Name: Enrolment No:	

UPES
End Semester Examination, Dec. 2025

Course: System Analysis and Optimization **Semester: 7th**
Program : INT-BBA-MBA **Time : 03 hrs.**
Course Code: DSIT8007 **Max. Marks: 100**

Instructions: all questions are compulsory

SECTION A
10Qx2M=20Marks

S. N..		Marks	CO
Q 1			
i.	System analysis primarily focuses on: a) Coding and UI development b) Breaking down a problem into components to find optimal solutions c) Employee recruitment d) Hardware design	**2 Marks**	**CO1**
ii.	Optimization in decision-making helps managers: a) Increase uncertainty b) Select the best alternative under given constraints c) Avoid mathematical modelling d) Ignore trade-offs	**2 Marks**	**CO1**
iii.	A deterministic model is characterized by: a) Random variables affecting outcomes b) Outcomes completely known and certain c) Time-dependent randomness d) Monte Carlo simulation	**2 Marks**	**CO1**
iv.	The Simplex Method is preferred over Graphical Method because: a) Graphical method is more accurate b) Simplex can handle multiple constraints and variables c) Simplex is only used for two variables d) Simplex eliminates constraints	**2 Marks**	**CO1**
v.	Shadow price in sensitivity analysis refers to: a) Profit earned per product b) Rate at which objective function increases per unit increase in a constraint's RHS c) Price of raw materials d) Cost of simulation	**2 Marks**	**CO1**
vi.	Duality in LP provides: a) Alternative optimal solutions b) Upper and lower bounds for the primal solution	**2 Marks**	**CO1**

	c) No relevant interpretation d) Only infeasible solutions		
vii.	The Hungarian method is used for: a) Assigning tasks to resources at minimum cost b) Predicting future demand c) Simulation modelling d) Finding optimal inventory levels	**2 Marks**	**CO1**
viii.	In a shortest-path problem, the objective is to: a) Minimize total flow b) Minimize travel cost or distance between two nodes c) Maximize route options d) Increase complexity of network	**2 Marks**	**CO1**
ix.	Dynamic programming is best suited for problems having: a) No structure b) Overlapping subproblems and optimal substructure c) Random outcomes d) No decision stages	**2 Marks**	**CO1**
x.	An example of capital budgeting solved using dynamic programming is: a) Hiring employees b) Selecting investment projects under budget limits c) Setting product prices d) Scheduling advertisements	**2 Marks**	**CO1**
Section B			
Q 2	Explain the difference between deterministic and probabilistic models. Provide one example of where each type is used in optimization.	**5 Marks**	**CO2**
Q 3	How does system analysis help identify inefficiencies in supply chain or service operations? Give one practical example.	**5 Marks**	**CO2**
Q 4	What is goal programming? Explain how it is useful when organizations face multiple conflicting objectives.	**5 Marks**	**CO2**
Q 5	Describe how Monte Carlo simulation supports decision-making under uncertainty. Provide one business application	**5 Marks**	**CO2**
Section C **Attempt Any 3**			
Q.6	Explain the role of system analysis in understanding complex business processes. Discuss how optimization models support managerial decision-making, using examples from supply chain, service systems, or manufacturing. Illustrate how deterministic and probabilistic models guide different types of decisions.	**10 Marks**	**CO3**
Q.7	Discuss the principles of dynamic programming and explain why DP is suitable for multistage decision problems. Using examples from inventory management, project scheduling, or capital budgeting, illustrate how DP leads to optimal	**10 Marks**	**CO3**

	decisions. Also explain how simulation techniques, especially Monte Carlo simulation, help organizations deal with uncertainty and risk.		
Q.8	Explain the logic behind the **Hungarian method** for solving assignment problems. Why is it more efficient than trial-and-error	**10 Marks**	**CO3**
Q .9	Formulate a real-life linear programming problem (resource allocation/production planning/marketing mix). Explain the steps involved in converting a real situation into LP form. Discuss how Simplex method solves such problems and evaluate the importance of sensitivity analysis and duality in interpreting the results.	**10 Marks**	**CO3**
Section D			
Q.10	A retail chain faces fluctuating weekly demand for a fast-moving product. Holding costs, shortage costs, and ordering costs vary across seasons. The management wants to determine the optimal ordering policy for the next 12 weeks to minimize total cost. Using dynamic programming principles, explain how the chain should construct stages, states, and decision rules to derive the optimal inventory replenishment strategy**.** **Or** A customer service call center receives calls with random inter-arrival times. Service duration follows a probability distribution. The center wants to determine the number of agents required to meet the service-level target of answering 90% of calls within 20 seconds. Explain how Monte Carlo or discrete-event simulation can be used to model the system, test alternative staffing scenarios, and decide the optimal number of agents**.**	**15 Marks**	**CO4**
Q.11	A hospital emergency department faces uncertain patient arrivals, varying service times, and limited doctors. High waiting times increase mortality risk and patient dissatisfaction. Explain how simulation can help the hospital analyze patient flow, allocate staff effectively, identify bottlenecks, and propose operational improvements. Support your answer with a structured simulation framework**.** **Or** Using the Hungarian Method, determine the optimal assignment and the minimum total cost for the matrix provided. assign four workers A, B, C, D to four jobs 1–4 at minimum total cost. Cost matrix (rows = workers A–D, columns = jobs 1–4):	**15 Marks**	**CO4**

			Job 1	**Job 2**	**Job 3**	**Job 4**					
		A	9	2	7	8					
		B	6	4	3	7					
		C	5	8	1	8					
		D	7	6	9	4					