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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination

Summer Semester, A. Y. 2022-2023

Course No IPE 4857

Time: 1½ Hours

Course Title: Operations Research

Full Marks: 75

There are 3 (Three) questions. Answer all of them. The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in the right column. Assume reasonable values if required.

1. A small city of 75,000 people requires an average of 300,000 gallons of water daily. The city is supplied with water purified at a central water works, where water is purified by filtration, chlorination and addition of two chemicals softening chemical P and health chemical Q. Water works plans to purchase two popular brands of products, product A and product B, which contain these two elements. One unit of product A gives 8 Kg of P and 3 Kg of Q. One unit of product B gives 4 Kg of P and 9 Kg of Q. To maintain the water at a minimum level of softness and meet a minimum in health protection, it is decided that at least 150 Kg of P and 100 Kg of Q must be added daily. At a cost of 8 USD and 10 USD per unit respectively for A and B, Determine the optimum quantity of each product A and B that should be used to meet consumer standard using Big M or Two Phase method. [25]
CO2, PO2, K2

2. A microwave manufacturing company has three plants and four warehouses at different locations. The unit cost of transporting the product from plant to warehouse is shown in the table. The capacity of each plant is shown on the right column and demand of each plant is shown in the bottom row. At first, find the initial basic feasible solution using any of the three methods, then do the optimality test and proceed with further steps until an optimal solution could be found for this transportation problem. [25]
CO2, PO2, K2

Plant/ Warehouse	U	V	W	X	Supply
K	2	3	11	7	6
L	1	0	6	1	7
M	5	8	15	9	10
Demand	7	5	3	2	17/17

3. Four different jobs are to be done by four different machines in an automobile manufacturing plant. Four machines are denoted as A, B, C, D and four jobs are identified as P, Q, R, S respectively. The assignment cost for this purpose is given in the table below. Only one job can be assigned to any one machine. The objective is to assign a job to a machine such that the total assignment cost is a minimum. Solve the problem using the appropriate method. [25]
CO2, PO2, K2

Machine/ Job	P	Q	R	S
A	5	7	11	6
B	8	5	9	6
C	4	7	10	7
D	10	4	8	3