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

COLAISTE NA hOLLSCOIL, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATIONS, 2004

B.E. DEGREE (ELECTRICAL)

Engineering Management
ME4001

Professor J. Monaghan
Professor P.J. Murphy
Dr. S.M. De Almeida

Time allowed: *3 hours*

Answer *five* questions.

All questions carry equal marks.

The use of a Casio fx570w or fx570ms calculator is permitted.

1.(a) Two machines capable of producing particular component are being considered for purchase. Using the data given below, determine the annual production quantity when both the machines appear equally economical. 15% interest rate is to be used to calculate the annual costs.

	M/C 1	M/C 2
Purchase Cost	€50,000	€80,000
Salvage Value	€5,000	€10,000
Expected Life	5 years	7 years
Production Rate (components per hour)	3 per hr	5 per hr
Cost of operation of M/C per hour	€8.00 per hr	€6.00 per hr
Annual maintenance cost	€1,000	€1,500
Raw material cost per component	€2.00	€2.00

(b) When the annual demand is twice the above BE quantity and the machine which is more economical at the level of output is used, a pre-tax profit of €15,000 per year can be achieved. Determine whether a 15% yield criterion can be met under the following conditions. The depreciation is "straight line" to zero book value over the life of the machine. The depreciation charge can be treated as a capital allowance. A tax rate of 25% is applicable.

2. What are the main differences between statistical inventory management and MRP systems.

In a factory the production rate of an item is 1,000 items per day while the internal demand is 1,000 per week. The cost of a manufactured item is €10 and the set up cost is €850.00 while the annual carrying cost is 26%. If the manufacturing batch size is to be multiples of daily production quantity, determine the optimum batch size.

If the demand is variable with a standard deviation of 100 items/week and a lead time of 3 weeks (from the reorder point to the start of production) determine the minimum safety stock to be maintained to give a service level of 97%.

Derive any formulae you may use and assume a 5 day working week.

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

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

(b) Explain the use of allowable drift in control charts and its consequence in relation to "TAGUCHI method of quality control".

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

Sample No.	1	2	3	4	5	6
Sample Size.	50	48	52	53	51	50
No. of Defects Found	1	1	2	2	2	1

4. The components X and Y are manufactured using 3 machines A, B and C. The processing time (in minutes) for each component on each machine is given in the table.

The profit from each component X and Y are £10 and £15 respectively.

Determine the maximum profit that can be generated during a 40 hour week and the unused capacities on the machines.

5. (a) What is understood by the following terms: bath-tub curve, reliability, failure density function, failure rate and MTBF.
The failure density function of a component is shown in the figure below. Calculate the reliability function R(t) and the failure rate $\lambda(t)$ for the component and sketch the two curves. Calculate also the MTBF of this component.

(b) A firm is to set the guarantee period of an electrical component. The component is to be replaced if it fails during the guarantee period. The components have a mean life of 7,500 hrs and are normally distributed with a standard deviation of 250 hrs. Determine the number of hours that should be guaranteed so that the total number of returns is less than 1.0% of the components sold.

What is the estimated cost of the guarantee per 1,000 items sold if the Guarantee period is set at 6,500 hrs. and the average cost per item replaced is €30.00

6. (a) For the net work shown, determine the following:

Early start, late finish, the float for each activity, critical path or paths and the Probability of completing the project 2 weeks ahead of schedule.

Activity	Mean Duration (Wks)	Std. Deviation (Wks)
A	3	1
B	4	1
C	7	2
D	7	1
E	5	1
F	10	2
G	12	2.5
H	3	1

(b) In the network below, the capacity of the arcs are as indicated s_1 and s_2 are the sources and N is the sink. Determine, using the "Maximal flow algorithm" the flow in each arc and the maximum flow to the sink.

7. What is understood by "working study" ? Give a brief account of its methods and applications in industrial environments.