OLLSCOIL NA h-ÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA h-OLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER 2001

B.E. DEGREE (ELECTRICAL)

PRODUCTION MANAGEMENT (ME4001)

Prof. J. O'Connor
Prof. R. Yacamini,
Dr S.M. De Almeida

3 HOURS

The use of approved electronic calculators is permitted.

Attempt **FIVE** Questions.

1. Discuss briefly the different types of layout of facilities in a factory giving the advantages of each type and the situations where they should be used.

Describe very briefly the Flexible Manufacturing Systems approach in modern factories.

2. Explain the terms "depreciation" and "capital allowance".

Two machines A and B which can produce a particular part but with different capacities and costs are being considered for purchase. Using a BE chart or otherwise determine which course of action should be taken, when the demand for the part is 40,000 per year. An interest rate of 15% and the production time per machine of 2,500 hrs per year is to be assumed. Assume also a tax rate of 40% and a capital allowance of 100% is given in the year of purchase. Sketch the BE chart for that situation and determine the cost per item.

	MACHINE A	**MACHINE B**
Capital Costs	£50,000	£125,000
Estimated Life	5 years	8 years
Salvage Value	$10,000	£10,000
Production Rate	5 Items per hr.	15 items per hr.
Annual Maintenance Costs	£5,000	£6,000
Operating Costs	£10 per hr.	£15 per hr.
Book value at end of life	0	0

3. (a) What is understood by Producer's Risk and Consumer's Risk?

Determine the Producer's Risk and Consumer's Risk using the Poisson distribution for the following conditions:

Acceptable Quality Level = 2%
Lot Tolerance Percentage Defective = 6%
Batch Size = 10,000
Sample Size = 100

Acceptable Criterion: "accept the batch if the number of defects is ≤2".

(b) Explain the use of allowable drift in control charts and its consequence.

The following were observed when sampling was carried out on the output from a manufacturing process.

Sample No.	1	2	3	4	5
Sample Size	50	48	52	53	51
No. of Defects Found	0	1	2	1	2

Plot the data on a control chart and comment on the results.

4. Explain briefly as to how cost control can be effected when the duration of a project is to be shortened.

Determine the following in respect of the net work diagram shown.

(i) the 'early start', 'late finish' and the total float for each of each of the activities.

(ii) the critical path

(iii) the probability of completing the project 2 days ahead of schedule.

If the project is to be shortened by four weeks which of the activities should be shortened and give reasons.

Activity	**Mean Expected duration (days)**	**Standard Deviation**	**Crash Cost per Day (£)**
A	4	1	100
B	18	2	100
C	4	.5	125
D	6	.75	125
E	20	1.25	80
F	8	1.0	100
G	24	2	80
H	22	1.5	80
I	2	.25	200
J	5	1.0	125
K	20	1.5	80

5. (a) Two products A and B are to be manufactured using processes P_1, P_2 and P_3. The time required to manufacture an item of A and B in each process is given in the table. The total available production capacity of each process is also shown.

The profit per item of A and B are £4.00 and £5.00 respectively. Determine the quantities of A and B that should be manufactured to optimise profit and the unused capacities of the processes.

	Time Requirement per item (mins)		Capacity in minutes
Process	A	B	
P_1	10	8	30,000
P_2	10	25	40,000
P_3	15	6	30,000

(b) The manufacture of a third product C is being considered. The processing time for this product in the processes P_1, P_2 and P_3 are 20 minutes, 8 minutes, and 5 minutes respectively while the available capacities and other data remain the same as in (a). The profit from each unit of C is £6.00.

Formulate the linear programme model for this problem and complete the first iteration (only) towards finding a solution to maximise profit.

6. Describe briefly the differences and the areas of application of statistical inventory management and MRP systems.

A firm manufactures a component, which is consumed in its factory. The average demand for the component is 1000 per week with a standard deviation of £250. The items are produced in batches with a production rate of 10,000 per week. Determine the optimum batch size to be produced and the average cost per item. Derive any formulae you may use.

Manufactured cost of a compound	=	£15.00
Holding cost	=	26% per year of the first cost
Set up costs	=	£1,000.00

Determine also the production range when the variable costs (holding and set-up costs) are allowed to vary by 10% of its minimum value.

What is the re-order level and the safety stock to be maintained to give a service level of 99%? Assume that the order to manufacture is issued when the stock level falls to its re-order level and that a time of 3 weeks is required between the issue of order and the start of production.

7. (a) Describe briefly a typical failure rate curve for a batch of components. In the system shown the reliability of each component can be described by –

$$R_i(t) = e^{-\lambda i.t}$$

Determine the system reliability after 250 hours of operation.

$$\lambda_A = \lambda_C = 0.1 \text{ per } 1000 \text{ hrs}$$
$$\lambda_B = \lambda_D = 0.15 \text{ per } 1000 \text{ hrs}$$

(Assume D is a redundant component doing the same function as C)

If the system reliability can also be approximated by the above equation determine the MTBF of the system.

(b) Describe the application of 'TAGUCHI' methods to quality control.