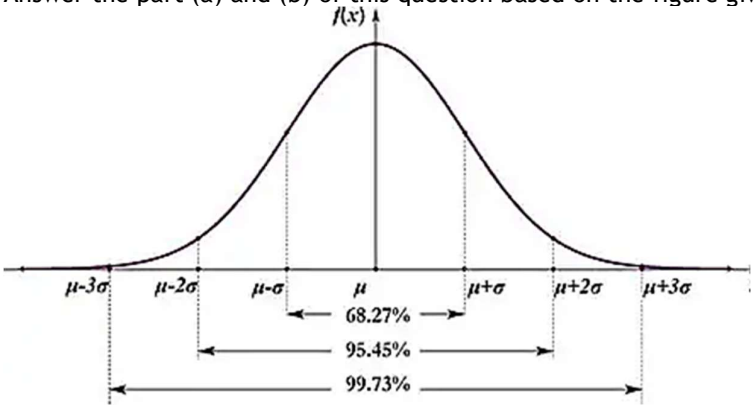
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : III**
BRANCH: AI & ML **SESSION : MO/2025**

SUBJECT: AI24201 MATHEMATICS FOR AI & ML

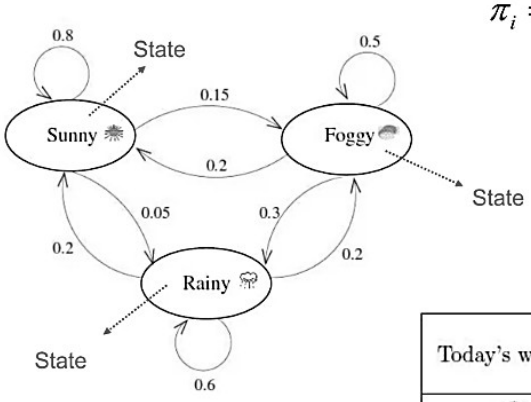
TIME: 02 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Assume a situation where 5 friends Aarav, Meera, Neha, Ravi, Tara were sending messages to each other In the morning, Aarav posts an assignment update in the class group. Meera replies to that post. Later, Aarav reacts 👍 to Meera's reply. Around noon, Meera writes a quick reminder to herself in "Saved Messages." Ravi sends a single direct question to Meera; she sees it but does not reply that day. Neha taps 👍 on Aarav's original post and has no other activity. Tara does not open the app at all that day. (i) Identify set and relations in this situation. (ii) Construct a graph of it. (iii) State whether your graph is directed or undirected and why? (iv) Create adjacency matrix of it. (v) Find degree of each vertex. (vi) Identify isolated, pendent vertices and self-loop in the create graph.	[0.5+1+0.5 +1+1+1]	1	4
Q.2(a)	Answer the part (a) and (b) of this question based on the figure given below:  Identify probability distribution shown in above figure? Justify your answer?	[1]	3	3
Q.2(b)	Mark the place of central tendencies i.e. mean, median and mode(all three) in given figure.	[1]	3	3
Q.2(c)	Solve using Master's method: T(n)= 3 T(n/2) + 3/4n + 1 T(n) =T(n-1)+log n	[1.5+1.5]	2	2
Q.3(a)	Identify which one of given problem is classification problem and why? Write short justification. (i) A webpage may show several ads. For each pageview, we log features (device, time, page category, ad positions). We want to predict whether at least one ad will be clicked during that pageview. (ii) Prediction of test scores based on number of study hours.	[1+1]	3	2

PTO

(b) For given Markov Model find probability of sequence Sunny-Foggy-Rainy-Rainy-Sunny-Foggy-Sunny? [3] 2 3



$$\pi_i = P(s_i):$$

P('Rainy')=0.3 ,
P('Sunny')=0.2 ,
P('Foggy')=0.5

$$a_{ij} = P(s_j \mid s_i)$$

Today's weather	Tomorrow's weather		
	0.8	0.05	0.15
	0.2	0.6	0.2
	0.2	0.3	0.5

Q.4(a) A clothing retailer might be interested in understanding which factors influence customer satisfaction. They could collect data on various features like price, product quality, customer service, and brand reputation. Which regression technique he will use to know the important features effecting his sales and why? [0.5+1.5] 3 2

Q.4(b) Ria keeps two imperfect logs: [1.5+1.5] 2 3

- Log X (11 consecutive days): happy, happy, sad, happy, happy, sad, sad, happy, happy, sad, sad
- Log Y (7 entries, not necessarily consecutive): (happy, pink), (sad, blue), (happy, pink), (happy, blue), (sad, blue), (sad, pink), (happy, pink)

Use the information above to decide which sequence should define the hidden states and which variable should define the observations.

1. Build the state-transition matrix A.
2. Build the observation/emission matrix B from above logs given.

Q.5 Find the Eigen values of the matrix given below [3+2] 1 3

A= $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

Find only one Eigen vector corresponding to least Eigen value.

:::::19/09/2025 :::::E