

THE UNIVERSITY OF ADELAIDE
DEPARTMENT OF MECHANICAL ENGINEERING
EXAMINATION FOR THE DEGREE OF BACHELOR OF ENGINEERING
NOVEMBER 1999
MANUFACTURING ENGINEERING 2 [7915]

TIME: THREE HOURS

[In addition, candidates are allowed 10 mins before the examination begins, to read the paper.]

Answer ALL Questions

[Candidates are allowed to refer to notes & books. Electronic calculators may be used.]

1.1 Given below are two years of monthly demand data for an item:

Month	Year 1	Year 2
January	75	74
February	78	81
March	81	97
April	92	105
May	108	114
June	116	120
July	110	102
August	108	111
September	92	95
October	87	86
November	78	75
December	72	77

Calculate the 3-month and the 6-month moving averages for the data.

Do the series of data show seasonal variation?

[12 Marks]

1.2 Types of layout performance criteria are listed below:

customer convenience, sales, communications, material handling and safety, capital investment, flexibility, atmosphere, organisational structure, flexibility, labour productivity, maintenance, work environment and employee attitudes.

From this list choose THREE criteria that you consider to be most important in the following four settings:

- | | |
|-----------------|----------------------------|
| (a) Bank | (b) Law Firm |
| (c) Parking Lot | (d) Small Metal Fabricator |

[8 Marks]

Please see next page.

2.1 List the process characteristics of the **job-shop** and the **dedicated production line** with respect to the following manufacturing aspects:

Equipment; Production Rate; Production Quantity; Plant Layout; Labour Skill; Part Variety.

Give **THREE** examples of products that are suitable for each of these **two** types of production processes.

[8 Marks]

2.2 The Big Bang Appliance Company is installing a line to produce a vacuum cleaner and you, as the operations manager, are responsible for designing the line. The line has to produce 480 units per day, and the company operates two 8-hour shifts each day. The work elements, time requirements, and immediate predecessor(s) are as follows:

Work Element	Time (sec)	Immediate Predecessor
A	55	-
B	45	A
C	25	B
D	20	B
E	40	B
F	50	D
G	70	D
H	45	F, G
I	20	E
J	80	H, I

- (a) What is the theoretical number of work stations?
 (b) If the line is balanced using the longest work-element time rule, what is the % balance delay?

[12 Marks]

3.1 What is a manufacturing cell or “cellular manufacturing”?

[4 Marks]

3.2 What is group technology? With respect to group technology discuss the methodology(s) for forming “part families”.

[12 Marks]

3.3 Why is decentralisation important in modern manufacturing systems design?

Outline the key questions in manufacturing systems design.

Explain why an effective manufacturing system is a flexible one.

Identify controllable and uncontrollable inputs and their effects on manufacturing systems.

[4 Marks]

4. A small high tech electronics company using highly skilled personnel is making special computer plugs in modules and requires an aggregate production plan for the six months from January through June. Determine the cost of each of the production strategies given the following information:

1. Chase strategy - vary the workforce assuming a starting workforce of 10. [6 Marks]
2. Constant workforce strategy - vary inventory and stockouts only with a workforce of 10. [7 marks]
3. Level workforce of 10 strategy - vary overtime only; inventory carry over is permitted. [7 Marks]

Data:

	Jan	Feb	March	April	May	June
Demand Data						
Beginning Inventory	0					
Forecast Demand	300	600	650	800	900	800

Cost Data:

Holding Cost	\$10/unit/month
Stockout Cost	\$20/unit/month
Subcontracting Cost/Unit	\$100
Hiring Cost/Worker	\$50
Layoff Cost/worker	\$100
Labour Cost/Hr (normal time)	\$12.50
Labour Cost/Hr. (overtime)	\$18.50

Production Data:

Labour Hrs./Unit	4
Normal work day (Hrs.)	8
Workdays /Month	22
Current Workforce	10

5. The Acme computer company needs to determine the set-up and carrying costs of its inventory by analysing the cost to determine the most economic method when using the following:

1. lot for lot,

[6 Marks]

2. economic batch quantity, and

[7 Marks]

3. part period balancing.

[7 Marks]

The gross requirements are known for the next ten weeks and the company will use these figures and the set-up and carrying cost to determine the best method to use based on this period. Which is the lowest cost method?

Data:

Holding cost: \$1.00/unit/week
 Set-up cost: \$100
 Lead time: 1 week

Period	1	2	3	4	5	6	7	8	9	10
Gross Requirements	35	30	40	0	10	40	30	0	30	55
Scheduled Receipts										
Projected on Hand	35									
Net Requirements										
Planned Order Receipts										
Planned Order Releases										

Tables similar to the above will be an aid to your calculations.