SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)

(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)

Accredited by NAAC with 'A+' Grade

Recognised as Scientific and Industrial Research Organisation

SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA

Regulation: R23	

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (Minors)

(Applicable for CE, ECE, EEE & ME)

COURSE STRUCTURE
(With effect from 2023-24 admitted Batch onwards)

Course Code	Course Name	Year/ Sem	Cr	L	T	P	C.I.E	S.E.E	Total Marks
B23AMM101	Database Management Systems	II-II	3	3	0	0	30	70	100
B23AMM201	Data Visualization	III-I	3	3	0	0	30	70	100
B23AMM301	Machine Learning	III-II	3	3	0	0	30	70	100
B23AMM401	Generative AI	IV-I	3	3	0	0	30	70	100
B23AMM501	*MOOCS-I	II-II to IV-I	3	--	--	--	--	--	100
B23AMM601	*MOOCS-II	II-II to IV-I	3	--	--	--	--	--	100
		TOTAL	**18**	**12**	**0**	**0**	**120**	**280**	**600**

*Two MOOCS courses of any ARTIFICIAL INTELLIGENCE & MACHINE LEARNING related Program Core Courses from NPTEL/SWAYAM with a minimum duration of 12 weeks (3 Credits) courses other than the courses offered need to be takenby prior information to the concern. These courses should be completed between II Year II Semester to IV Year I Semester.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMM101	Minors	3	--	--	3	30	70	3 Hrs.

DATABASE MANAGEMENT SYSTEMS

(Minors Degree Course in AI & ML)

Course Objectives: This course aims to equip students with the following:

1.	Introduce database management systems
2.	Analyze database through systematic database design approaches
3.	Use SQL as a universal Database language
4.	Demonstrate normalization
5	Explain transaction management techniques

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

S.No	Outcome	Knowledge Level
1.	**Describe** database management systems fundamental concepts	K2
2.	**Analyze** databases using Conceptual and Logical database design	K4
3.	**Apply** SQL to Create, maintain and manipulate a relational database	K3
4.	**Apply** normalization for refining database schema	K3
5.	**Illustrate** Transaction management techniques.	K2

SYLLABUS

UNIT-I (08 Hrs)	Introduction: Databases and Database Management Systems, Characteristics of DBMS, DBMS Vs File System, Database Users, Database applications. Brief introduction of different Data Models, Introduction to Relational Database Management Systems, Concepts of Schema, Instance, three tier schema architecture for data independence, Database system structure, Centralized and Client Server architecture for the database.
UNIT-II (10 Hrs)	Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra (select and project) . Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, extended features of ER model.
UNIT-III (12 Hrs)	SQL: Simple Database schema, data types, table definitions (create, alter), Creating tables with relationship, implementation of key and integrity constraints, different DML operations (insert, delete, update), Basic SQL querying (select and project) using where clause, nested queries, sub queries, grouping, aggregation, ordering, relational

	set operations, implementation of different types of joins, view (updatable and non-updatable).
UNIT-IV (10 Hrs)	Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, closure of functional dependencies, normal forms based on functional dependencies, 1NF, 2NF and 3 NF, Boyce-Codd normal form (BCNF), Lossless joinand dependencypreserving decomposition.
UNIT-V (10 Hrs)	Transaction Concept: Transaction State, ACID properties, Concurrent Execution of transactions, Schedules, Serializability, Recoverability, Testing for Serializability, Lock based and timestamp-based concurrency protocols, Implementation of Isolation, Failure Classification, ARIES Recovery algorithm.
Textbooks:	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan (Author), Database System Concepts,7th Edition, TMH, 2021.
2.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Pearson, 2014
Reference Books:	
1.	C.J. Date, A. Kannan and S. Swamy Nathan, An Introduction to Database Systems, 8th Edition,Pearson, 2006.
2.	Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, 7th Edition, Pearson, 2017.
3.	Corlos Coronel, Steven Morris, Peter Robb, Database Principles Fundamentals of Design Implementation and Management, CBS publishers and Distributors, 2014.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_ 01275806667282022456_shared/overview

