(First Semester)

Branch- **MATHEMATICS**

OPTIMIZATION TECHNIQUES

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks $(10 \times 1 = 10)$

Module No.	Question No.	Question	K Level	CO
1	1	Identify that a set of arcs joining two nodes, passing through other nodes in the network, then it is called as _____. a) Path b) Flow c) Tree d) Spanning Tree	K1	CO1
	2	Estimating breakthrough paths with positive flow between the source and sink nodes in the network by using _____. a) Minimal spanning tree algorithm b) Maximal-flow algorithm c) Dijkstra's algorithm d) Floyd's algorithm	K2	CO1
2	3	When a state j, if the probability of being revisited from other state is 1, then it is called as _____. a) Periodic b) Recurrent c) Transient d)Absorbing	K1	CO2
	4	The mean recurrence time in n −state Markov chain is computed by _____. a) $\pi_{ij} = \frac{1}{\mu_{ij}}$ b) $\mu_j = \frac{1}{\pi_{ij}}$ c) $\pi_{ij} = \frac{1}{\mu_i}$ d) $\mu_{ij} = \frac{1}{\pi_j}$	K2	CO2
3	5	Which method is suited for analytically tractable probability density functions such as the exponential and the uniform? a) Inverse method b) Convolution method c) Acceptance-rejection method d)Subinterval method	K1	CO3
	6	The next arrival time t_1, for $\lambda = 4$ customers per hour and $R = 0.9$ *is* _____ a) 34.5 minutes b) 34.6 minutes c) 34.7 minutes d) 34.8 minutes	K2	CO3
4	7	In general $\lvert H \rvert_{X_0}$ is indefinite, then identify that X_0 must be a _____. a) Stationary point b) Extreme point c) Inflection point d) Saddle point	K1	CO4
	8	The equations to give the necessary conditions for determining station points of $f(X)$ subject to $g(X) = 0$ *is* _____. a) $\frac{\partial L}{\partial \lambda} = 0, \frac{\partial L}{\partial X} = 0$ b) $\frac{\partial f}{\partial \lambda} = 0, \frac{\partial f}{\partial X} = 0$ c) $\frac{\partial g}{\partial \lambda} = 0, \frac{\partial g}{\partial X} = 0$ d) $\frac{\partial f}{\partial \lambda} = 0, \frac{\partial g}{\partial \lambda} = 0$	K2	CO4
5	9	Write the name of the method for finding an interval of uncertainty known to include the optimum solution point? a)Direct search method b) Gradient method c) Inverse method d) Convolution method	K1	CO5
	10	The general constrained non linear programming problem has at least one of the functions $f(X)$ and $g(X)$ is _____. a) Linear b) Non-linear c) separable d) non separable	K2	CO5

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Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Construct the project network for the following table and determine the critical path. All the durations are in days. Activity Predecessor(s) Duration (days) A – 5 B – 6 C A 3 D A 8 E B, C 2 F B, C 11 G D 1 H E 12	K3	CO1
		(OR)		
	11.b.	Illustrate the construction of the time schedule and determination of the floats in the project.		
2	12.a.	Compute (i) Absorbing and transient states of the transition matrix $P = \begin{pmatrix} .2 & .5 & .3 \\ 0 & .5 & .5 \\ 0 & 0 & 0 \end{pmatrix}$. (ii) Periodic states of the transition matrix: $P = \begin{pmatrix} 0 & .6 & .4 \\ 0 & 1 & 0 \\ .6 & .4 & 0 \end{pmatrix}$	K2	CO2
		(OR)		
	12.b.	Compute the steady state probability distribution of the transition matrix $P = \begin{pmatrix} .30 & .60 & .10 \\ .10 & .60 & .30 \\ .05 & .40 & .55 \end{pmatrix}$.		
3	13.a.	Evaluate Erlang distribution with example.	K5	CO3
		(OR)		
	13.b.	Discuss about the generation of random numbers and using multiplicative congruential method, generate three random numbers if $b = 9, c = 5, m = 12$. The seed is $u_0 = 11$.		
4	14.a.	Consider the following problem: $f(X) = {x_1}^2 + 3{x_2}^2 + 5x_1{x_3}^2$ $g_1(X) = x_1x_3 + 2x_2 + {x_2}^2 - 11 = 0$ $g_2(X) = {x_1}^2 + 2x_1x_2 + {x_3}^2 - 14 = 0.$ to validate the value of $\partial_c f$ & ∂x_2 at X_0.	K5	CO4
		(OR)		
	14.b.	Consider the following problem: $Minimize\ f(X) = {x_1}^2 + {x_2}^2 + {x_3}^2$ Subject to $g_1(X) = 2x_1 + x_2 - 5 \leq 0$ $g_2(X) = x_1 + x_3 - 2 \leq 0$ $g_3(X) = 1 - x_1 \leq 0$ $g_4(X) = 2 - x_2 \leq 0$ $g_5(X) = -x_3 \leq 0$ Verify that both $f(X)$ & $g(X)$ are convex and nature of the stationary point.		
5	15.a.	Sketch about Quadratic programming model and explain its algorithm, to find feasible solution space.	K3	CO5
		(OR)		

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5	15.b.	Solve the following problem by using separable convex programming to estimate the optimum solution . $Maximize\ z = x_1 - x_2$ Subject to $3{x_1}^4 + x_2 \leq 243$ $x_1 + 2{x_2}^2 \leq 32$ $x_1 \geq 2.1$ $x_2 \geq 3.5.$	K3	CO5

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Explain Dijkstra's algorithm and PERT networks.	K3	CO1
2	17	A product is processed on two sequential machines I and II. Inspection takes place after a product unit is completed on either machine. There is a 5% chance that the unit will be junked before inspection. After inspection, there is a 3% chance the unit will be junked and a 7% chance of being returned to the same machine for reworking. Else, a unit passing inspection on both machines is good. (a) For a part starting at machine I, determine the average number of visits to each state. (b) If a batch of 1000 units is started on machine I, determine the average number of completed good units. For the Markov chain, the production process has 6 states: start at $I(s1)$, inspect after $I(i1)$, start at $II(s2)$, inspect after $II(i2)$, junk after inspection I or $II(J)$, and good after $II(G)$. States J and G are absorbing states. The transition matrix is given as $P = \begin{pmatrix} 0 & .95 & 0 & 0 & .05 & 0 \\ .07 & 0 & .9 & 0 & .03 & 0 \\ 0 & 0 & 0 & .95 & .05 & 0 \\ 0 & 0 & .07 & 0 & .03 & .9 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$.	K3	CO2
3	18	Explain the convolution method with Poisson distribution and Normal distribution.	K2	CO3
4	19	Explain Lagrangean method and validate this method with following problem: $Minimize\ f(X) = {x_1}^2 + {x_2}^2 + {x_3}^2$ Subject to $g_1(X) = x_1 + x_2 + 3x_3 - 2 = 0$ $g_2(X) = 5x_1 + 2x_2 + x_3 - 5 = 0$	K5	CO4
5	20	Solve the following problem by using separable programming to estimate the optimum solution . $Maximize\ z = x_1 + {x_2}^4$ Subject to $3x_1 + 2{x_2}^2 \leq 9 \quad x_1, x_2 \geq 0.$	K5	CO5

Z-Z-Z END