 22AIM822.6**	**8 Hours**

Four Dimension of Analysis, Criteria of Effectiveness, Metrics, Social Network Analysis, Semantic Analysis, Online Sentiment Analysis, Tools, Social Media Management, Centrality Measures, Opinion Mining, Feature Based Sentiment Analysis

Case Study	Construct a small hypothetical social network (e.g., a classroom, department, or friend circle) and represent it using graphs.
Text Book	Text Book 2: Ch:10.1,10.2,10.4,10.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Tanmoy Chakraborty, "Social Network Analysis". Wiley, 2021. ISBN: 978-9354247835.

2) Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining: An Introduction", Cambridge university press,2014.ISBN: 978-1139908313

Reference Books:

1) Matthew Denny, Institute for Social Science Research, University of Massachusetts, AMHERST, "Social Network Analysis"-2014

2) Timothy Baldwin, University of Melbourne, "Semantic Analysis of Social Media"-2014

Web links and Video Lectures (e-Resources):

- http://www.razorsocial.com/social- media analytics-tools/
- https://ocw.mit.edu/courses/15-599-workshop-in-it-collaborative-innovation-networks-fall-2011/278df2377b30ed8119f9b751553298b8_MIT15_599F11_lec04.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group Discussion
- Flipped Class
- Seminar
- Case study

MOBILE COMPUTING			
Course Code	**22AIM823**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM823.1	Understand the working principles of mobile networks and contrast different types of telecommunication networks.
22AIM823.2	Apply skills in working with Cognitive radio networks and recent telecommunication networks.
22AIM823.3	Assess the recent telecommunication networks and resource management.
22AIM823.4	Develop the routing and energy-efficient protocols in ad hoc and sensor networks
22AIM823.5	Design of various wireless network protocols using simulation tools.
22AIM823.6	Evaluate knowledge of communication technologies using various evaluation techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM823.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
22AIM823.2	3	-	-	-	-	-	-	-	-	-	-	-	2	3
22AIM823.3	-	3	-	-	-	-	-	-	-	-	-	2	2	3
22AIM823.4	-	-	3	-		-	-	-	-	-	-	2	2	3
22AIM823.5	-	-	3	-	2	-	-	-	-	-	-	2	2	3
22AIM823.6	-	-	-	3	-	2	-	-	-	2	-	2	2	3

MODULE-1	**INTRODUCTION**	**22AIM823.1**	**8 Hours**

Overview of wireless and mobile infrastructure; Preliminary concepts on cellular architecture; Design objectives and performance issues; Radio resource management and interface; Propagation and path loss models; Channel interference and frequency reuse; Cell splitting; Channel assignment strategies; Overview of generations: - 1G to 5G.

Case Study	A comparative study of mobile technology from 1G to 5G
Text Book	Text Book 1: Ch:1,3,4,7,11

MODULE-2	**LOCATION AND HANDOFF MANAGEMENT**	**22AIM823.2**	**8 Hours**

Introduction to location management (HLR and VLR); Mobility models characterizing individual node movement (Random Walk, Fluid flow, Markovian, Activity based); Mobility models characterizing the movement of groups of nodes (Reference point-based group mobility model, Community based group mobility model); Static (Always vs. Never update, Reporting Cells, Location Areas) and Dynamic location management schemes (Time, Movement, Distance, Profile Based). Terminal Paging (Simultaneous paging, Sequential paging). Location management and Mobile IP. Overview of handoff process: Factors affecting handoffs and performance evaluation metrics. Handoff strategies, Different types of handoffs (soft, hard, horizontal, vertical).

Case Study	A user is continuously moving between different cells in a cellular network. How would the location management system track the user's changing location?
Text Book	Text Book 2: Ch: 4,6,7,8,9

MODULE-3	**WIRELESS TRANSMISSION FUNDAMENTALS**	**22AIM823.3**	**8 Hours**

Introduction to narrow and wideband systems; Spread spectrum; Frequency hopping; Introduction to MIMO; MIMO Channel Capacity and diversity gain; Introduction to OFDM; MIMO-OFDM system; Multiple access control (FDMA, TDMA, CDMA, SDMA); Wireless local area network; Wireless personal area network (Bluetooth and zigbee).