					Course Code: B23AMM101
		SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (A)			**R23**
		II B.Tech. II Semester MODEL QUESTION PAPER			
		DATABASE MANAGEMENT SYSTEMS			
		(Minors Degree Course in AI & ML)			
Time: 3 Hrs.					**Max. Marks: 70 M**
		Answer Question No.1 compulsorily			
		Answer **ONE Question** from **EACH UNIT**			
		Assume suitable data if necessary			
					10 x 2 = 20 Marks
			CO	**KL**	**M**
1.	**a).**	What are the goals of DBMS?	**1**	**1**	**2**
	b).	What is Data Independence? List the types.	**1**	**1**	**2**
	c).	Quote the example for composite attribute.	**2**	**1**	**2**
	d).	What is meant by cardinality and degree of relation?	**2**	**1**	**2**
	e).	Explain the difference between drop and delete commands?	**3**	**1**	**2**
	f).	Explain the left outer join?	**3**	**1**	**2**
	g).	State 1NF with example?	**4**	**1**	**2**
	h).	Define dependency preserving decomposition?	**4**	**1**	**2**
	i).	What is conflict serializability?	**5**	**1**	**2**
	j).	Mention any two failure classifications?	**5**	**1**	**2**
					5 x 10 = 50 Marks
		UNIT-1			
2.	**a)**	Compare Database Management Systems with File Processing Systems	**1**	**3**	**4**
	b)	Explain the roles of different database users	**1**	**2**	**6**
		OR			
3.	**a)**	Discuss the applications of Database Management Systems	**1**	**2**	**5**
	b)	Describe the structure of a Database Management System	**1**	**2**	**5**
		UNIT-2			
4.		Give syntax and apply the SQL commands for defining two example tables of your choice. Then insert data, update data in the tables	**2**	**3**	**10**
		OR			
5.		What are relational instances and schemas? How'd you use keys and schemas in relational model?	**2**	**3**	**10**

		UNIT-3			
6.	**a)**	Define and differentiate between Domain, Key, and Integrity constraints.	**3**	**3**	**5**
	b)	Illustrate the SELECT and PROJECT operations in Relational Algebra	**3**	**2**	**5**
		OR			
7.	**a)**	Describe any two extended features of the ER model	**2**	**2**	**5**
	b)	What are the different types of relationships in ER models?	**2**	**2**	**5**
		UNIT-4			
8.	**a)**	Apply Loss-less join decomposition into BCNF for an example table	**4**	**3**	**5**
	b)	Apply dependency preserving decomposition into 3NFfor an example table	**4**	**3**	**5**
		OR			
9.		Illustrate Normal forms from 1 NF to BCNF with suitable examples.	**4**	**3**	**10**
		UNIT-5			
10.	**a)**	Briefly discuss ARIES algorithm.	**5**	**2**	**5**
	b)	What is a Transaction? Explain about transaction states?	**5**	**2**	**5**
		OR			
11.	**a)**	What is the locking protocol? Describe the Strict Two Phase locking protocol?	**5**	**2**	**5**
	b)	Explain in detail about ACID properties with examples?	**5**	**2**	**5**

CO-COURSE OUTCOME **KL-KNOWLEDGE LEVEL** **M-MARKS**

NOTE : Questions can be given as A,B splits or as a single Question for 10 marks

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMM201	Minors	3	--	--	3	30	70	3 Hrs.

