OLLSCOIL NA hÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

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B.E. Degree (ELECTRICAL)

ENGINEERING MANAGEMENT (ME4001)

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Attempt FIVE Questions

The use of the approved electronic calculator is permitted

3 Hours

Questions follow overleaf/…

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

   Describe briefly the FMS approach in modern factories.

2. Describe the differences and the areas of application of statistical inventory management and MRP systems. The mean demand for a component is 1,000 per week with a standard duration of 200 per week.

   If the items are manufactured in batches with a production rate of 5,000 per week, determine the optimum batch size to be produced. Prove any formulae you may use.

Cost of item	=	€20.00
Holding costs	=	26% per year of the first cost
Set up costs	=	€800.00

   Determine the reorder level and the safety stock required to give a service level of 95%. Assume that the lead time between the issue of order (at ROL) and the start of production is 4 weeks.

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

3. (a) Explain briefly the techniques used in statistical quality control giving situations where there are used.

   (b) The characteristics of a particular single acceptance sampling plan are as follows:

AQL	=	2%
LTPD	=	4%
Sample size	=	150
Batch size	=	2,000
Acceptance criterion:	=	"accept the batch if the number of defects is less than or equal to 3"

Question continued overleaf/…

Determine the producer's risk and the consumer's risk using

(1) the Poisson distribution
(2) Thorndike chart

(c) Draw the control chart for the following data:

Mean sample size	=	145
Number of samples taken	=	8
Total number of defects found in all samples	=	23

4. (a) Explain the terms "capital allowance" and "depreciation".

An investment of €250,000 on new equipment is expected to yield a cost reduction of €40,000 per year. Determine whether the investment meets a 15% yield criterion after tax, if the equipment is to be discontinued after 5 years and sold for €150,000.

Assume

Taxation	=	40%
Depreciation	=	straight line to zero book value over 10 years
Capital Allowcance	=	depreciation charge per year to be treated as the capital allowance per year.

(b) A component can be manufactured using two available processes. Determine which of the processes should be used and the total cost per day when the demand is 1500 items per day. Sketch the BE chart for the situation.

	Process I	**Process II**
Fixed cost per day	€100	€200
Variable cost per item	€1.50	€1.25
Capacity of the process	600 items/day	1000 items/day

5. Explain briefly as to how costs can be controlled when the duration of a project is shortened.

   For the net work shown determine the following:

   (1) Early start, late finish and the float for each activity.
   (2) Critical path or paths.
   (3) Probability of completing the project 2 weeks ahead of schedule.
   (4) The minimum size of workforce required to carry out the project on schedule assuming that the workers can carry out all tasks.

Activity	**Mean Duration (wks)**	**Standard Deviation (wks)**	**Resource Requirements (Man wks)**
A	2	.5	16
B	3	.7	3
C	4	.9	12
D	5	1.0	10
E	6	1.0	12
F	3	.5	12
G	5	.5	30
H	7	1.0	35
I	4	.75	32
J	3	.25	12

Q. 6 overleaf/…

6. The products X and Y are assembled using sub-assemblies A_1, A_2, A_3 and A_4. The requirements of the sub-assemblies in the manufacture of X and Y and the total available are as shown in the table. The profit from each of X and Y is €22.50 and €20 respectively. If a minimum profit of €3000 is expected, determine graphically or otherwise the quantities of X and Y to be manufactured so that:

(a) the total profit is a maximum
(b) the total number of items produced is a maximum
(c) the total number of items produced is a minimum

		A_1	A_2	A_3	A_4
Number of Sub-Assemblies required	X	1	-	2	2
	Y	1	2	1	-
Total Availability		200	300	300	250

7. (a) What is understood by the following terms

bath-tub curve, reliability, failure density function, failure rate and MTBF.

Determine the reliability of the two systems shown after 1500 hrs of operation. Reliability of each component is given by $e^{-\lambda_i t}$, and the reliability of the pair of stand-by components is given by

$$e^{-\lambda_A t}.(1+\lambda_A.t)$$

where

λ_A = 0.2 per 10000 hrs
λ_B = 0.05 per 1000 hrs
λ_C = 0.1 per 2000 hrs

What is the expected number of hours that the system will be operating in a year? (Assume a 40 hour week).

Q.7 (b) overleaf/…

(b) (i) An item has a specification 100 ± 4 ohms. The items produced through a process gave a mean value of 101 with a standard deviation of 2 ohms. Determine the number of items expected to fall outside the specifications in a batch of 1000.

(ii) The probability density function of the life of an optical component is given by $\frac{1}{4}e^{-x/a}$

where x is in years and a = 4 years.

What is the probability that a component will last up to 4 years?