Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAM
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	PRODUCTION CONTROL
COURSE CODE	:	BBM 40402
PROGRAMME CODE	:	BBA / BBD
EXAM DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS EXAM PAPER CONTAINS **ELEVEN (11)** PAGES INCLUSIVE OF COVER

Q1 (a) Name four (4) functional areas of an integrated manufacturing system.

(4 marks)

(b) Explain the flextime policy and compressed work week policy in work scheduling.

(6 marks)

(c) An industrial engineer at an automotive plant wishes to determine the standard time for vehicle front seat assembly process for their new electric car. The assembly process for front seats of each car is done by two operators: one operator for left seat assembly and another operator for right seat assembly. Using time study approach, and assuming car seats are assembled simultaneously by the two operators, the engineer has summarized his findings for 5 cycles of assembly process in Table Q1(c).

Table Q1(c): Time Analysis for Door Assembly (Time in Seconds)

No.	Work Elements	Cycle				
		1	2	3	4	5
1	Seat holding and jig fixture	32	33	33	33	32
2	Seat alignment	43	42	42	42	44
3	Bolt assembly	35	36	34	35	36

(i) Assume that work element 1 and 2 have 115% performance rating and work element 3 have 105% performance rating, calculate the standard time for the whole assembly operations if allowance factor is 14%.

(7 marks)

(ii) With assumptions that the company works on 2 shifts daily (8 hours per shift) and 26 working days per month, estimate roughly the number of cars that can be assembled with completed front seat assembly per month.

(4 marks)

(iii) Estimate the salary of a front seat assembly worker per shift if the cost for this assembly process per car is RM 0.50 using your estimation in Q1(ii).

(4 marks)

Q2 (a) Explain two (2) features of a good facility layout planning.

(4 marks)

(b) Explain two (2) types of inventory costing with examples.

(6 marks)

(c) The assembly process of an automotive dashboard sub-assembled is as presented in Table Q2(b) below:

Table Q2(b): Assembly Line Process

Task	Follower	Performance Time (minutes)
A	-	0.3
B	A	0.3
C	-	0.9
D	C	0.7
E	B	0.4
F	D,E	1.1
G	F	0.5
H	G	0.4

(i) Draw a precedence diagram for this operation.

(4 marks)

(ii) Assuming 8 hours of working per day, and daily production of 300 units of automotive dashboard sub-assembly, calculate the cycle time.

(3 marks)

(iii) Calculate the theoretical minimum number of workstations.

(3 marks)

(iv) Balance the assembly line by assigning tasks into workstations. Determine the overall efficiency of this balanced assembly line.

(5 marks)

Q3 (a) Describe two (2) implications of ISO standards implementation.

(4 marks)

(b) Elaborate the following total quality management concepts using a simple or illustrated example with explanations.

(i) Continuous improvement

(3 marks)

(ii) Taguchi Loss Function

(3 marks)

(c) A quality engineer is monitoring the performance of 20 assembly lines of a power controller chip using remote monitoring technology. The performance for each assembly line (measured using defects per 1,000 products) for a particular day is summarised as in Table Q3(c).

Table Q3(c): Defects Per Assembly Line

Line No.	Defects	Line No.	Defects
1	7	11	17
2	5	12	9
3	20	13	14
4	10	14	4
5	11	15	9
6	8	16	8
7	12	17	12
8	9	18	4
9	6	19	6
10	13	20	16

(i) Determine the upper control limit (UCL) and lower control limit (LCL) for a 99.73% (3-sigma) confidence level.

(4 marks)

(ii) Plot a simple 3-sigma *p*-chart using information from Q3(c)(i) on graph paper.

(8 marks)

(iii) Determine the assembly line(s) with unacceptable defect rates (if any) and provide evaluation on what should be done with the problematic assembly line(s).

(3 marks)

Q4 (a) Explain the key differences between Material Requirement Planning (MRP) and MRP II.

(4 marks)

(b) An electrical appliance company has designed a new ceiling fan called "Sepoi S1" for budget-concerned home users. The product structure is as shown in Figure Q4(b) with numbers of components or subassemblies indicated. Lead time for each component is as shown in Table Q4(b).

Table Q4(b): Lead Time for Components

Lead Component	Lead Time (weeks)
Sepoi S1 (Ceiling Fan)	2
Blades	1
Fastener Set	1
Motor Sub-Assembly	2
Fan Motor	3
Fan Control Unit	2

(i) A production engineer is assigned to ensure that 500 units of the ceiling fan are ready in week 8. Generate the gross material requirements for this demand.