DATA VISUALIZATION

(Minors Degree Course in AI & ML)

Course Objectives: This course aims to equip students with the following:

1.	Familiarize students with the basic and advanced techniques of information visualization and scientific visualization.
2.	Learn key techniques of the visualization process and implement.
3.	Detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

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

S.No	Outcome	Knowledge Level
1.	**Illustrate** the key stages of the visualization process from data acquisition to visual representation.	**K2**
2.	**Apply** visual mapping techniques to develop effective visualization applications.	**K3**
3.	**Apply** suitable visualization and interaction techniques to develop and enhance visualization systems.	**K3**
4.	**Apply** suitable visualization techniques to effectively represent the complex data structures including the use of metaphorical visualization.	**K3**
5.	**Demonstrate** the ability to visualize complex data types using appropriate techniques and data structures	**K3**

SYLLABUS

UNIT-I (10Hrs)	What Is Visualization?, History of Visualization, Relationship between Visualization and Other Fields, The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.
UNIT-II (10 Hrs)	Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.
UNIT-III (10 Hrs)	Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.
UNIT-IV (10 Hrs)	Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization.

UNIT-V (10 Hrs)	Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations. **Recent trends** in various perception techniques, various visualization techniques, data structures used in data visualization.
Textbooks:	
1.	Interactive Data Visualization: Foundations, Techniques, and Applications. WARD, GRINSTEIN, KEIM. Natick : A K Peters, Ltd.(2015)
2.	Information Visualization: Perception for Design by Colin Ware,Interactive Technologies(2004)
Reference Books:	
1.	The Visual Display of Quantitative Information E. Tufte, Graphics Press.(2001)
2.	Visualizing Data-Ben Fry 'Reilly Media (2008)
e-Resources	
1.	https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf
2.	https://www.slideteam.net/powerpoint/Data-Visualization
3.	https://www.slideshare.net/slideshow/unit-iiipptx/265063170

		Course Code: B23AMM201			
		SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (A)			**R23**
		III B.Tech. I Semester MODEL QUESTION PAPER			
		DATA VISUALIZATION			
		(Minors Degree Course in AI & ML)			
Time: 3 Hrs.					**Max. Marks: 70 M**
		Answer Question No.1 compulsorily			
		Answer **ONE Question** from **EACH UNIT**			
		Assume suitable data if necessary			
					10 x 2 = 20 Marks
			CO	**KL**	**M**
1.	**a).**	State any two Gestalt principles related to visual perception.	**1**	**1**	**2**
	b).	Explain the relationship between visualization and other fields.	**1**	**1**	**2**
	c).	What is a visualization reference model?	**2**	**1**	**2**
	d).	Mention one key consideration in the design of visualization applications.	**2**	**1**	**2**
	e).	List two classification categories of visualization systems.	**3**	**1**	**2**
	f).	Name the types of data visualized in one, two, and multi-dimensional visualizations.	**3**	**1**	**2**
	g).	Mention two types of graphs used in visualization.	**4**	**1**	**2**
	h).	What is metaphorical visualization?	**4**	**1**	**2**
	i).	Name two types of data structures used in data visualization.	**5**	**1**	**2**
	j).	What is volumetric data visualization?	**5**	**1**	**2**
					5 x 10 = 50 Marks
		UNIT-1			
2.	**a).**	Explain the importance of visual perception in data visualization.	**1**	**2**	**5**
	b).	Describe the visualization process and Explain its key stages.	**1**	**2**	**5**
		OR			
3.	**a).**	Discuss how Gestalt principles influence the design of visual representations.	**1**	**2**	**5**
	b).	Explain the challenges posed by information overload in visualization and discuss ways to overcome these challenges.	**1**	**2**	**5**
		UNIT-2			
4.	**a).**	Explain the components of the visualization reference model in detail	**2**	**2**	**5**

