Reg. No.															

Question Paper Code	13442

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Artificial Intelligence and Data Science

Common to Computer Science and Engineering (Artificial Intelligence and Machine Learning)

20AIPC403 - ADVANCED MACHINE LEARNING

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The Ising Model's nodes can have spin states of _____ or _____. (a) +1 or -1 (b) 0 or 1 (c) +2 or -2 (d) 1 or 2	1	K1	CO1
2.	The energy functions in a Markov Network are defined using _____ potentials. (a) clique (b) path (c) network (d) node	1	K1	CO1
3.	Bayesian networks are _____. (a) cyclic (b) undirected (c) acyclic (d) directed and acyclic	1	K1	CO2
4.	Parameter Estimation problem is about: (a) Identifying Input Parameters (b) Identifying Output Parameters (c) Identifying Model Parameters (d) All of the Mentioned	1	K1	CO2
5.	VAE loss function composed of _____ and regularization terms can be derived using particular statistical technique of variational interference. (a) normal (b) reconstruction (c) Gaussian (d) None of the Mentioned	1	K1	CO3
6.	MCMC sampling uses to sample from _____ distribution for the purpose of inference. (a) prior (b) posterior (c) max likelihood (d) likelihood	1	K1	CO3
7.	The stochastic forward passes illustrate the decomposition of predictive uncertainty into ____. (a) epistemic components (b) aleatoric components (c) supervised components (d) epistemic components and aleatoric components	1	K1	CO4
8.	By catering to the ____, Bayesian neural network can avoid the overfitting problem by addressing the regularization properties. (a) Random distributions (b) probability distributions (c) sequential distributions (d) None of the Mentioned	1	K1	CO4
9.	In the _____, base classifiers will output their classifications, and then the Meta-classifier(s) will make the final classification (a) prediction phase (b) modeling phase (c) classification phase (d) aggregation phase	1	K1	CO5
10.	In an encoder-decoder framework for time series forecasting, what is the primary role of the encoder? (a) To extract relevant temporal patterns from historical data (b) To directly generate future forecasts without transformations (c) To minimize dependencies between correlated time series (d) To replace probabilistic forecasting with deterministic modeling	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Describe the impact of clique.	2	K2	CO1
12.	Differentiate an ising and potts model.	2	K2	CO1
13.	Define junction tree calibration.	2	K2	CO2

14.	List the uses of variable estimation.	*2*	*K2*	*CO2*
15.	Distinguish between forward and importance sampling.	*2*	*K2*	*CO3*
16.	Define sampling.	*2*	*K2*	*CO3*
17.	List the abstractions defined by Tensor Flow Distribution.	*2*	*K1*	*CO4*
18.	Explain the autoregressive model in density estimator.	*2*	*K2*	*CO4*
19.	Define Bayesian Neural Network.	*2*	*K1*	*CO5*
20.	Illustrate the Aleatory uncertainty.	*2*	*K2*	*CO5*
21.	Define the auto encoder.	*2*	*K1*	*CO6*
22.	Why is the Gaussian Copula useful in multivariate time series forecasting?	*2*	*K2*	*CO6*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Explain the directed graphical model with an example.	*11*	*K2*	*CO1*
		OR			
	b)	Explain the Potts and Ising models? Analyze their principles and applications in different domains.	*11*	*K2*	*CO1*
24.	a)	Discuss the use of Variable elimination algorithms in graphical model inference.	*11*	*K2*	*CO2*
		OR			
	b)	Explain how message passing is carried out in a junction tree and why it is useful for inference.	*11*	*K2*	*CO2*
25.	a)	Illustrate and explain the concept of Variational Auto encoders (VAEs) using a well-structured diagram.	*11*	*K2*	*CO3*
		OR			
	b)	Write types of sampling and demonstrate the importance sampling.	*11*	*K2*	*CO3*
26.	a)	Describe briefly about Masked Autoregressive Flow for Density Estimation	*11*	*K2*	*CO4*
		OR			
	b)	Explain are TensorFlow Distributions, and how do they facilitate probabilistic programming and uncertainty estimation in machine learning?	*11*	*K2*	*CO4*
27.	a)	Explain Bayesian Neural Networks in detail, covering their probabilistic nature, inference methods, and real-world applications.	*11*	*K2*	*CO5*
		OR			
	b)	Explain the concept of Meta-Learning to a real-world machine learning scenario and demonstrate how it allows models to adapt faster to new tasks by leveraging past experiences.	*11*	*K2*	*CO5*
28.	a)	Apply the Gaussian Copula framework to model dependencies between multiple time series. How does it improve the quality of probabilistic forecasts?	*11*	*K3*	*CO6*
		OR			
	b)	Construct and explain a DeepAR-based model for forecasting. Compare how it is differ in learning and output generation compared to classical autoregressive models?	*11*	*K3*	*CO6*