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ET-301(A)/ET-534(B)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) Term-End Examination December, 2017

ET-301(A)/ET-534(B) : SYSTEMS METHODS

Time : 3 hours *Maximum Marks : 70*

Note : *All questions are* ***compulsory****. Use of calculators is allowed. Each and every notation should be elaborated. Assume any missing data suitably.*

1. Answer any ***six*** of the following questions : *6×5=30*

(a) What do you understand by Economic System ? Describe its elements.

(b) What do you understand by Electric Power Generation Systems ? Describe an electric power generation system with the help of a block diagram.

(c) A DC motor is the most suitable motor for variable speed drives. State the reasons.

(d) Differentiate between physical and non-physical systems by citing at least two examples of each.

(e) What are Causal and Non-causal systems ? Cite at least two examples of each.

(f) Differentiate between block diagram and interconnection diagram with the help of suitable examples (at least one).

(g) What do you understand by model of a system ? Describe in brief, Mathematical model and Physical model with the help of examples.

(h) Write the relevance of dynamic programming in decision-making.

2. Answer any ***two*** of the following : *2×10=20*

(a) Obtain the initial basic feasible solution of a transportation problem using North-West Corner Rule :

Origin \ Demand	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Requirement	6	10	15	4	

(b) A company has A and B as its products with a profit margin of ₹ 2 and ₹ 1 respectively per unit. The following table indicates the labour, equipment and material to produce each product.

	Requirement per unit		
	Product A	Product B	Total
Labour (Man hours)	3·0	2·0	12·0
Equipment (Machine hours)	1·0	2·3	6·9
Material (Unit)	1·0	1·4	4·9

Formulate the linear programming problem specifying the product mix which will maximise profit without exceeding the various levels of resources.

(c) Maximize $z = 4x_1 + 5x_2$

subject to $3x_1 + 2x_2 \leq 6$

$2x_1 + 4x_2 \leq 5$

$x_1, x_2 \geq 0$

Use an appropriate linear programming method for solving the problem. Give assumptions.

3. Answer any ***two*** of the following : *2×10=20*

(a) A company decides to make four sub-assemblies through four contractors. Each contractor is to receive only one sub-assembly. The cost of each sub-assembly is determined by the bids submitted by each contractor and is shown in the following table in hundreds of rupees. Assign the different sub-assemblies to contractors to minimise the total cost.

Contractor / Sub-Assembly	1	2	3	4
1	15	13	14	17
2	11	12	15	13
3	13	12	10	11
4	14	17	14	16

(b) A construction company requires a large amount of gravel and sand. The requirements are 1000 m^3 of coarse gravel, 2000 m^3 of fine gravel, 1000 m^3 of fine sand and 1200 m^3 of coarse sand. There are two pits A and B from which the above material can be obtained. Analysis shows that the material at each pit has the following composition :

Material	Pit A	Pit B
Coarse gravel	15%	35%
Fine gravel	20%	40%
Fine sand	30%	15%
Coarse sand	35%	10%

It costs the construction company ₹ 10/m^3 for material and handling. Formulate the linear programming model.

(c) A vending machine dispenses hot chocolate or coffee. Service time is 30 seconds per cup and is constant. Customers arrive at a mean rate of 80 per hour, and this rate is Poisson distributed.

Determine :

(i) The average number of customers waiting in line

(ii) The average time customers spend in the system

(iii) The average number in the system