	b).	Analyze the process and importance of creating visual representations in data visualization.	**2**	**4**	**5**
		OR			
5.	**a).**	Explain how visual mapping affects the interpretation of data in visualization.	**2**	**2**	**5**
	b).	Evaluate the role of visual analytics in decision making with suitable examples.	**2**	**4**	**5**
		UNIT-3			
6.	**a).**	Explain the classification of visualization systems with examples.	**3**	**2**	**5**
	b).	Illustrate the methods for visualizing multi-dimensional data effectively.	**3**	**3**	**5**
		OR			
7.	**a).**	Explain the challenges in visualizing text and text documents.	**3**	**2**	**5**
	b).	Discuss the impact of misleading visualization techniques on data interpretation.	**3**	**3**	**5**
		UNIT-4			
8.	**a).**	Explain visualization techniques used for trees and graphs.	**4**	**2**	**5**
	b).	Describe methods to visualize clusters and networks effectively.	**4**	**3**	**5**
		OR			
9.	**a).**	Explain the concept of metaphorical visualization and its advantages.	**4**	**2**	**5**
	b).	Discuss the effectiveness of group visualization techniques in representing complex data.	**4**	**3**	**5**
		UNIT-5			
10.	**a).**	Explain techniques used for visualization of vector fields and simulations.	**5**	**2**	**5**
	b).	Illustrate collaborative visualization and its benefits in data analysis.	**5**	**3**	**5**
		OR			
11.	**a).**	Explain the significance of geographic information systems (GIS) in data visualization.	**5**	**2**	**5**
	b).	Compare different data structures used in visualization and their impact on performance.	**5**	**4**	**5**

CO-COURSE OUTCOME **KL-KNOWLEDGE LEVEL** **M-MARKS**

NOTE : Questions can be given as A,B splits or as a single Question for 10 marks

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMM301	Minors	3	--	--	3	30	70	3 Hrs.

MACHINE LEARNING

(Minors Degree Course in AI & ML)

Course Objectives: This course aims to equip students with the following:

1.	Introduce the basic concepts and techniques of Machine Learning
2.	Demonstrate regression, classification and clustering methods.
3.	Introduce the concepts of dimensionality reduction, Regularization
4.	Illustrate the concepts of artificial neural networks and reinforcement learning

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

S.No	Outcome	Knowledge Level
1.	**Use** the concepts of Machine Learning and Feature Engineering	K3
2.	**Apply** Classification models on real world datasets	K3
3.	**Apply** Regression models and ensemble models	K3
4.	**Demonstrate** the concepts of Clustering, dimensionality reduction and regularization techniques,	K3
5.	**Apply** the concepts of artificial neural networks	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Machine Learning:** Evolution of Machine Learning, Paradigms for ML, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets. **Features:** Kinds of feature, Feature transformations: Thresholding and Discretisation, Normalisation, Incomplete Features, Feature construction and selection.
UNIT-II (10 Hrs)	**Supervised Learning:** Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions. **Classification:** Different Classification Algorithms Based on the Distance Measures, Nearest Neighbours, Decision Trees, Naive Bayes, Binary Class classification and Multi Class classification, Logistic Regression,

UNIT-III (10 Hrs)	**Regression:** Linear Regression, **Linear Models:** SVM, Linear SVM. **Ensemble Learning:** Introduction, Voting Classifiers, Bagging, Random Forests, Boosting: AdaBoost, Gradient Boosting.
UNIT-IV (10 Hrs)	**Unsupervised Learning Techniques:** Clustering, Hierarchical Clustering, Partitional clustering: K-Means Clustering,Soft clustering: Fuzzy C-Means Clustering **Dimensionality Reduction:** The Curse of Dimensionality, PCA **Regularization Techniques:** Lasso, Ridge
UNIT-V (10 Hrs)	**Neurons, NNs, Linear Discriminants:** The Neuron, Neural Networks, The perceptron, **Multilayer perceptrons:** Going forwards, Going backwards, Backpropagation for Trainingan MLP ,Multilayer perceptron in practice, Examples of using MLP.

