

2002 National Exams

Mec-B5

PRODUCTION PLANNING AND MANUFACTURING

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. Any non-communicating calculator is permitted. This is an Open Book exam. Note to candidates you must indicate the type of calculator being used, i.e., write the name and model designation of the calculator, on the first inside left hand sheet, of the exam work book.
3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
4. All questions are of equal value.

1. The historical demand for a product is: January, 80; February, 100; March, 60; April, 80; and May, 90.
 - a) Using a simple four-month moving average, what is the forecast for June? If June experienced a demand of 100, what would your forecast be for July?
 - b) Using a single exponential smoothing with $\alpha = 0.20$, if the forecast for January had been 70, compute what the exponentially smoothed forecast would have been for the remaining months through June.
 - c) Using least squares regression analysis, compute a forecast for June, July, and August.
 - d) Using a weighted moving average with weights of 0.30, 0.25, 0.20, 0.15, and 0.10, what is June's forecast?

2.
 - a) The cost of producing between 1,500 units and 2,500 units of a product consists of \$25,000 fixed cost and \$10-per-unit variable cost. With the selling price at \$20 per unit, what is the break-even point? Suppose the price per unit was increased to \$25. How does this affect the break-even point?
 - b) A new machine has a cost of \$24,000, an estimated economic life of eight years, and a salvage value of \$4,000 at the end of the eight-year period. Assume that the annual operating costs will be \$3,000 per year and the going rate of interest is 10 percent. What is the present value of new expenditures for the machine?

3. An electronics firm has just won a contract to manufacture two products (A and B) for the government. The firm has three major departments - design, manufacture, and test. The design department has finished its work, and now it is up to manufacturing to actually start production.

The contract stipulates that 1,000 A's and 2000 B's must be made over the next 30 working days. It is management's objective to produce the product on straight time (i.e., an eight-hour work day). Other data about the case are as follows.

Standard time per unit A	20 hours
Standard time per unit B	5 hours
Set-up time per unit A	3 hours
Set-up time per unit B	2 hours
Number of batches	1 for A and 1 for B
Standard set-up time per batch A	16 hours
Standard set-up time per batch B	10 hours
Organizational efficiency including operator productivity	80%

- a) How many workers are required to complete the project on time?
- b) Halfway through the project, the government asks if you can add another 300 A's to the contract. Assume that you can react instantaneously by pulling workers off other projects. (This will entail a separate batch of A.) For this remaining 15 days, how many additional workers are required?

4. The following tasks must be performed on an assembly line in the sequence and times specified below.

Task	Task time (seconds)	Task which must precede
A.....	50	
B.....	40	
C.....	20	A
D.....	45	A, C
E.....	20	A, C
F.....	25	A, C, D
G.....	10	A, C, E
H.....	35	A, B, C, D, E, F

- a) Draw the schematic diagram.
- b) What is the theoretical minimum number of stations required to meet a forecasted demand of 400 units per eight-hour day?
- c) Select a balancing rule and balance the line in the minimum number of stations to produce 400 units per day.
- 5
- a) What are the three basic controllable variables of a production planning problem? What are the four major costs?
- b) Distinguish between pure and mixed strategies in production planning.
- c) How does Search Decision Rule method work?
- d) What are the general conditions for which preventive maintenance is appropriate?
6. The requirements for a motor drive unit to be assembled into a dictating machine follow the assembly schedule for the completed unit. The assembly schedule requires motor drive units with the timing shown in Table 1. Other data for the motor drive unit are: average requirements are $\bar{R} = 116.7$ units per week, $c_p = \$400$ per lot, and $c_H = \$4$ per unit per week. What is the inventory record and total incremental cost under each of the following lot size policies?
- a) Economic lot size
- b) Economic periodic reorder model
- c) Part-period total cost balancing

Table 1
Requirements Schedule for a Motor Drive Unit

Week number	1	2	3	4	5	6	7	8	9	10	11	12
Requirements, units	25	30	75	125	200	325	400	100	0	100	0	10
Total requirements for 12 weeks, 1390 units.												

7. 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, and an overhaul costs \$500 and lasts two years. Experience indicates that annual operating costs increase with time owing to increased maintenance charges. Table 2 shows operating costs for new and overhauled machines.

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.

Table 2
Operating Costs

Year	New Machine	First Overhaul	Second Overhaul	Third Overhaul	Fourth Overhaul
1	\$1000	\$1100	\$1300	\$1700	\$2300
2	\$1100	\$1300	\$1700	\$2300	\$3200

8. A time study was made of an existing job to develop new time standards. A worker was observed for a period of 45 minutes. During that period, 30 units were produced. The analyst rated the worker as performing at a 90 percent performance rate. Allowances in the firm for rest and personal time are 12 percent.
- What is the normal time for the task?
 - What is the standard time for the task?
 - If the worker produced 300 units in an eight-hour day, what would his/her day's pay be if the basic rate was \$6.00 per hour and the premium payment system paid on a 100 percent basis?