



NEW HORIZON
COLLEGE OF ENGINEERING

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Academic Year 2026 - 2027
Onwards



**7th and 8th Semesters
Scheme & Syllabus**

CREDITS: 160(NEP)

[2022 Scheme]

AI

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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 | ❖ Professionalism |
| ❖ Innovation | ❖ Inclusiveness |
| ❖ Integrity | ❖ 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

- P01 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- P02 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.
- P03 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.
- P04 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.
- P05 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.
- P06 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.
- P07 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.
- P08 Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.
- P09 Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- P010 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.
- P011 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.
- P012 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, **CIE:** 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:

- To encourage independent learning and the innovative attitude of the students.
- To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team working.
- To expand intellectual capacity, credibility, judgment and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To install responsibilities to oneself and others.
- 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-hours Tutorial (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-hours Tutorial(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
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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													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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, 1997 ISBN: 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
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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 2021 Publisher(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:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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 speech/toxic 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:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS 01	PS02
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.														
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	
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 - Ekert 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:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
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:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
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.

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.

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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", John Wiley & Sons Inc., New York, 2007. ISBN:8126513705, 978-8126513703.

Reference Books:

1. Morton Nadier and Eric Smith P., "Pattern Recognition Engineering", John Wiley & Sons, New York, 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	PS01	PS02
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
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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=1Credit
 2-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	02- Credits courses are to be designed for 25 hrs. of Teaching-Learning Session
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-hous Self Study for Skill Development (SDA) per week = 1 Credit	

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, **CIE:** 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:

1-hr. Lecture (L) per week=1Credit

2-hrs. Tutorial (T) per week=1Credit

2-hrs. Practical / Drawing (P) per week=1Credit

2-hrs. Self Study for Skill Development (SDA) per week = 1 Credit

03-Credit courses are to be designed for 40 hrs. in Teaching-Learning Sessions

02-Credit courses are to be designed for 25 hrs. of Teaching-Learning Sessions

01-Credit courses are to be designed for 15 hrs. of Teaching-Learning Sessions

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

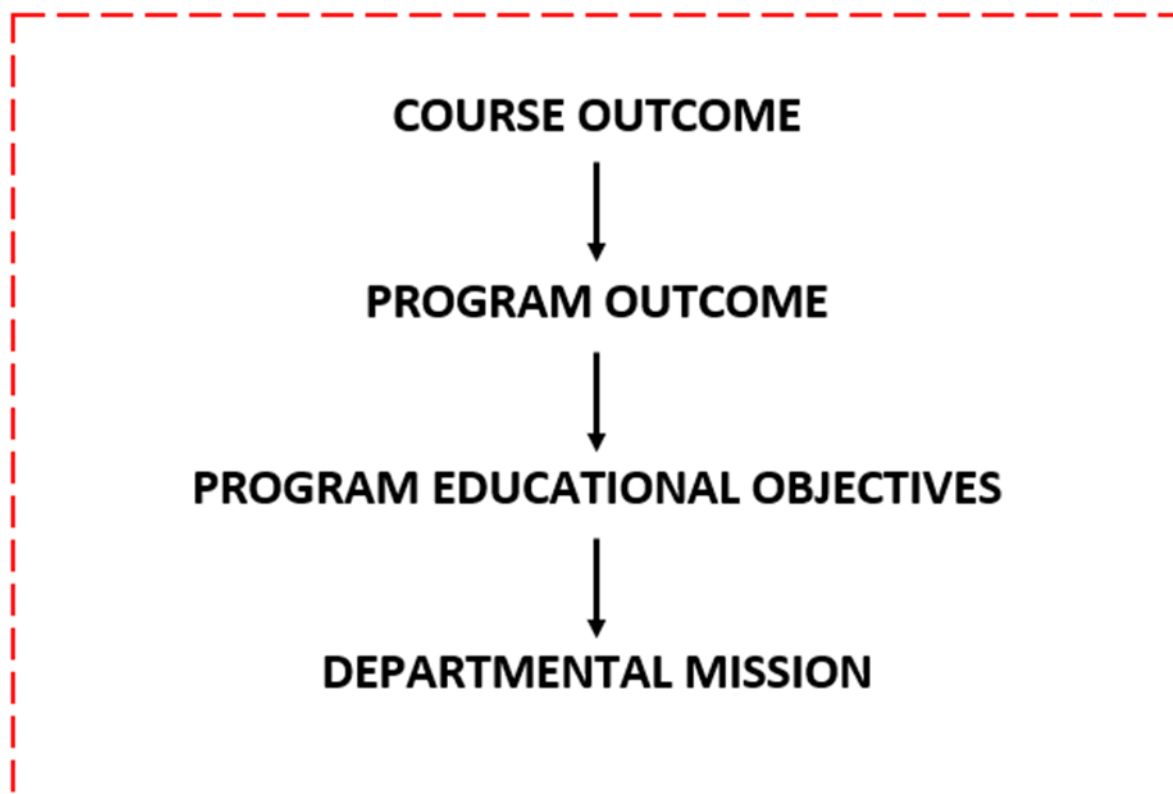
Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead, classes, opportunities, 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 degree program are the statements that describe the expected achievements of graduate in their career and in particular, what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