Textbooks:	
1.	"Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024
2.	Introduction to Machine Learning, Alpaydin E, MIT Press (2014) 3rdEdition
Reference Books:	
1.	Machine Learning: An algorithmic perspective, Stephen Marsland, 2nd edition, CRC press, 2014.
2.	The elements of statistical learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second edition , Springer, 2009.
3.	Machine Learning in Action, Peter Harington, 2012, Cengage.
4.	Python Machine Learning Cookbook-Practical Solutions from Preprocessing to Deep Learning, Chris Albon, Oreilly, 2018.
5.	Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, Tensorflow, Sebastian Raschka, Vahid Mirjalili, Second edition, 2020
6	Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge, 2012
e-Resources	
1.	"Machine Learning" course by Andrew Ng on Coursera
2.	"Introduction to Machine Learning (IITKGP)" by Prof. Sudeshna Sarkar, on Swayam
3.	"Principal Component Analysis versus Linear Discriminant Analysis", https://medium.com/analytics-vidhya/illustrative-example-of-principalcomponent-analysis pcavs-linear-discriminant-analysis-lda-is-105c431e8907
4.	"Regularization in Machine Learning", https://towardsdatascience.com/regularization

	inmachine-learning76441ddcf99a
5.	Grid search for model tuning", https://medium.com/analyticsvidhya/illustrative-example ofprincipal-component-analysis-pca-vs-lineardiscriminant-analysis-lda-is-105c431e8907

					Course Code: B23AMM301
		SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (A)			**R23**
		III B.Tech. II Semester MODEL QUESTION PAPER			
		MACHINE LEARNING			
		(Minors Degree Course in AI & ML)			
Time: 3 Hrs.					**Max. Marks: 70 M**
		Answer Question No.1 compulsorily			
		Answer **ONE Question** from **EACH UNIT**			
		Assume suitable data if necessary			
					10 x 2 = 20 Marks
			CO	**KL**	**M**
1.	**a).**	Mention two types of data used in Machine Learning.	**1**	**2**	**2**
	b).	Explain feature engineering with an example.	**1**	**2**	**2**
	c).	List two distance measures used in classification tasks.	**2**	**2**	**2**
	d).	What is Logistic Regression?	**2**	**1**	**2**
	e).	Define Margin in the context of SVM	**3**	**1**	**2**
	f).	What is Ensemble Learning?	**3**	**1**	**2**
	g).	Explain Curse of Dimensionality?	**4**	**2**	**2**
	h).	Define Ridge Regression.	**4**	**1**	**2**
	i).	Explain the difference between forward and backward pass.	**5**	**2**	**2**
	j).	What is the purpose of activation functions in NNs?	**5**	**1**	**2**
					5 x 10 = 50 Marks
		UNIT-1			
2.	**a).**	Explain the paradigms of machine learning with examples.	**1**	**2**	**5**
	b).	Explain the importance of data preprocessing. Demonstrate with a mini example.	**1**	**2**	**5**
		OR			
3.	**a).**	Explain the different stages in Machine Learning.	**1**	**2**	**5**
	b).	Explain filter method in feature selection	**1**	**2**	**5**
		UNIT-2	**2**	**2**	**5**
4.	**a).**	Explain Manhattan and Cosine similarity measures with examples.	**2**	**3**	**5**
	b).	Apply K-Nearest Neighbor Classifier to following dataset.			