Text Book	Text Book 1 : Ch: 9

MODULE-4	**MOBILE AD-HOC NETWORKS &WIRELESS SENSOR NETWORKS**	**22AIM823.4, 22AIM823.6**	**8 Hours**

Characteristics and applications; Coverage and connectivity problems; Routing in MANETs.
Concepts, basic architecture, design objectives and applications; Sensing and communication range; Coverage and connectivity; Sensor placement; Data relaying and aggregation; Energy consumption; Clustering of sensors; Energy efficient Routing (LEACH).

Text Book	Text Book 3: Ch: 1,6,13,14

MODULE-5	**D2D COMMUNICATIONS IN 5G CELLULAR NETWORKS**	**22AIM823.5, 22AIM823.6**	**8 Hours**

Introduction to D2D communications; High level requirements for 5G architecture; Introduction to the radio resource management, power control and mode selection problems; Milli-meter wave communication in 5G

Applications	What new applications and services can be enabled by D2D communication in 5G, such as social networking, location-based services, and collaborative applications?
Text Book	Text Book4: Ch: 3,5,6

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Theodore S. Rappaport, "Wireless Communications". Pearson Education, 2021.ISBN -978-0130422323
2. Jochen Schiller, "Mobile Communications". Pearson Education 2nd edition 2023, ISBN: 978-8131717534
3. Rajesh Kumar, C. Siva Ram Murthy, and B. S. Manoj, "Wireless Ad Hoc and Sensor Networks: Theory and Applications", Wiley India.ISBN-10: 052186523X.
4.Afif Osseiran, José F. Monserrat & Patrick Marsch,"5G Mobile and Wireless Communications Technology", Cambridge University Press,2016. ISBN: 978-1107130098

Reference Books:

1. Ivan Stojmenovic, "Handbook of Wireless Networking and Mobile Computing", Wiley-Interscience, 2002.ISBN:978-0471419020
2. Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan Mandayam and H. Vincent Poor, "Principles of Cognitive Radio", Cambridge University Press, 2012. ISBN: 978-1139844017.

Web links and Video Lectures (e-Resources):

- https://www.ncbi.nlm.nih.gov/guide/training-tutorials/
- https://www.ebi.ac.uk/training/
- https://www.coursera.org/specializations/bioinformatics

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Class Presentation
- Group Discussion on related research with Mobile Technology.

PATTERN RECOGNITION			
Course Code	**22AIM824**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

22AIM824.1	Understand the need and significance of mathematical fundamentals in pattern recognition to solve real-time problems.
22AIM824.2	Apply unsupervised techniques for clustering data without prior knowledge.
22AIM824.3	Analyze pattern recognition models to extract interesting patterns from structured data like graph, syntactic description.
22AIM824.4	Develop prototype pattern recognition algorithms that can be used to study algorithm behavior and performance against real-world multivariate data
22AIM824.5	Create a solution to a real-world problem using distinct pattern recognition strategies
22AIM824.6	Evaluate pattern recognition abilities using new techniques.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM824.1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
22AIM824.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
22AIM824.3	-	3	-	-	2	-	-	-	-	-	-	2	3	3
22AIM824.4	-	-	3		2	-	-	-	-	-	-	2	3	3
22AIM824.5	-	-		3	2	-	-	-	-	-	-	2	3	3
22AIM824.6	-	-		3	3	-	-	-	-	-	-	2	3	3

MODULE-1	**CLASSIFICATION**	**22AIM824.1**	**8 Hours**
Overview of pattern recognition-Discriminant functions -Supervised Learning-Parametric estimation Maximum likelihood estimation.			
Text Book	Text Book 3: Ch 2, 3, 4		

MODULE-2	**PATTERN CLASSIFIER**	**22AIM824.2, 22AIM824.3**	**8 Hours**
Bayesian parameter estimation-perceptron algorithm-LMSE algorithm-problems with Bayes approach-Pattern classification by distance functions-Minimum distance pattern classifier.			
Text Book	Text Book 3: Ch 1 Text Book 4: Ch 4		

MODULE-3	**UNSUPERVISED CLASSIFICATION**	**22AIM824.2, 22AIM824.3**	**8 Hours**
Clustering for unsupervised learning and classification-Clustering concept-C-means algorithm-Hierarchical clustering procedures-Graph theoretic approach to pattern clustering Validity of clustering solutions.			
Text Book	Text Book 4: Ch 5, 8		

