The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX6240 Industrial Engineering** / ᴍᴇx 6ᴤ4ᴏ
Academic Year	:	2015/16
Date	:	10.12.2016
Time	:	0930-1230 hrs
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 08 questions. All questions carry equal marks.
3. Answer any 05 questions only.
4. **You must attach MRP sheets to your answer book**

Q1. A project has activities from A to G as shown in the table given below. The Preceding activities, Normal duration, crash duration, normal cost and crash cost for each activity are also given.

Activity	Preceding Activity	Normal duration(days)	Crash duration(days)	Normal cost (Rs)	Crash cost(Rs)
A	-	7	5	500	900
B	A	4	2	400	600
C	A	5	5	500	500
D	A	6	4	800	1000
E	B,C	7	4	700	1000
F	C,D	5	2	800	1400
G	E,F	6	4	800	1600

(a) Name two common scheduling techniques known to you.

(b) What are the main differences of PERT and CPM?

(c) Draw the Activity On Arrow (AOA) diagram using the data given in the Table above.

(d) Find the Critical Path of the project

(e) Find the project duration.

(f) Find Earliest Start time (EST) and Latest Finishing time(LFT) of each activity.

(g) How many days can be delayed in activities B, D and F without affecting the project completion time?

(h) What is the total cost of the project if it is competed in normal duration?

(i) If project is completed in 20 days, what is the percentage increase of the cost?

Q2. a) What is the objective of Method Study?

b) When selecting a job for method study, what are the important factors that you have to take in to account?

c) What is the purpose of carrying out work measurement?

d) How are the results of work measurement used to improve the productivity of a production system?

e) A bolt needs to be machined on a lathe machine. First it needs to be turned up to required diameter and then make threads on it. The time taken for each operation for 6 samples have been recorded as follows;

No	Job Element	Cycles observed (minute)						Performance Rating (%)
		1	2	3	4	5	6	
1	Holding the work	2	3	3	2	4	7	112
2	Setting tools	3	2	4	8	3	4	119
3	Turning the bolt	3	4	5	4	5	3	115
4	Cutting thread	5	3	4	3	5	3	120

If the allowance factor for this job is 13%

      i.   Compute the normal time for the entire process

      ii. Compute the standard time for the job

Q3.   a)   What are the benefits of MRP?

      b)   What are the elements of the MRP system?

Product X is made of two units of Y and three units of Z. Y is made of two units of A and two units of B. Z is made of two units of A and three units of C.

Lead times are as given below:

Product	X	Y	Z	A	B	C
Lead Time(Weeks)	1	2	4	2	1	3

c) Draw the Product structure tree (BOM)
d) If 100 units of X are needed in week ten (10), develop a Material Requirement Plan
    (i)   when there are currently zero on hand stock
    (ii)   when there are currently on hand in stock 20X, 40Y, 30Z, 50A,100B and 500C.

(Use the MRP sheets (Page 6 &7) to answer this question. You must attach these two sheets to your answer book before you handover it)

Q4.

a) What is the key principle of lean operations?

b) If you introduce lean manufacturing to your organization what could you achieve?

c) Define the term Just in Time (JIT)?

d) Explain the main difference between Traditional approach and JIT approach in any product or service organization?

e) What is Push system and Pull system and where is the Pull system applied

Q5.

    a)   What is Enterprise Resource Planning (ERP)?

    b)   How does ERP system work?

    c)   What are the main components of ERP system?

    d)   Give main reasons to go for an ERP system.

    e)   What are the hidden costs of an ERP system?

    f)   What are the benefits of a ERP system?

    g)   Give major risks in implementing an ERP system.

    h)   What are the four (04) main ERP implementing phases?

Q6.   a)   Transportation problems can be solved using different methods. Name three of them.

    b)   There are 03 factories located at Galle, Kandy and Kurunegala and four distribution centers at Kaluthara, Colombo, Negambo, and Gampaha. Supply from 03 factories are 5000, 6000 and 9000 units respectively and the demand in 04 distribution centres are 7000, 5500,4500 and 3000 units respectively. Transportation cost distribution is given below in Rs.

Location	Kaluthara	Colombo	Negambo	Gampaha
Galle	100	80	70	120
Kandy	120	130	60	100
Kurunegala	80	100	120	140

    (i)   Is this an unbalanced transportation problem? If not why?

    (ii)   Find the transportation schedule using the least cost method.

    (iii)   Use MODI method to find the optimum transportation schedule.

    (iv)   What is the total minimum transportation cost?

Q7. (a) For what purpose linear programming tool is sued?

(b) What are the basic elements of a linear programing model?

(c) What is the importance of Linear programming?

(d) What are the limitations of graphical method?

(e) A furniture manufacture makes chairs and tables. The available resources, amount of wood needed for a one unit, maximum possible amount of resources and the profit from one unit of products are given in the Table below.

Resources	Amount needed for a unit		Maximum amount of resources available
	Table	Chair	
Wood (m^3)	30	20	300
Labour (hrs)	5	10	110
Profit per unit (Rs)	600	800	

(i)   Determine and define the decision variables

(ii)   Formulate the objective function

(iii)   Formulate each constrains

(iv)   Find the number of Tables and Chairs manufactured to maximize the profit using the simplex method.

Q8   a)   Describe "Kanban" and explain the importance of Kanban for any organization.

c)   Why is TPS important for an organization?

d)   What are the seven wastes defined by TPS?

e)   What kind of a role can Supply Chain Management play in an organization which operates in worldwide?

e)   Describe five basic components of Supply Chain Management.

Item		Week									
		1	2	3	4	5	6	7	8	9	10
X (LT=1)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
Y (LT=2)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
Z (LT=4)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
A (LT=2)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
B (LT=1)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
C (LT=3)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										

Item		Week									
		1	2	3	4	5	6	7	8	9	10
X (LT=1)	Gross Requirement										
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Y (LT=2)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
Z (LT=4)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
A (LT=2)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
B (LT=1)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										
C (LT=3)	Gross Requirement										
	On Hand ( )										
	Net Requirement										
	Planned Order receipts										
	Planned Order release										