		<table><tr><th>BRIGHTNESS</th><th>SATURATION</th><th>CLASS</th></tr><tr><td>40</td><td>20</td><td>Red</td></tr><tr><td>50</td><td>50</td><td>Blue</td></tr><tr><td>60</td><td>90</td><td>Blue</td></tr><tr><td>10</td><td>25</td><td>Red</td></tr><tr><td>70</td><td>70</td><td>Blue</td></tr><tr><td>60</td><td>10</td><td>Red</td></tr><tr><td>25</td><td>80</td><td>Blue</td></tr></table> Now identify to which class label the given test sample belongs to considering K=3 nearest neighbors (Brightness=20, Saturation=35, Class=?).			
		OR			
5.	**a).**	Explain the working of a Decision Tree classifier using the concept of Information Gain.	**2**	**2**	**5**
	b).	Apply Naïve Bayes Classifier to classify the following tuple using the dataset given below {Color='Red', Type='SUV', Origin='Domestic'} <table><tr><th>Example No.</th><th>Color</th><th>Type</th><th>Origin</th><th>Stolen?</th></tr><tr><td>1</td><td>Red</td><td>Sports</td><td>Domestic</td><td>Yes</td></tr><tr><td>2</td><td>Red</td><td>Sports</td><td>Domestic</td><td>No</td></tr><tr><td>3</td><td>Red</td><td>Sports</td><td>Domestic</td><td>Yes</td></tr><tr><td>4</td><td>Yellow</td><td>Sports</td><td>Domestic</td><td>No</td></tr><tr><td>5</td><td>Yellow</td><td>Sports</td><td>Imported</td><td>Yes</td></tr><tr><td>6</td><td>Yellow</td><td>SUV</td><td>Imported</td><td>No</td></tr><tr><td>7</td><td>Yellow</td><td>SUV</td><td>Imported</td><td>Yes</td></tr><tr><td>8</td><td>Yellow</td><td>SUV</td><td>Domestic</td><td>No</td></tr><tr><td>9</td><td>Red</td><td>SUV</td><td>Imported</td><td>No</td></tr><tr><td>10</td><td>Red</td><td>Sports</td><td>Imported</td><td>Yes</td></tr></table>	**2**	**3**	**5**
		UNIT-3			
6.	**a).**	Explain the algorithm for Support Vector Machine for linearly separable data	**3**	**2**	**5**
	b).	Compare AdaBoost and Gradient Boosting in terms of working and performance.	**3**	**2**	**5**
		OR			
7.		Explain the working of random forest classifier. How does it improve accuracy compared to singe decision tree.	**3**	**2**	**10**
		UNIT-4			
8.	**a).**	What is the main purpose of principal component analysis? Explain	**4**	**2**	**5**
	b).	Consider the following set of data points: (2,3), (3,4), (5,6), (8,8), (9,10)	**4**	**3**	**5**

		Apply the first iteration of K-Means clustering with K=2 and initial centroids as (2,3) and (8,8). Show the new centroids.			
		OR			
9.	**a).**	Compare and contrast Lasso and Ridge Regression	**4**	**2**	**5**
	b).	Given three data points (1,1),(4,4), (7,7) and two initial clusters centers at (2,2) and (6,6), compute the initial membership values using Fuzzy C-Means Clustering with m=2	**4**	**3**	**5**
		UNIT-5			
10.		Illustrate Multilayer Perceptron architecture and also explain briefly the backpropagation algorithm to train multilayer perceptron	**5**	**2**	**10**
		OR			
11.	**a).**	What is a Perceptron? What are the problems that can be solved with perceptron? Explain	**5**	**2**	**5**
	b).	Explain how a single-layer perceptron works for binary classification. Give an example.	**5**	**2**	**5**

CO-COURSE OUTCOME **KL-KNOWLEDGE LEVEL** **M-MARKS**

NOTE : Questions can be given as A,B splits or as a single Question for 10 marks

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMM401	**Minors**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

GENERATIVE AI

(Minors Degree Course in AI & ML)

Course Objectives:

1.	Understand generative AI and neural networks by learning the fundamentals of generative AI models, including auto encoders and Generative Adversarial Networks (GANs).
2.	Explore sequence modeling and word embeddings by studying RNNs, LSTMs, and word embedding techniques in NLP.
3.	Develop proficiency in transformers, large language models (LLMs), and prompting strategies for effective generative and predictive tasks.