MODULE-4	**STRUCTURAL PATTERN RECOGNITION**	**22AIM824.4, 22AIM824.5, 22AIM824.6**	**8 Hours**
Elements of formal grammars-String generation as pattern Syntactic Description-Parsing-Stochastic grammars structural representation. Description-Recognition of and applications-Graph based.			
Self-study	Feature Extraction: Entropy minimization-Karhunen-Loeve transformation.		
Text Book	Text Book 4: Ch 9		

MODULE-5	**NEURAL NETWORKS, KERNAL MACHINES**	**22AIM824.5, 22AIM824.6**	**8 Hours**
Neural network structures for pattern recognition-Neural Network based pattern associators– Self organizing networks-Support vector machines (SVM)-Kernel machines, Maximum margin classification, and generalizability and VC(Vapnik–Chervonenkis) dimension.			
Text Book	Text Book 1: Ch:11, 13		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Trevor H, Robert T,Jerome Friedman, "The Elements of Statistical Learning", Springer Series,2017. ISBN: 978-0387848587

2). Christopher M Bishop, "Pattern Recognition and Machine Learning". Springer, 2011. ISBN: 1493938436

3). Duda R.O., and Hart.P.E."Pattern Classification and Scene Analysis", second edition, Wiley, 2007. ISBN 9788126511167.

4). Robert J.Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches" , JohnWiley& Sons Inc., New York, 2007. ISBN:8126513705, 978-8126513703.

Reference Books:

1. Morton Nadier and Eric Smith P.," Pattern Recognition Engineering", John Wiley & Sons, NewYork, 1993. ISBN: 978-0471622932

Web links and Video Lectures (e-Resources):

- http://www.digimat.in/nptel/courses/video/106106046/L01.html
- https://dss-kiel.de/index.php/teaching/lectures/lecture-pattern-recognition

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Organizing Group wise discussions on issues
- Seminars

BLOCK CHAIN TECHNOLOGY			
Course Code	**22AIM825**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course outcomes: At the end of the course, the student will be able to:

22AIM825.1	Understand the basic concepts and technology used tor blockchain.
22AIM825.2	Develop Ethereum block chain contract.
22AIM825.3	Construct secure Bitcoin transactions through the application of Bitcoin Script.
22AIM825.4	Analyze the primitives of the distributed computing and cryptography related to blockchain.
22AIM825.5	Evaluate the blockchain solutions for practical use cases across diverse fields.
22AIM825.6	Apply security features in blockchain technologies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM825.1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
22AIM825.2		-	3	-	-	-	-	-	-	-	-	-	2	2
22AIM825.3	-	-	3	-	2	-	-	-	-	-	-	-	2	2
22AIM825.4	-	3	-	-	-	-	-	-	-	-	-	3	2	2
22AIM825.5	-	-	-	3	2	-		-	-	2	-	-	2	2
22AIM825.6	3	-	-	-	-	-	-	-	-	-	-	2	2	2

MODULE-1	**INTRODUCTION**	**22AIM825.1**	**8 Hours**
Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.			
Self-study	Understanding Byzantine Generals and Nakamoto's Blockchain Models.		
Text Book	Text Book 1: Ch:1-28,33-78		
MODULE-2	**BASIC DISTRIBUTED COMPUTING & CRYPTO PRIMITIVES**	**22AIM825.2,22AIM825.6**	**8 Hours**
Atomic Broadcast, on sensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, ollison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero- knowledge systems			
Case Study	Explore Byzantine fault tolerance model, Collision resistant hash case studies. Please put only which is applicable for the module. If not applicable, please remove this row.		
Text Book	Text Book 1: Ch:85-120		
MODULE-3	**BITCOIN BASICS**	**22AIM825.2, 22AIM825.3**	**8 Hours**
Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use			
Case Study	Explore Bitcoin Scripting and Consensus**.**		
Text Book	Text Book 1: Ch:121,122,123-190		
MODULE-4	**ETHEREUM BASICS**	**22AIM825.4, 22AIM825.5**	**8 Hours**
Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript			
Applications	Investigate and explore Bitcoin scripting vs. Ethereum Smart Contracts.		
Text Book	Text Book 2: Ch;1-46		
MODULE-5	**PRIVACY, SECURITY ISSUES IN BLOCKCHAIN**	**22AIM825.5, 22AIM825.6**	**8 Hours**
Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks			
Self-study	Survey on different blockchain attacks, its preventions and solutions.		
Text Book	Text Book 2: Ch:123-195		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	

Suggested Learning Resources:

Text Books:

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press,2016. ISBN:9780691171692.

2. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, 2017. ISBN: 1546772804.

Reference Books:

1.Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing, 2018. ISBN: 9781788839044.

2.Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing, 2019. ISBN: 978-1789531374.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/results?search_query=Byzantine+Generals+problem+block+chain+technology
- https://www.youtube.com/watch?v=Q2H2ndbHUFQ
- https://www.youtube.com/watch?v=-2RJz-_8lbo
- https://www.youtube.com/watch?v=hxbgsamAtW8
- https://onlinecourses.nptel.ac.in/noc22_cs44/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Problem-Solving
- Seminars

INTERNSHIP			
Course Code	**22AIM83**	**CIE Marks**	**100**
L:T:P:S	**0:0:10:0**	**SEE Marks**	**100**
Hrs / Week	**20**	**Total Marks**	**200**
Credits	**10**	**Exam Hours**	**03**

Objectives

1.Students will be competent to connect with reputable industry, laboratory, or research institutes to gain Practical knowledge on software development and design, product design and development, analytics, Business processes and insights, industry practices, and other related aspects, as well as develop Problem- solving skills.

2.Students acquire technical, interpersonal, and teamwork abilities to fulfil the demands of business, academia, and other organizations in the important areas of automation and digitalization

Course outcomes: At the end of the course, the student will be able to:

22AIM83.1	Apply domain knowledge for problem solving.
22AIM83.2	Analyse solutions to complex business problems.
22AIM83.3	Design solutions for the target platform.
22AIM83.4	Create an innovation method to solve the Real-World issues
22AIM83.5	Make efficient use of time and accomplish the assigned work within the time frame
22AIM83.6	Develop a technical report based on the technical knowledge acquired from the industry during the internship.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22AIM83.1	3	-	-	-	-	2	2	2	3	-	-	3	3	2
22AIM83.2	-	3	-	-	-	2	2	2	3	-	-	3	3	2
22AIM83.3	-	-	3	3	3	2	2	2	3	-	3	3	3	2
22AIM83.4	-	-	3	3	3	2	2	2	3	3	3	3	3	2
22AIM83.5	-	-	-	-	-	2	2	2	3	-	3	3	3	2
22AIM83.6	-	-	3	-	3	2	2	2	3	3	2	3	3	2

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Internship.

Internship: The mandatory Internship is for **14 to 20 weeks**. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements. If the students are opting for the 8th semester, the following internship options are available:

- Industry Internship
- Research Internship
- Skill Enhancement Courses
- Post-Placement Training as Internship
- Online Internship

Industry internship: It is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints. Students undertaking industry internships must ensure the organization is listed on the VTU Internship Portal. If not, request the organization to register on the portal.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research. Research internships must be carried out in recognized research centers. Ensure that these centers are registered on the portal.

Skill Enhancement Courses: Students can take Skill-based courses with credits totalling the same as those of the internship. Students must be taken from registered providers listed on the VTU Internship Portal.

Post-Placement Training as Internship: The post-placement training is also considered an internship. For students placed during their 6th/7th semester and willing to take the training during their final year, colleges must inform the recruiting companies in advance to register on the VTU Internship Portal.

Online Internship: Reputed online internship platforms, including those identified by NSDC, are already listed on the VTU Internship portal. If colleges come across other eligible organizations not yet listed, they are informed to ask the organization to register on the VTU Internship portal.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship. With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

Evaluation Stages:

Activity	Evaluation Attribute
Review-I	1. A brief introduction about the company with an assigned domain, project or modules, and other necessary details. 2. Submit the offer letter received from the company.
Review-II	1. Show progress during the internship period using a PowerPoint presentation.
Review-III	1. Show a demo of the work carried out or completed with the necessary details. 2. Submit the final report in the prescribed format with an internship completion certificate.

