(I) 08/10/2025

NEP - Semester End Examination – October 2025

Program: FYIT Sem I **Course:** Quantitative Foundations for Data Analysis

Program Code: UGIT01 **Course Code:** NUIT107

Duration: 1 Hour **Max. Marks:30**

Instructions:

1. All questions are compulsory with internal choice.
2. Write clearly question and sub-question number.
3. Symbols have their usual meanings.
4. Scientific calculator fx 82 series or lower version is only permitted.
5. Graph paper will be provided, if required.

Q. 1		Attempt any THREE of the following.	[15]	Course Outcome	Knowledge Level
	(a)	Monthly cloud data storage used is given as follows: 100GB, 200GB, 400GB, 800GB, 1600GB (i) Identify the sequence type. (ii) Write Σ notation for total storage in 5 months. (iii) Predict storage in 7th month. (iv) Calculate storage cost in month 5 at ₹3/GB. (v) Write a mapping from month number to storage size.		CO1	L2
	(b)	Let P = "Sensor active" and Q = "Threshold exceeded" (i) Construct truth table for $P \rightarrow Q$ (ii) When will alarm trigger? (iii) Identify rows with false output. (iv) When is system safe? (v) Check whether $P \rightarrow Q \equiv \neg Q \rightarrow \neg P$		CO2	L1, L2
	(c)	Course enrollments for Artificial Intelligence (AI) and Data Science (DS) is as given AI = {A, B, C, D, E}, DS = {C, D, F, G} (i) Find students enrolled in both. (ii) Find students enrolled only in AI. (iii) Total unique students. (iv) AI × DS pairs. (v) Map AI student to project score: A:85, B:80, C:90, D:95, E:88. State domain, range.		CO1	L3
	(d)	A music streaming app records the number of songs played every hour: 5, 8, 11, 14, ... (i) Identify the sequence type. (ii) Derive the general term. (iii) Calculate total songs played in 24 hours using sigma notation. (iv) Find at what hour will 53 songs be played. (v) Comment on why an arithmetic sequence is apt for this modeling.		CO1	L3
	(e)	A bank grants loans if conditions on CIBIL score (P), income proof (Q), and no existing loan (R) are met. (i) Frame a compound proposition combining: "If P		CO2	L4

		and Q or R, then loan granted." (ii) Construct the truth table for $(P \wedge Q) \vee R$. (iii) Identify logical equivalence for $\neg(P \vee Q)$ and $(\neg P \wedge \neg Q)$. (iv) Write the contrapositive and converse of: "If CIBIL score ≥ 750, then loan granted." (v) Give an example of a real-world data query using this rule in SQL-like syntax.			
Q. 2		**Attempt any THREE of the following.**	**[15]**	**Course Outcome**	**Knowledge Level**
	(a)	Hospital records provide the following information: • Probability a random patient is COVID-positive: $P(COVID) = 0.10$ • False positive rate of the diagnostic test: $P(test + \mid no\ COVID) = 0.05$ • Optimistic sensitivity: $P(test + \mid COVID) = 0.95$ • Oxygen saturation (SpO_2) data for patients (in %): COVID-positive group: Mean=88, SD=4 COVID-negative group: Mean=95, SD=2 Answer the following: (i) Represent the means of oxygen levels as a 2×1 column vector, with the COVID-positive group first. (ii) Represent the standard deviations of oxygen levels as a 2×1 column vector, with the COVID-positive group first. (iii) Using Baye's Theorem, compute the probability that a patient actually has COVID given the test result is positive. (iv) Based on the given SD values, identify which group (COVID-positive or COVID-negative) shows lower variation in oxygen levels. Briefly explain your reasoning.		**CO3, CO4**	**L3, L4**
	(b)	The following are the scores obtained by participants in an AI Hackathon:50, 55, 60, 70, 80 (i) Calculate the Mean of the scores. (ii) Find the Median of the scores. (iii) Determine the Mode of the scores. (iv) Calculate the Range and Variance of the scores. (v) Based on the data, comment on the shape of the distribution (whether it is symmetrical or skewed).		**CO5**	**L3, L4**
	(c)	A company is analyzing customer ratings (out of 10) for two products A and B from 4 users. Ratings are stored in the matrix		**CO3, CO5**	**L3**