BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

MF F219: OPERATIONS MANAGEMENT

Mid Semester Examination: Closed Book

Max Marks: 60 **Duration: 90 minutes** **Date: 18/3/2023**

Note: Justify your each answer. Partial marks will not be awarded if justification is incorrect or multiple answers are written.

Q1.

The following set of four jobs is to be processed through three machines in a XYZ company following the mass production. The sequence is first turning on a lathe machine, then drilling on radial drilling machine and finally finishing on a grinding machine. Processing time in minutes at each machine is shown in the **Table 1**.

a) Determine the optimal order in which the jobs should be processed, so that the entire set of jobs is completed as soon as possible. **[6]**
b) Make a Gantt chart to map out the schedule on each machine for optimal order. **[3]**
c) What is the total length of time of this schedule? **[2]**
d) Determine the idle time for each machine? **[3]**

Jobs	Lathe	Drilling	Grinding
1	4	3	8
2	3	7	5
3	1	2	7
4	3	4	2

Table 1

	Course				
Professor	**1**	**2**	**3**	**4**	**5**
A	1	2	1	4	5
B	5	4	3	2	1
C	4	1	2	3	5
D	4	2	2	1	3
E	2	4	4	4	1

Table 2

Q2.

A university needs to assign professors to teach courses in the next semester. As a criterion for judging who should teach each course, the student feedback of the past 4 years is reviewed. Since each of the five professors taught each of the five courses at one time or another during the 4-year period, a course rating for each faculty is recorded (with 5 being best) and shown in the **Table 2**. Assign the professors to courses to maximize the overall teaching rating. **[8]**

Q3.

Following activities are required to be completed to get the new laboratory built and the equipment installed in the mechanical department of an educational institute.

a) How many weeks will the lab take to complete? **[2]**
b) Which activities, and how much can be delayed without delaying the completion time? **[3]**
c) Suppose activity F and activity C each could be shortened by one week. How would this affect the completion time? **[2]**
d) If the lab has to be built in 22 weeks, then how much extra cost would be incurred to compete by this time? **[3]**
e) Department gets a penalty of $4500 per week, for every week the lab is not completed. In how many weeks the lab will be completed if department is willing to pay crashing cost as long as it is less than $4500 per week? **[6]**

Activity	Predecessors	Normal Time (Weeks)	Normal Cost ($)	Crash Time (Weeks)	Crash Cost ($)
A	-	5	7,000	3	13,000
B	A	10	12,000	7	18,000
C	A	8	5,000	7	7,000
D	B	6	4,000	5	5,000
E	C	7	3,000	6	6,000
F	C	4	6,000	3	7,000
G	D, E, F	4	7,000	3	9,000

Q4.

A manual assembly line is to be designed to make a small consumer product. The work elements, their times, and precedence constraints are given in the table below. The workers will operate the line for 420 min per day and must produce 300 products per day. A mechanized belt, moving at a speed of 1.25 m/min, will transport the products between stations. Previous experience suggests that the up time efficiency for the line will be 95%, and repositioning time lost per cycle will be 0.03 min.

a) Determine the theoretical minimum number of workers on the line. **[2]**

b) Balance the line using the rank positional weight method and calculate its efficiency. **[8]**

Element	Time (Min.)	Preceded by	Element	Time	Preceded by
1	0.4	-	6	0.2	3
2	0.7	1	7	0.3	4
3	0.5	1	8	0.9	4, 9
4	0.8	2	9	0.3	5, 6
5	1.0	2, 3	10	0.5	7, 8

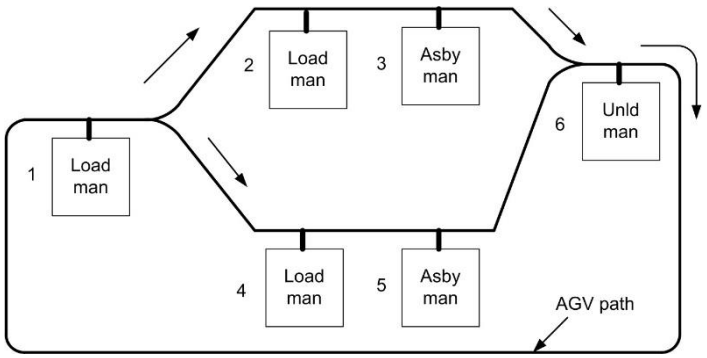
Q5.

A rail guided vehicle (RGV) system is being planned as part of an assembly cell. The system consists of two parallel lines, as shown in Figure. In operation, a base part is loaded at station I and delivered to either station 2 or 4, where components are added to the base part. The RGV then goes to either station 3 or 5, respectively, where further assembly of components is accomplished. From stations 3 or 5, the product moves to station 6 for removal from the system. Vehicles remain with the products as they move through the station sequence; thus, there is no loading and unloading of parts at stations 2, 3, 4, and 5. After unloading parts at station 6, the vehicles then travel empty back to station 1 for reloading. The hourly moves (parts/hr) and distances (ft, below the slash) are listed in the table below. RGV speed = 150 ft/min. Assembly cycle times at stations 2 and 3 = 4.0 min each and at stations 4 and 5 = 6.0 min each. Load and unload times at stations 1 and 6, respectively, are each 0.75 min. Traffic factor = 1.0, Availability =1.0. Determine

a) Cycle time, T_c **[4]**

b) Hourly delivery rate per vehicle, R_{dv} **[4]**

c) Number of RGVs required to operate the system **[4]**



	To	1	2	3	4	5	6
From	**1**	0/0	13L/100	-	9L/80	-	-
	2	-	0/0	13L/30	-	-	-
	3	-	-	0/0	-	-	13L/50
	4	-	-	-	0/0	9L/30	
	5	-	-	-	-	0/0	9L/70
	6	22E/300	-	-	-	-	0/0

****