CIE Assessment Pattern (100 Marks)

RBT Levels		Qualitative Assessment (s)
		100 Marks
L1	**Remember**	**-**
L2	**Understand**	20
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	20

SEE Assessment Pattern (100 Marks)

RBT Levels		Exam Marks Distribution (100)
L1	**Remember**	
L2	**Understand**	20
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	20

INDIAN KNOWLEDGE SYSTEMS			
Course Code	**22IKK84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**1**	**Total Marks**	**50**
Credits	**0**	**Exam Hours**	**--**

Course outcomes: At the end of the course, the student will be able to:

22IKK84.1	Provide an overview of the concept of the Indian Knowledge System and its importance.
22IKK84.2	Appreciate the need and importance of protecting traditional knowledge.
22IKK84.3	Recognize the relevance of Traditional knowledge in different domains.
22IKK84.4	Establish the significance of Indian Knowledge systems in the contemporary world.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22IKK84.1	2	-	-	-	-	-	-	3	-	-	-	1
22IKK84.2	-	-	-	-	-	2	-	-	-	-	-	-
22IKK84.3	-	-	2	2	-	-	-	-	-	-	-	-
22IKK84.4	-	-	-	-	-	3	2	-	-	-	-	-

MODULE-1	**INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS (IKS)**	**22IKK84.1, 22IKK84.2**	**5 Hours**

Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.

MODULE-2	**TRADITIONAL KNOWLEDGE IN PROFESSIONAL DOMAIN**	**22IKK84.3**	**5 Hours**

Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Dyes and painting technology, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.

MODULE- 3	**TRADITIONAL KNOWLEDGE IN GOVERNANCE AND ECONOMICS**	**22IKK84.4**	**5 Hours**

Governance and public administration, United Nations Sustainable development goals, an overview of Indian economic thought–Arthasastra and Nitisastra, Leadership and Motivation, Planning and Organizing, Financial Management

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s) - (MCQs)	AAT
		25	25
L1	**Remember**	**5**	**5**
L2	**Understand**	**5**	**5**
L3	**Apply**	5	5
L4	**Analyze**	**5**	5
L5	**Evaluate**	**5**	**5**
L6	**Create**	**-**	**-**

Suggested Learning Resources:

Reference Books:

1. **Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0

2. **Traditional Knowledge System in India**, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230

3. **Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334

Web links and Video Lectures (e-Resources):

1. https://iksindia.org/lectures-and-videos.php
2. http://nptel.ac.in/courses/121106003/
3. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
4. https://www.youtube.com/watch?v=LZP1StpYEPM

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Reflection and Discussion
- Case Studies

APPENDIX A
NEWHORIZON COLLEGE OF ENGINEERING
B.E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examinations for 2022-2026BATCH (2022 Scheme)

III Semester														
Sl. No	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	BSC	22MAC31	Mathematical Foundation for Computing Sciences	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	22AIM32	Data Structure and Algorithms	AIML	3	0	0	0	3	3	50	50	**100**
3	PCCL	22AIL32	Data Structure and Algorithms Lab	AIML	0	0	1	0	1	2	50	50	**100**
4	PCC	22AIM33	Object Oriented Programming with Java	AIML	3	0	0	0	3	3	50	50	**100**
5	PCCL	22AIL33	Object Oriented Programming with Java Lab	AIML	0	0	1	0	1	2	50	50	**100**
6	PLC	22AIM34X	Programming Language Course	AIML	2	0	1	0	3	4	50	50	**100**
7	AEC	22AIM35X	Ability Enhancement Course –III	AIML	0	0	1	0	1	2	50	50	**100**
8	BSC	22BIK36	Bio Inspired Design and Innovation	Any Dept	3	0	0	0	3	3	50	50	**100**
9	UHV	22SCK37	Social Connect and Responsibility	AIML	0	0	1	0	1	2	50	--	**50**
10	NCMC	22NSS30	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED30	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG30	Yoga	Yoga Teacher									
Total									**19**	**26**	**500**	**400**	**900**

12	NCMC	22DMAT31*	Basic Applied Mathematics-I	BS	0	0	0	0	0	2	50	--	50

BSC: Basic Science Course, PCC: Professional Core Course, PCCL: Professional Core Course Laboratory, UHV: Universal Human Value Course, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, L: Lecture, T: Tutorial, P: Practical S:SDA: Self Study for Skill Development, K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