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

S.No.	Outcome	Knowledge Level
1.	**Explain** the fundamentals of Generative AI and distinguish between generative and discriminative models.	**K2**
2.	**Apply** sequence modelling techniques, including RNNs and LSTMs, and demonstrate the use of word embeddings like Word2Vec in NLP tasks.	**K3**
3.	**Explain** the transformer architecture and the functioning of large language models like BERT and GPT.	**K2**
4.	**Apply** generative models and pretraining strategies of BERT and GPT to solve domain-specific problems in healthcare and finance	**K3**
5.	**Demonstrate** effective prompt engineering strategies and discuss their application in various NLP tasks such as information extraction and text generation.	**K3**

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Generative AI:** What is generative modelling? Definition and principles of Generative AI, Difference between generative AI and traditional AI, Generative Versus Discriminative Modeling, Generative Model Taxonomy **Neural networks**: Perceptron, multilayer Perceptron: Neural Networks, Activation functions, Training Neural Networks: Back propagation, Batching, Hyperparameters, Vanishing and Exploding Gradients, Evaluation Metrics
UNIT-II (10 Hrs)	**Sequence Modelling:** Recurrent Neural Networks, The Long Short-Term Memory. **Word Embedding:** Vector semantics, Types of Word Embeddings: Frequency-Based Embeddings,Word2Vec, FastText, Bias in Word Embedding, Limitations of Word Embedding Methods, Applications of Word Embeddings. **Basic Auto encoder Concepts:** Auto encoder for Data Compression

UNIT-III (10 Hrs)	**Transformers and Large Language Models**: The Transformer: A Self-Attention, Multi-head Attention, Transformer Encoder Block, Transformer Decoder Block, Positional Embeddings, The Residual Stream view of the Transformer Block. The input: Embedding's for token and position. The Language Modelling Head, Large Language Models with Transformers: BERT, GPT
UNIT-IV (10 Hrs)	**Language model pretraining:** Encoder-based pretraining: BERT Pretraining, Decoder-based Pretraining: GPT pretraining, **Applications of LLM's:**Healthcare:Enhancing Diagnostics and Patient Care, Finance: Transforming Data Analysis and Risk Management. **Generative Adversarial Networks (GANs) Basics**: Generator vs Discriminator Simple Image Generation Pipeline using GANs **Variational Autoencoders (VAEs) Overview** :Variational Autoencoders, The Encoder, The Loss Function, Training the Variational Autoencoder, VAEs vs GANs – Key differences
UNIT-V (10 Hrs)	**Prompting Strategies in LLMs:** Prompt Engineering**:** Prompt Shape, Manual Template Engineering, Automated Template Learning, Types of Prompts: Zero-Shot, Few-Shot, Chain-of-Thought, Tree of Thoughts, Graph of Thoughts, **Prompt Applications:** In-context learning, knowledge Probing, Information Extraction, Question answering, text generation, Classification -Based Tasks.
Textbooks:	
1.	Chakraborty, Tanmoy. "Introduction to Large Language Models: Generative AI for Text." (2025).
2.	David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, Play, 2nd Edition, Oreilly
Reference Books:	
1.	Krohn, Jon, Grant Beyleveld, and Aglaé Bassens. Deep learning illustrated: a visual, interactive guide to artificial intelligence. Addison-Wesley Professional, 2019.
2.	Goodfellow, Ian, Yoshua Bengio, Aaron Courville, and Yoshua Bengio. *Deep learning*. Vol. 1, no. 2. Cambridge: MIT press, 2016.
3.	Burkov, Andriy. *The hundred-page machine learning book*. Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019.
e-Resources	
1.	Generative AI with LLMs - DeepLearning.AI
2.	Generative AI and Large Language Models - Course
3.	https://genai-handbook.github.io/

