Reg. No.: | | | | | | | | |

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

PG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2024.

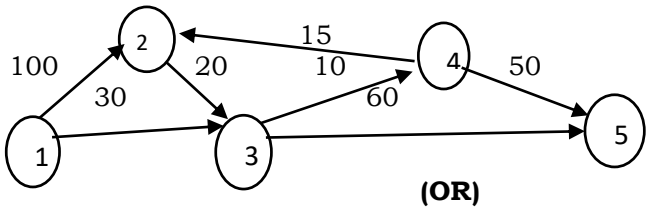
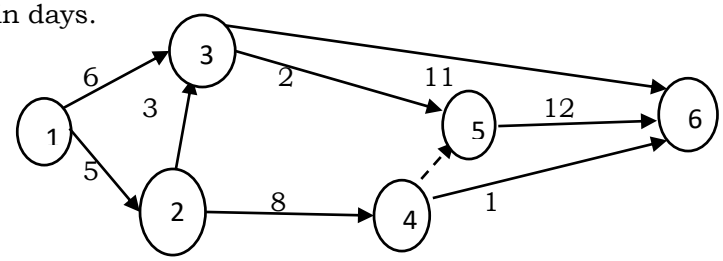
(For those admitted in June 2023 and later)

PROGRAMME AND BRANCH: M.Sc., MATHEMATICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
III	PART - III	CORE-10	P23MA310	OPERATIONS RESEARCH

Date : 13.11.2024 / FN **Time : 3 hours** **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	**SECTION – A (10 X 1 = 10 Marks)** **Answer ALL Questions.**
CO1	K1	1.	The starting basic solution consists of ____ basic variables in the transportation problem with m sources and n destinations. a) m+n b) m+n+1 c) m+n-1 d) n+m-1
CO1	K2	2.	The assignment method can be solved by ____. a) north west corner method b) Modi method c) VAM d) Hungarian method
CO2	K1	3.	Which of the following links all the nodes of the network with no loops allowed. a) tree b) spanning tree c) connected network d) directed network
CO2	K2	4.	_____ equals the sum of the capacities of the associated arcs. a) residuals b) cut c) residue network d) cut capacity
CO3	K1	5.	Any solution that satisfies all the constraints of the LPP model is a _____. a) objective function b) non-negative restrictions c) feasible solution d) non-feasible solution
CO3	K2	6.	____ represents the amount by which the variable amount of the resource exceeds its usage by the activities. a) slack variable b) unrestricted variable c) surplus variable d) restricted variable
CO4	K1	7.	Which of the following represents the fixed charge incurred when an order is placed? a) Purchasing cost b) Setup cost c) Holding cost d) Shortage cost
CO4	K2	8.	Critical ratio is ____. a) $\frac{p-c}{p+h}$ b) $\frac{p+c}{p+h}$ c) $\frac{p+h}{p-c}$ d) $\frac{p+h}{p+c}$
CO5	K1	9.	Which of the following is correct? a) $W_s = W_q + \frac{1}{\mu}$ b) $W_q = W_s + \frac{1}{\mu}$ c) $W_s = W_q + \frac{1}{\lambda}$ d) $W_s = W_q - \frac{1}{\lambda}$
CO5	K2	10.	Truncated Poisson distribution is____ a) $P_0(t) = 1 - \sum_{n=1}^{N} p_n(t)$ b) $P_0(t) = 1 + \sum_{n=1}^{N} p_n(t)$ c) $P_n(t) = 1 - \sum_{n=1}^{N} p_0(t)$ d) $P_n(t) = 1 + \sum_{n=1}^{N} p_0(t)$
Course Outcome	**Bloom's K-level**	**Q. No.**	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K2	11a.	The SunRay Transport Company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demand (also in truckloads) together with the unit transportation costs per truckload on the different routes are summarized