DMAT31*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Programming Language Course (PLC)			
22AIM341	Linux Programming	22AIM 343	Programming for IoT
22AIM342	Perl Programming	22AIM 344	Java Script Programming
Ability Enhancement Course–III (all are Laboratory Courses 0-0-1-0)			
22AIM351	Problem solving using Prolog	22AIM353	Data Analysis using MS-Excel
22AIM352	Python for Data Analytics	22AIM354	Exploratory Data Analysis

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: 1- hour Lecture (L) per week=1Credit2-hours Tutorial(T) per week=1 Credit 2- hours Practical/ Drawing(P)per week=1Credit 2-hous Self Study for Skill Development (SDA) per week= 1 Credit	03- Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING

B.E.in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations for 2022-2026 BATCH (2022 Scheme)

IV Semester

Sl. No	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	BSC/ PCC	22MAC41	Discrete Mathematics and Graph Theory	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	22AIM42	Database Management System	AIML	3	0	0	0	3	3	50	50	**100**
3	PCCL	22AIL42	Database Management System Lab	AIML	0	0	1	0	1	2	50	50	**100**
4	PCC	22AIM43	Design and Analysis of Algorithm	AIML	3	0	0	0	3	3	50	50	**100**
5	PCCL	22AIL43	Design and Analysis of Algorithm Lab	AIML	0	0	1	0	1	2	50	50	**100**
6	PCC	22AIM44	Data Science	AIML	3	0	0	0	3	3	50	50	**100**
7	PCCL	22AIL44	Data Science Lab	AIML	0	0	1	0	1	2	50	50	**100**
8	PLC	22AIM45X	Programming Language Course	AIML	2	0	1	0	3	4	50	50	**100**
9	AEC	22AIM46X	Ability Enhancement Course –IV	AIML	0	0	1	0	1	2	50	50	**100**
10	UHV	22UHK47	Universal Human Values and Life Skills	Any Dept	1	0	0	0	1	2	50	50	**100**
11	PROJ	22AIM48	Mini Project-I	AIML	0	0	1	0	1	2	50	50	**100**
12	NCMC	22NSS40	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED40	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG40	Yoga	Yoga Teacher									
Total									**21**	**30**	**600**	**550**	**1150**
13	NCMC	22DMAT41*	Basic Applied Mathematics-II	BS	0	0	0	0	0	2	50	--	50

2DMAT41*: This non-credit mandatory course to be offered with only CIE and so SEE to lateral students

BSC: Basic Science Course, **PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PROJ**: Mini Project work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering. **ESC:** Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation

Programming Language Course (PLC)

22AIM451	Ruby Programming	22AIM453	R Programming
22AIM452	C#and.Net Framework	22AIM454	Advanced Python Programming

Ability Enhancement Course–IV (all are Laboratory Courses 0-0-1-0)

22AIM461	Database Programming using Casandra	22AIM463	GoLang Programming
22AIM462	Data Visualization	22AIM464	Haskell programming

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini projectas

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

(ii) A group of 2-4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 2 -4 students if the Mini Project work is a multi-disciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates
National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: - hour Lecture (L) per week=1Credit2-hours Tutorial(T) per week=1 Credit 2-hours Practical / Drawing (P) per week=1 Credit - hous Self Study for Skill Development (SDA) per week= 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02-Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

V Semester

Sl No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hrs	Marks		
					L	T	P	S			CIE	SEE	Total
1	HSMS	22AIM51	Software Engineering and Project Management	AIML	3	0	0	0	3	3	50	50	**100**
2	PCC	22 AIM 52	Machine Learning	AIML	3	0	0	0	3	3	50	50	**100**
3	PCCL	22AIL52	Machine Learning Lab	AIML	0	0	1	0	1	2	50	50	**100**
4	PCC	22 AIM 53	Natural Language Processing	AIML	3	0	0	0	3	3	50	50	**100**
5	PCCL	22AIL53	Natural Language Processing Lab	AIML	0	0	1	0	1	2	50	50	**100**
6	PEC	22AIM54X	Professional Elective Course-I	AIML	3	0	0	0	3	3	50	50	**100**
7	AEC	22RMK55	Research Methodology and IPR	AIML	1	1	0	0	2	3	50	50	**100**
8	AEC	22SDK56	Critical and Creative Thinking Skills	AIML	0	0	1	0	1	2	50	--	**50**
9	UHV	22ESK57	Environmental Studies	Any Dept	1	0	0	0	1	1	50	50	**100**
10	PROJ	22AIM58	Mini Project-II	AIML	0	0	1	0	1	0	50	50	**100**
11	NCMC	22NSS50	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED50	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG50	Yoga	Yoga Teacher									
Total									**19**	**24**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation

Professional Elective Course-I

22AIM541	Architecting AI Systems & Operating Systems	22AIM544	Information Storage and Retrieval
22AIM542	Internet of Things (IoT)	22AIM545	Computational Intelligence
22AIM543	Advanced Java Programming		

22XXX51(HSMS)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.

For IT allied Branches: Software Product Management

For Core Branches: Engineering Economics and Management / Industrial Management and Entrepreneurship

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

A group of 2- 4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 2 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.
National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition:	03-Credits courses are to be designed for 40 hrs. in Teaching-Learning Session
1-hr. Lecture (L) per week=1Credit	
2-hrs. Tutorial (T) per week=1Credit	02- Credits courses are to be designed for 25 hrs. of Teaching-Learning Session
2-hrs. Practical / Drawing (P) per week=1Credit	
2-hous Self Study for Skill Development (SDA) per week = 1 Credit	01-Credit courses are to be designed for 15 hrs. of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Artificial Intelligence and Machine Learning
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

VI Semester

Sl. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hrs.	Marks		
					L	T	P	S			CIE	SEE	Total
1	PCC	22AIM61	Deep Learning	AIML	3	0	0	0	3	3	50	50	**100**
2	PCCL	22AIL61	Deep Learning Lab	AIML	0	0	1	0	1	2	50	50	**100**
3	PCC	22AIM62	Big Data & Cloud Technologies	AIML	3	0	0	0	3	3	50	50	**100**
4	PCCL	22AIL62	Big Data & Cloud Technologies Lab	AIML	0	0	1	0	1	2	50	50	**100**
5	PCC	22AIM63	Ethical Cyber Security	AIML	2	1	0	0	3	4	50	50	**100**
6	PEC	22AIM64X	Professional Elective Course-II	AIML	3	0	0	0	3	3	50	50	**100**
7	PROJ	22AIM65	Project Phase I	AIML	0	0	2	0	2	0	50	50	**100**
8	AEC	22SDK66	Problem Solving Skills	AIML	0	0	1	0	1	2	50	--	**50**
9	AEC	22AIM67X	Ability Enhancement Course – V	AIML	0	0	1	0	1	2	50	50	**100**
10	OEC	23NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	**100**
11	NCMC	22NSS60	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED60	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG60	Yoga	Yoga Teacher									
Total									**21**	**26**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course-II

22AIM641	Computer Networks	22AIM644	Augmented and Virtual Reality
22AIM642	Computer Vision	22AIM645	Randomized Algorithms
22AIM643	Embedded Systems		

Ability Enhancement Course – V

22AIM671	AI powered UI design	22AIM674	Mobile Application Development
22AIM672	API and Microservices	22AIM675	Software Testing and Quality Assurance
22AIM673	Web Frameworks		

Industrial Open Elective Courses-I: Credit for OEC is 03 (L: T:P:S) can be considered as (3:0:0:0). The teaching and learning of these Courses will be based on hands-on. The Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III to VI semesters (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree

Credit Definition:	03-Credit courses are to be designed for 40 hrs. in Teaching-Learning Sessions
1-hr. Lecture (L) per week=1Credit	02-Credit courses are to be designed for 25 hrs. of Teaching-Learning Sessions
2-hrs. Tutorial (T) per week=1Credit	01-Credit courses are to be designed for 15 hrs. of Teaching-Learning Sessions
2-hrs. Practical / Drawing (P) per week=1Credit	
2-hrs. Self Study for Skill Development (SDA) per week = 1 Credit	