					Course Code: B23AMM401
		SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (A)			**R23**
		IV B.Tech. I Semester MODEL QUESTION PAPER			
		GENERATIVE AI			
		(Minors Degree Course in AI & ML)			
Time: 3 Hrs.					**Max. Marks: 70 M**
		Answer Question No.1 compulsorily			
		Answer **ONE Question** from **EACH UNIT**			
		Assume suitable data if necessary			
					10 x 2 = 20 Marks
			CO	**KL**	**M**
1.	**a).**	Describe generative AI and differentiate it from traditional AI approaches.	**1**	**2**	**2**
	b).	Explain the concept of vanishing gradients and its effect on training deep neural networks.	**1**	**2**	**2**
	c).	List two applications of RNNs.	**2**	**1**	**2**
	d).	List different word embedding techniques.	**2**	**1**	**2**
	e).	Define self-attention mechanism in transformers.	**3**	**1**	**2**
	f).	Differentiate between encoder and decoder blocks in a transformer?	**3**	**2**	**2**
	g).	Write the applications of LLMs	**4**	**1**	**2**
	h).	Describe key differences between Variational Autoencoders (VAEs) and Generative Adversarial Networks(GANs).	**4**	**2**	**2**
	i).	Demonstrate zero-shot prompting with a simple example.	**5**	**3**	**2**
	j).	Explain "Chain-of-Thought" prompting in Large Language Models?	**5**	**2**	**2**
					5 x 10 = 50 Marks
		UNIT-1			
2.	**a).**	Explain the taxonomy of generative models with examples (VAE, GAN, etc.).	**1**	**2**	**5**
	b).	Differentiate between Perceptron and Multilayer Perceptron. Draw their structures.	**1**	**2**	**5**
		OR			
3.	**a).**	Describe the role of activation functions in neural networks. Mention any two commonly used activation functions and their properties.	**1**	**2**	**5**
	b).	Describe the back propagation algorithm and explain one step of back propagation with an example	**1**	**2**	**5**

		UNIT-2			
4.	**a).**	Describe the structure of an LSTM cell and explain how it avoids vanishing gradients.	**2**	**2**	**5**
	b).	Describe the architecture of the CBOW variant of Word2Vec with neat diagrams	**2**	**2**	**5**
		OR			
5.	**a).**	Explain the FastText word embedding technique. How does it improve over Word2Vec for out-of-vocabulary (OOV) words?	**2**	**2**	**5**
	b).	Apply basic autoencoder architecture for data compression and describe how the encoder, decoder, and loss function are used.	**2**	**3**	**5**
		UNIT-3			
6.	**a).**	Explain the structure and purpose of the Transformer encoder block.	**3**	**2**	**5**
	b).	Compare BERT (bidirectional) and GPT (autoregressive) in terms of training objectives	**3**	**2**	**5**
		OR			
7.	**a).**	Illustrate how the language modeling head in GPT predicts the next word in a given sentence fragment.	**3**	**2**	**5**
	b).	Summarize the purpose of the attention mechanism in a Transformer	**3**	**2**	**5**
		UNIT-4			
8.	**a).**	Describe the architecture of a Variational Autoencoder (VAE) and the two-part loss function (reconstruction loss + KL-divergence)	**4**	**2**	**5**
	b).	Use a large language model (LLM) like BERT or GPT for processing clinical data or patient records and demonstrate how it assists doctors in diagnostics and patient care	**4**	**3**	**5**
		OR			
9.	**a).**	Demonstrate a simple image generation pipeline using a GAN and explain the steps involved	**4**	**3**	**5**
	b).	Explain with an example how LLMs can improve risk management or fraud detection in the finance sector.	**4**	**2**	**5**
		UNIT-5			
10.	**a).**	Explain the concept of prompt engineering and why prompt shape is important for LLM performance	**5**	**2**	**5**
	b).	Demonstrate how in-context learning works using a prompt designed for information extraction from a short paragraph.	**5**	**3**	**5**

		OR			
11.	**a).**	Describe manual template engineering and how it helps in improving prompt quality.	**5**	**2**	**5**
	b).	Demonstrate the chain-of-thought prompting approach in complex reasoning tasks with an example	**5**	**3**	**5**

CO-COURSE OUTCOME **KL-KNOWLEDGE LEVEL** **M-MARKS**

NOTE : Questions can be given as A,B splits or as a single Question for 10 marks