THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

BACHELOR OF TECHNOLOGY – LEVEL 4

FINAL EXAMINATION – 2009/2010

MEX4235 – PRODUCTION MANAGEMENT

DATE : *MARCH 26, 2010*

TIME : *1400 HRS. – 1700 HRS.*

DURATION : *THREE HOURS*

ANSWER ANY FIVE (05) QUESTIONS. *ALL QUESTIONS CARRY EQUAL MARKS.*

Question 01

Write short notes on any **four (04)** of the following.

(i) Process layout and product layout. Use relevant examples of such layouts appropriately.

(ii) Group Technology and its benefits.

(iii) Preventive maintenance and breakdown maintenance with their advantages.

(iv) Computer-based systems that support the "today's factories".

(v) Ergonomic considerations involved in modern industry. Quote suitable examples to elucidate your answer.

(vi) Management accounting and cost accounting.

Question 02

A ceramic product manufacturer requires expanding his business to meet the growing demand for his products. The company has ordered new automated manufacturing facility and this requires un-interrupted power supply for 24 hours operation. The management of the company decides to have its own power generation plant.

The activity sequence of the power plant erection project is as follows;

- Plant design activity precedes selection of the site, and the selection of generator as well as the recruitment of personnel.
- Site selection activity precedes site preparation.
- Generator manufacturer selection activity precedes generator manufacturing and preparation of operation manual.
- Operation manual preparation and personnel recruitment activities can occur concurrently, but both must be completed before operator training.
- Site preparation and generator manufacture precede generator installation.
- Generator installation and operator training occur concurrently, but these should be completed in order to obtain the license from the relevant authorities.

The time estimate for completing each activity is given in Table.Q2.

Activity	Time estimates (week)
Plant design	12
Site selection	12
Generator manufacturer selection	04
Personnel recruitment	03
Site Preparation	13
Generator manufacture	20
Operation manual preparation	05
Generator installation	04
Operator training	09
Licensing	07

Table.Q2

(i) Construct a network diagram for the total project showing precedence relationships.

(ii) Determine the critical path and expected project completion time.

(iii) Draw the time scale diagram.

Question 03

(i) In production management activities, **marginal costing** is used as a managerial tool in decision-making. Explain briefly how it is used.

(ii) Describe the **Breakeven point** and **margin of safety** within the context of production management activities.

(iii) A modern office furniture manufacturing company produces four main items, namely computer tables (CT), computer chairs (CC), office lockers (OL) and book shelves (BS), where the product combination is as shown in Table.Q3. Production is carried out using metal and fiber product manufacturing machines and the finishing operations require skilled labour. The fixed cost of the company is Rs.200,000.

Product	CT	CC	OL	BS
Sales volume (units)	1000	2500	1500	2000
Selling Price (Rs./unit)	100	150	200	250
Marginal Cost (Rs./unit)	50	80	75	100
Direct Labor (hrs/unit)	20	35	35	40
Direct Material (kg/unit)	10	10	20	30

Table.Q3

(a) Assuming that there is no constraint on labour and material, and considering that the normal conditions determine the product on which the company should concentrate more to achieve higher profits.

(b) If the direct skilled labour is in short supply, on what product should the company concentrate?

(c) If direct material is the constraint, what is the product on which the company should concentrate?

(d) Draw the profit-volume graph to represent the above information and determine the breakeven point.

Question 04

(i) Distinguish the **time study** and **activity sampling**.

(ii) Explain why it is more beneficial in breaking down jobs into constituent elements for a time study exercise and state the basic rules involved in selecting work elements.

(iii) Discuss the term **rating the element** clearly indicating the relationship and associated details of observation time, basic time and standard time.

(iv) Comment on the statement **to achieve the maximum efficiency, the man-machine system must be designed/considered as an integral part.**

Question 05

(i) State the main recording techniques commonly used in method study and explain each of them stating the salient features.

(ii) Figure.Q5 shows exploded view of a hand-torch. It consists of six parts namely, *1.* Light cover, *2.* Light, *3.* Light holder, *4.* Main body housing, *5.* Switch and *6.* Back cap. Assume the sub-parts of Light cover and Back cap are already assembled. It is required to assemble the torch in large numbers.