APPENDIX B

List of Assessment Pattern			
SNO	**Tasks**	**Blooms category/Level**	**Remarks**
1	Assignments	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
2	Group Discussions	Apply-L3, Analyse-L4	Group
3	Case Studies/Case Lets	Apply-L3, Analyse-L4, Evaluate-L5	Individual/ Group
4	Practical Orientation on Design thinking	Analyse-L4, Create-L6	Creativity & Innovation
5	Participatory & Industry- Integrated Learning	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
6	Practical activities/Problem solving exercises	Apply-L3, Analyse-L4, Evaluate-L5	Individual/ Group
7	Class Presentations	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
8	Analysis of Industry/ Technical /Business Reports	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
9	Reports on Industrial Visit	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
10	Industrial/Social/Rural Projects	Analyse-L4, Create-L6	Individual/ Group
11	Participation in external seminars/workshops	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
12	Any other academic activity	Understand-L2, Apply-L3, Analyse-L4	Individual/ Group
13	Online/ Offline Quizzes	Understand-L2, Apply-L3	Individual
	Note:		
	1. The choice or selection of appropriate Tasks for each Assessment Type by the course coordinator		
	2. Assign/fix the marks for each Assessment Type by course coordinator.		
	3. Students either submit the report for Task or not, as determined by the course coordinator.		
	4. Need to get final approval from the HoD /BOS Chairman, once finalized the mark allocations for Tasks and Assessment types.		

APPENDIX C

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessmentin OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation: Program Educational Objectives: The Educational objectives of an engineering degreeprogram are the statements that describe the expected achievements of graduate in theircareer and in particular, what the graduates are expected to perform and achieve during thefirst few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduateattributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the programcurriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcome:

APPENDIX D

The Graduate Attributes of NBA

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design / Development of Solutions:** Design solutions for complex engineering problems and design system components or processes of engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and Environmental contexts, demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, andnorms of the engineering practice.

PO9 **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication Skills:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

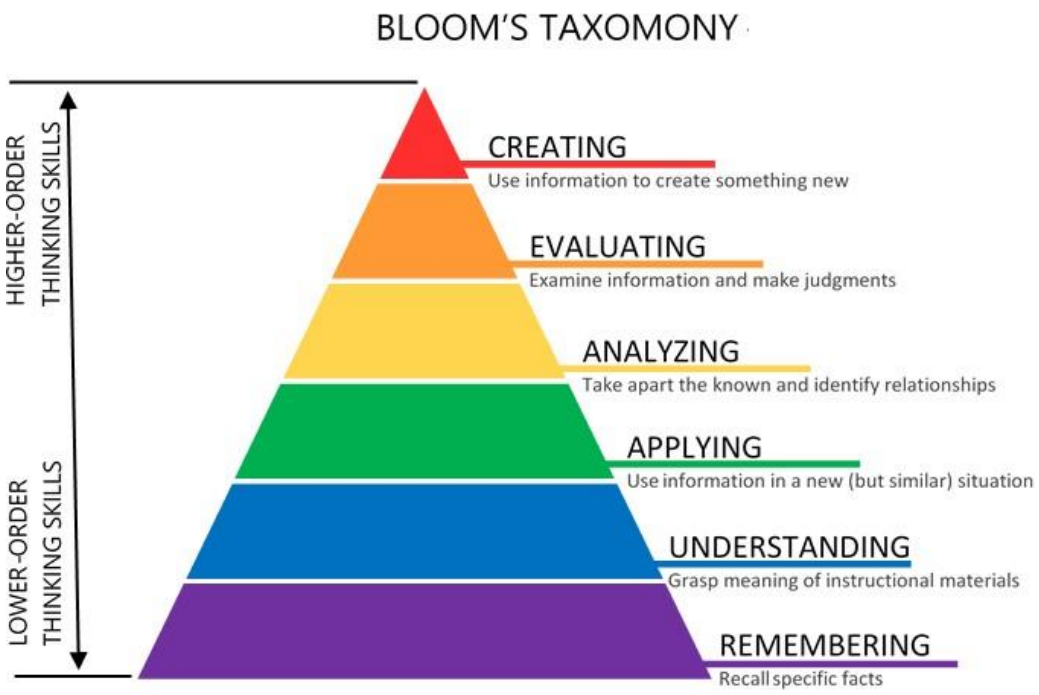
PO11 **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX E

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels ofhuman cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and otherevaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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