			in the following transportation model. The unit transportation costs c_{ij} are in hundreds in dollars. Mill Silo: 1 | 2 | 3 | 4 | Supply 1 | 10 | 2 | 20 | 11 | 15 2 | 12 | 7 | 9 | 20 | 25 3 | 4 | 14 | 16 | 18 | 10 Demand | 5 | 15 | 15 | 15 Estimate the starting solution by least-cost method.
			(OR)
CO1	K2	11b.	Joe Klyne's three children John, Karen and Terri want to earn some money to take care of personal expenses during a school trip to local zoo. Mr. Klyne has chosen three chores for his children: mowing the lawn, painting the garage and washing the family cars. To avoid anticipated siblings competitions, he asked them to submit (secret) bids for what they feel was a pair pay for each of three chores. The understanding then was that all three children will abide by their father's decision as to who gets which chore. The following table summarizes the bids received. Mow | Paint | Wash John | $15 | $10 | $9 Karen | $9 | $15 | $10 Terri | $10 | $12 | $8 Based on this information how should Mr. Kylne assign the chores?
CO2	K2	12a.	The network in the following figure gives the permissible routes and their lengths in miles between city 1 (node 1) and four other cities (nodes 2 to 5). Estimate the shortest routes from city 1 to each of the remaining four cities. 
			(OR)
CO2	K2	12b.	Discover the critical path for the project network in the following figure. All the durations are in days. 
CO3	K3	13a.	Reddy mikks produces both interior and exterior paints from two raw materials, M1 and M2. The following table provides the basic data of the problem: Tons of raw material per ton of: Exterior paint | Interior paint; Maximum daily availability (tons) Raw material M1 | 6 | 4 | 24 Raw material M2 | 1 | 2 | 6 Profit per ton($1000) | 5 | 4 | Prepare the LPP model for the above data.
			(OR)
CO3	K3	13b.	McBurger fast-food restaurant sells quarter-pounder and cheeseburger. A quarter bounder uses a quarter of a pound of meat and a cheese burger uses only 0.2 lb. The restaurant starts the day with 200 lb of neat but may order more at additional cost of 25 cents per pound to cover the delivery cost. Any surplus meat at the end of the day is donated to HotSoup Charity. McBurger's profits are 20 cents from a quarter-pounder and 15 cents for a cheese burger. All in all. McBurger does not expect to sell more than 900 sandwiches in any one day. How much of each sandwich should McBurger make?

CO4	K3	14a.	Neon lights on the U of A campus are replaced at the rate of 100 units per day. The physical plant orders neon lights periodically. It costs \$100 to initiate a purchase order. A neon light kept in storage is estimated to cost about \$.02 per day. The lead time between placing and receiving an order is 12 days. Determine the optimal inventory policy for ordering the neon lights. **(OR)**
CO4	K3	14b.	The daily demand for an item during a single period occurs instantaneously at the start of the period. The pdf of the demand is uniform between 0 and 10 units. The unit holding cost of the item during the period is \$.50 and the unit penalty cost for running out of stock is \$4.50. The unit purchase cost is \$.50. A fixed cost of \$25 is incurred each time an order is placed. Determine the optimal inventory policy for the item.
CO5	K4	15a.	Babies are born in a sparsely populated state at the rate of one birth every 12 minutes. The time between births follows an exponential distribution. Examine the following: (a) The average number of births (b) The probability that no births will occur in any one day. (c) The probability of issuing 50 birth certificates by end of the next 3 hours given that 40 certificates were issued during last 2 hours. **(OR)**
CO5	K4	15b.	Illustrate the model (M/M/1) (GD/N/∞) and also find the expected number of customers in the system.

Course Outcome	Bloom's K-level	Q. No	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K4	16a.	The SunRay Transport Company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demand (also in truckloads) together with the unit transportation costs per truckload on the different routes are summarized in the following transportation model. The unit transportation costs c_{ij} are in hundreds in dollars.

		Mill 1	2	3	4	Supply
Silo	1	10	2	20	11	15
	2	12	7	9	20	25
	3	4	14	16	18	10
Demand		5	15	15	15	

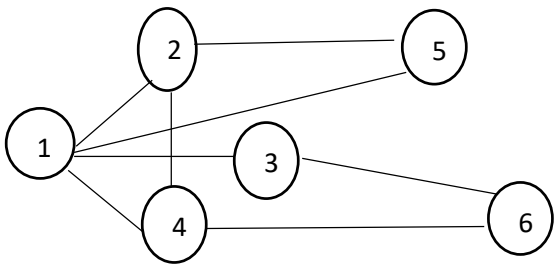
Examine the final solution for the transportation model starting with north-west corner rule solution.