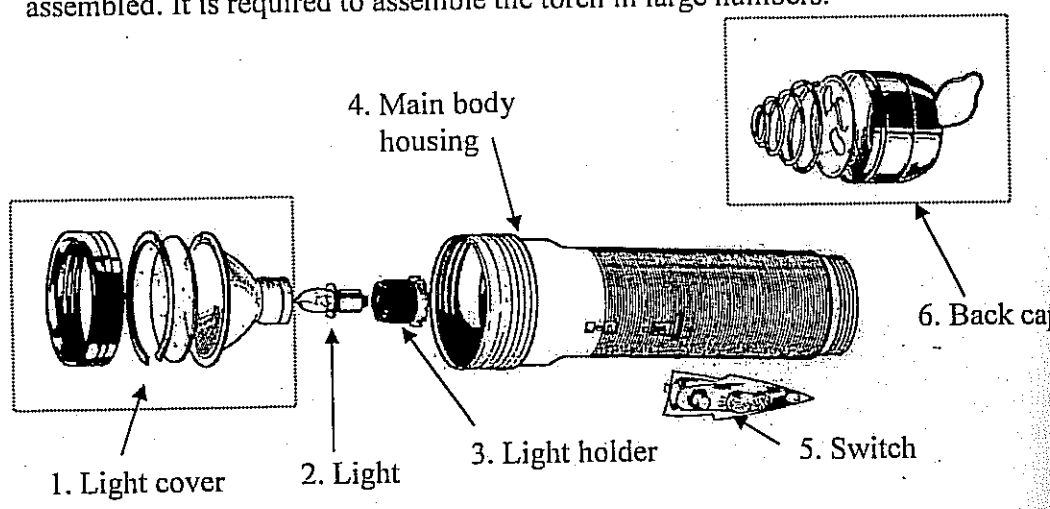


Figure.Q5

(a) Draw a suitable layout for the assembly operation. Assume that each part and final assembly is placed in separate bins, which are placed on a semi-circular table, the mean radius of which does not exceed 60*cm*. Also, the assembly takes place at the central area of the table whilst the operator is seated at the centre of the circle.

(b) Draw the two-handed process chart for the assembly considering the layout you suggest. Use worksheet provided with the question paper.

Question 06

(i) Distinguish **quality assurance** and **quality control.**

(ii) The best selling item of Four Star Apparel Company is men's short-sleeve shirts. The production process requires the material to be cut into large patterned squares by operators, which are then sewn together at another stage of the process. The length of a cloth square should be 36*cm*. If the squares are not of a correct length, the final shirt will be either too large or too small. In order to monitor the cutting process, the quality control department takes a sample of four squares of cloth every hour and measures the length. Table.Q6 gives data recorded for 10 such batches.

Sample	Measurements (cm)			
1	37.3	36.5	38.2	36.1
2	33.4	35.8	37.9	36.2
3	341	34.8	37.1	35.3
4	36.1	37.2	36.7	34.2
5	35.1	38.6	37.2	35.6
6	34.4	34.5	36.7	36.0
7	38.1	37.2	35.3	35.7
8	35.4	36.2	36.3	34.3
9	37.1	39.4	38.1	36.2
10	32.1	34.0	35.6	36.1

Table.Q6

(a) Setup the mean and range charts in order to check the stability of the cutting process.

(b) Comment on the stability of the process.

Note: You may use following data, if necessary.

Sample Size (n)	Constant (d_n)	Factors (m) for Warning Limits = $1.96 / (d_n \sqrt{n})$	Factors (m) for Action Limits = $3.09/(d_n \sqrt{n})$
2	1.128	1.23	1.94
3	1.693	0.67	1.05
4	2.059	0.48	0.75
5	2.236	0.38	0.59
6	2.334	0.32	0.50
7	2.704	0.27	0.43
8	2.847	0.24	0.38

Control limits : $\overline{X} \pm m\overline{W}$
FACTORS IN MEAN CONTROL CHARTS

Sample Size (n)	Factor (R)			
	For Warning Limit		For Action Limits	
	Upper	Lower	Upper	Lower
2	2.81	0.04	4.12	0.00
3	2.17	0.18	2.98	0.04
4	1.93	0.29	2.57	0.10
5	1.81	0.37	2.34	0.16
6	1.72	0.42	2.21	0.21
7	1.66	0.46	2.11	0.26
8	1.62	0.50	2.04	0.29

Control limits : multiply W by R
FACTORS IN RANGE CONTROL CHARTS

Question 07

(i) List the important factors to be considered in describing a Job Shop Scheduling (JSS) exercise.

(ii) Which of the above factors could be categorized as either static or dynamic?

(iii) XYZ company has received five jobs simultaneously. Each job has to be processed on two machines P and Q in the same order (first on machine P and then Q). The processing times required by each job are as given Table.Q7.

Job No.	Processing Time (Hrs)	
	On Machine P	On Machine Q
1	10	05
2	04	08
3	06	02
4	04	07
5	06	12

Table.Q7

(a) Schedule the five jobs using Johnson's algorithm in order to minimize the total through-put time of all jobs.

(b) Show the above results on a Gantt-chart and determine the total through-put time.

(c) What is the waiting time of Job No.4 for the machine Q?

(d) Comment on the total machine idle time in your schedule.

Question 08

(i) State the objectives of **capacity management**. Explain the situations where the production manager is not prepared to adjust the system capacity with the demand level fluctuation.

(ii) What is meant by **capacity smoothing** in capacity planning? Distinguish differences in capacity smoothing techniques.

(iii) A fertilizer manufacturing company has three plants P, Q and R, and three warehouses X, Y and Z located in distinct areas. Daily production capacities of plants are 9, 15 and 6 metric tons per day, whilst the daily requirements to warehouses are 10, 12 and 8 tons respectively. Transportation costs in thousand Rupees from plants to warehouses are given in Table.Q8.

Find the optimal transportation allocation for minimum transport cost.

From \ To	X	Y	Z
P	10	20	12
Q	16	20	14
R	20	14	12

Table.Q8

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Note: Work sheet for question no. 5

LEFT HAND	O	⇨	▽	D	O	⇨	▽	D	RIGHT HAND

Two-Handed Process Chart