

O7- Mec-B4, Integrated Manufacturing Systems

3 hours duration

Notes:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK exam. Any non-communicating calculator is permitted.
3. Any five (5) questions constitute a complete paper. Only the first five (5) questions as they appear in your answer book will be marked.
4. All questions are of equal value.
5. Some questions require an answer in essay format. Clarity and organization of the answer are important.

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1. a) Previous experience shows that the mean time between failures of a radar set is 240 hours. Assuming a constant failure rate, what is the chance of running the set for 24 hours without failure?
- b) The following reliability requirements have been set on the subsystems of a communication system:

Subsystem	Reliability (for a 4 hour period)
Receiver	0.970
Control System	0.989
Power Supply	0.995
Antenna	0.996

What is the expected reliability of the overall system if the above requirements are met?

2. A company is considering whether to overhaul or replace a machine. The machine was purchased four years ago and was overhauled two years ago. A new machine costs \$2000.00 and an overhaul costs \$500.00 and lasts two years. Experience indicates that annual operating costs increase with time owing to increased maintenance charges. Table 1 shows operating costs for new and overhauled machines.

Table 1

Year	New Machine	First Overhaul	Second Overhaul	Third Overhaul	Fourth Overhaul
1	\$1,000	\$1,100	\$1,300	\$1,700	\$2,300
2	\$1,100	\$1,300	\$1,700	\$2,300	\$3,200

Analyze the situation and indicate what decision should be made. Assume that machines have no salvage value at any time and that the cost of capital is 15 percent per year.

3. A manufacturing concern has four departments, and the flow between combinations of departments is as follows:

From	To			
	A	B	C	D
A		2		2
B	2		4	
C		3		1
D	2		1	

- a) Using the operation sequence analysis technique, how should the departments be arranged?

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b) Now suppose that the area requirements are as follows:

Department A – 3600 sq. ft.

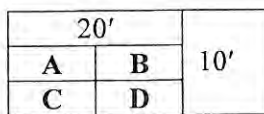
Department B – 2400 sq. ft.

Department C – 2400 sq. ft.

Department D – 1600 sq. ft.

Sketch the block diagram based on your answer in part a.

4. A small service organization has four departments arranged as shown in the figure below, on the left, with interdepartmental distances based on the centre of departments A,B,C and D. The number of trips between departments during a typical work week is given on the right. The department sizes are appropriate, and the cost of a trip is primarily a function of distance. What do you think of the present layout? Would you suggest any changes?



Number of Trips

	A	B	C	D
A	-	25	15	20
B		-	20	10
C			-	5
D				-

5. For the next week, the work centre capacities are as follows:

Work Centre	A	B	C	D
Capacity (hours available)	70	45	60	55

The following jobs have been loaded on the work centres:

Hours Required per Work Centre				
Job Number	A	B	C	D
10	5	6	4	2
12	6	2	-	4
14	2	6	2	2
15	7	8	4	-
16	4	-	6	2
17	8	5	2	3
18	14	11	9	5
19	3	9	4	-
20	6	-	5	7

Is sufficient capacity available to perform all of the jobs? Are any work centres overloaded?

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6. The Green Manufacturing Company has leased facilities to manufacture a new product. The following data have been formulated from cost to market studies:

Estimated annual sales	24,000 units
Estimated costs:	
Materials	\$96,000
Direct Labour	14,400
Overhead	24,000
Administrative Expenses	28,000

Selling expenses are expected to be 15% of sales. The required profit is \$1.02 per unit.

- a) What should the selling price be per unit?
 - b) What is the breakeven point in dollars and units if overhead and administrative expenses are fixed but other costs are variable?
- 7.
- a. What are some of the objectives of materials handling?
 - b. What should an effective inventory control system accomplish? What vital areas should be considered in developing a comprehensive control system?
 - c. List some factors which influence the selection of a forecasting model.