(OR)

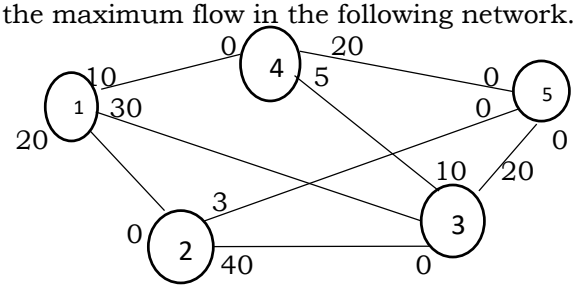
CO1	K4	16b.	Solve the following assignment problem

	I	II	III	IV
1	\$1	\$4	\$6	\$3
2	\$9	\$7	\$10	\$9
3	\$9	\$5	\$11	\$7
4	\$8	\$7	\$8	\$5

CO2	K5	17a.	The Midwest TV cable Company is in the process of providing cable service to five new housing development areas. The following figure depicts the potential TV linkages among the five areas. The cable miles are shown on each branch. Determine the most economical cable network.



CO2	K5	17b.	**(OR)**

			Evaluate the maximum flow in the following network. 
CO3	K5	18a.	Solve by graphical method: $max\ z = 5x_1 + 4x_2$ subject to $6x_1 + 4x_2 \leq 24, x_1 + 2x_2 \leq 6, -x_1 + x_2 \leq 1, x_2 \leq 2$ and $x_1, x_2 \geq 0$ **(OR)**
CO3	K5	18b.	Ozrak Farms uses at least 800 lb of special feed daily. The special feed is a mixture of corn and soybean meal with the following compositions: Feedstuff / Lb per lb of feedstuff: Protein, Fiber, Cost($/lb) Corn: .09, .02, .30 Soybean meal: .60, .06, .90 The dietary requirements of the special feed stipulate at least 30% protein and at most 5% fiber. Evaluate the daily minimum-cost feed mix.
CO4	K5	19a.	LubeCar specializes in fast automobile oil change. The garage buys car oil in bulk at $3 per gallon. A price discount of $2.50 per gallon is available if Lube Car purchases more than 1000 gallons. The garage services approximately 150 cars per day, and each oil change requires 1.25 gallons. LubeCar stores bulk oil at the cost of $.02 per gallon per day. Also the cost of placing an order for bulk oil is $20. There is a 2-day lead time for delivery. Evaluate the optimal inventory policy. **(OR)**
CO4	K5	19b.	Electro uses resin in its manufacturing process at the rate of 1000 gallons per month. It cost Electro $100 to place on order for a new shipment. The holding cost per gallon per month is $2, and the shortage cost per gallon is $10. Historical data show that the demand during lead time is uniform over the range (0,100) gallons. Evaluate the optimal ordering policy for Electro.
CO5	K6	20a.	Visitors parking at Ozark College is limited to only five spaces. Cars making use of this space arrive according to a Poisson distribution at the rate of six cars per hour. Parking time is exponentially distributed with a mean of 30 minutes. Visitors who cannot find an empty space immediately on arrival may temporarily wait inside the lot until a parked car leaves. That temporary space can hold only three cars. All other cars that cannot park or find a temporary waiting space must go elsewhere. Prepare the answers for the following: (a) The probability p_n of n cars being in the system (b) The effective rate at which cars arrive at the lot (c) The average number of cars in the lot (d) The average time a car waits for a parking space inside the lot (e) The average number of occupied parking spaces **(OR)**
CO5	K6	20b.	Automata car wash facility operates with only one bay. Cars arrive according to a Poisson distribution, with a mean of 4 cars per hour and may wait in the facility's parking lot if the bay busy. The time for washing and cleaning a car is exponential, with a mean of 10 minutes. Cars cannot park in the lot can wait in the street bordering the wash facility. Suppose that a new system installed so that the service time for all cars is constant and equal to 10 minutes. How does the new system affect the operation of the facility?