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

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

Mapping of Outcome:



APPENDIX D

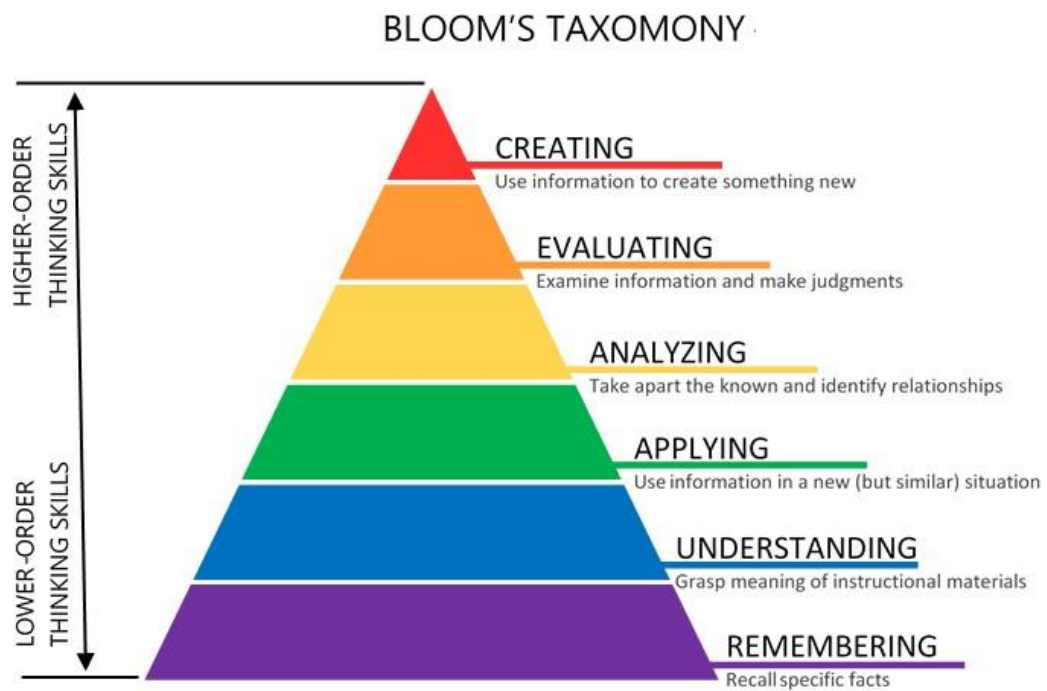
The Graduate Attributes of NBA

- P01 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Engineering problems.
- P02 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.
- P03 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.
- P04 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.
- P05 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.
- P06 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.
- P07 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.
- P08 Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
- P09 Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- P010 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.
- P011 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.
- P012 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 of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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