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Program: B.Sc.Engg. (ME) **Date: 16 May 2023**
Semster: 8th Semester **Time: 10:00 AM-01:00 PM**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

SEMESTER FINAL EXAMINATION — SUMMER SEMESTER: 2021-2022
MCE-4821 Materials Handling — TIME: 3 HRS 00 MIN
FULL MARKS: 150

There are 6 (Six) questions. Answer all Questions. Marks in the Margin indicate full marks

1(a) The From-To Chart in the table below indicates the number of loads moved per 8-hour day (above the slash) and the distances in ft (below the slash) between departments in a particular factory. Fork lift trucks are used to transport materials between departments. They move at an average speed = 275 ft/min (loaded) and 350 ft/min (empty). Load handling time per delivery is 1.5 min, and anticipated traffic factor = 0.9. Assume reliability = 1.0 and worker efficiency = 110%. Use an availability factor = 95% and worker efficiency = 110%. Determine the number of trucks required under each of the following assumptions: (i) the trucks never travel empty; and (ii) the trucks travel empty a distance equal to their loaded distance. (17) [CO3, PO3]

To Dept.	A	B	C	D	E
From Dept A	-	62/500	51/450	45/350	0
B	0	-	0	22/400	0
C	0	0	-	0	76/200
D	0	0	0	-	65/150
E	0	0	0	0	-

(b) List the different major principles that need to be followed for the optimum design of materials handling system and hence explain the planning and system principles. (8) [CO4, PO4]

2(a) A recirculating conveyor has a total length of 700 ft and a speed of 90 ft/min. Spacing of part carriers = 14 ft. Each carrier can hold one part. Automatic machines load and unload the conveyor at the load and unload stations. Time to load a part is 0.10 min and unload time is the same. To satisfy production requirements, the loading and unloading rates are each 2.0 parts per min. Evaluate the conveyor system design with respect to the three principles developed by Kwo. (13) [CO4, PO5]

2 (b) A roller conveyor moves tote pans in one direction at 150 ft/min between a load station and an unload station, a distance of 200 ft. With one worker, the time to load parts into a tote pan at the load station is 3 sec per part. Each tote pan holds 8 parts. In addition, it takes 9 sec to load a tote pan onto the conveyor. Determine: (i) spacing between tote pan centers flowing in the conveyor system, and (ii) flow rate of parts on the conveyor system. (iii) Consider the effect of the unit load principle. Suppose the tote pans were smaller and could hold only one part rather than 8. Determine the flow rate in this case if it takes 7 sec to load a tote pan onto the conveyor (instead of 9 sec for the larger tote pan), and it takes the same 3 sec to load the part into the tote pan. (12) [CO3, PO4]

3(a) The length of the storage aisle in an AS/RS = 240 ft and its height = 60 ft. Suppose horizontal and vertical speeds of the S/R machine are 300 ft/min and 60 ft/min, respectively. The S/R machine requires 18 sec to accomplish a pick and deposit operation. Find: (i) the single-command and dual-command cycle times per aisle, and (ii) throughput for the aisle under the assumptions that storage system utilization = 85% and the number of single command and dual command cycles are equal. (12) [CO3, PO3]

3(b) A single carousel storage system has an oval rail loop that is = 30 ft long and 3 ft wide. Sixty carriers are equally spaced around the oval. Suspended from each carrier are 5 bins. Each bin has a volumetric capacity = 0.75 ft^3. Carousel speed = 100 ft/min. Average pick and deposit time for a retrieval = 20 sec. Determine: (i) volumetric capacity of the storage system, and (ii) hourly retrieval rate of the storage system. (13) [CO3, PO3]

4 (a) Explain the Kanban production control systems and hence discuss the operating rules for a dual card kanban system with necessary illustrations. (13) [CO1, PO1]

4 (b) Explain briefly the different JIT goals and different building blocks that need to be followed for the implementation JIT. (12) [CO1, PO1]

5 (a) What is packaging in international marketing? Explain the different types of packaging and discuss briefly the different packaging testing method. (10) [CO1, PO1]

5 (b) What is warehousing? Explain the different types of warehouses and its advantages. (7) [CO1, PO1]

5 (c) List the different types of Materials handling equipment and hence explain the working principle of AGV pallet truck with necessary diagram. (8) [CO1, PO1]

6 (a) Explain briefly the zone control method to implement the blocking system for controlling the traffic movement of AGVs inside a manufacturing plant. (10) [CO2, PO2]

6 (b) A company has three production facilities *S*1, *S*2 and *S*3 with production capacity of 7, 9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses *D*1, *D*2, *D*3 and *D*4 with requirement of 5, 8, 7 and 14 units (in 100s) per week, respectively. The transportation costs (in Taka) per unit between factories to warehouses are given in the table below: (15) [CO3, PO2]

	D1	D2	D3	D4	Supply Availability
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand Requirements	5	8	7	14	34

Use Least Cost Method (LCM) to find initial basic feasible solution to the transportation problem using above data to find out the total transportation cost.