(6 marks)

(ii) After a stock check, the engineer found that there are 300 units of blades, 400 units of fastener sets and 50 units of motor sub-assemblies. In order to meet 500 units of "Sepoi S1" demand in week 8, generate the net material requirements with consideration of current stock availability (*note: use the Net Requirement Planning Sheet on page 11 and attach to answer sheet*).

(6 marks)

(c) Three jobs A, B, and C need to be processed by a lathe machine and a grinding machine. Every job is done by lathe machine followed by a grinding machine as shown in Table Q4(c).

Table Q4(c): Job Tasks for Machining Center

Job	Lathe Machine	Grinding Machine
A	2	5
B	8	8
C	6	12

(i) By using Johnson's rule, determine the best process sequence.

(3 marks)

(ii) Sketch the sequence of two machines and determine the idling time.

(6 marks)

-END OF QUESTIONS-

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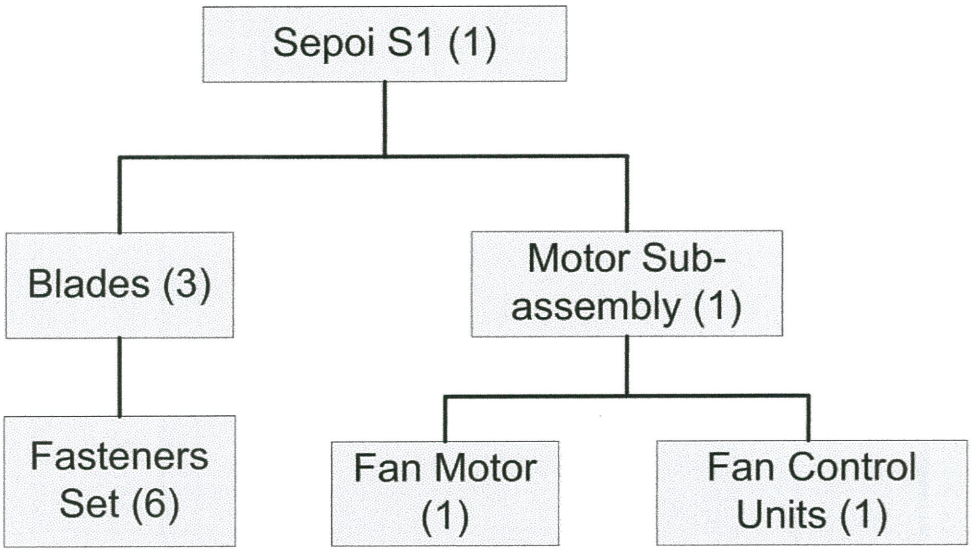

FIGURE Q4(b)

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LIST OF FORMULA

Time Studies

Average observed time = (sum of times recorded) / number of observations

Normal time = (average observed time) x (performance rating factor)

Standard time = (total normal time) / (1 – allowance factor)

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}}$$

$$n = \left(\frac{zs}{h\bar{x}}\right)^2$$

n = Required sample size
z = number of standard deviations required for desired level of confidence (from table)
s = standard deviation of the initial sample
$\bar{x}$ = mean of sample size
h = accuracy level desired in percent of the job element, expressed as decimal (5% = .05)

$$n = \frac{z^2 p(1-p)}{h^2}$$

n = Required sample size
z = number of standard deviations required for desired level of confidence (from table)
p = estimated value of sample proportion (of time worker is observed busy or idle)
h = acceptable error level, in percentage decimals (5% = .05)

Process Layout Analysis

$$minimize\ cost = \sum_{i=1}^{n}\sum_{j=1}^{n} X_{ij}C_{ij}$$

$n = total\ number\ of\ work\ centers\ or\ depts$

$i, j = individual\ departments$

$X_{ij} = number\ of\ loads\ moved\ from\ dept.i\ to\ dept.j$

$C_{ij} = cost\ to\ move\ a\ load\ between\ dept.i\ and\ dept.j$

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LIST OF FORMULA

Assembly Line Balancing

Cycle Time = Production time available per day / units required per day

$$minimum\ workstations = \frac{\sum_{i=1}^{n} T_i}{cycle\ time}$$

$$Efficiency = \frac{\sum Task\ times}{(actual\ number\ of\ workstations) \times (Largest\ assigned\ cycle\ time)}$$

Inventory Control

$$EOQ = \sqrt{\frac{2DS}{H}}$$

Total Cost = Carrying costs + Ordering Costs + Puchase Costs

$$TC = \frac{QH}{2} + \frac{DS}{Q} + PD$$

D = Demand, S = Ordering Cost, H = Holding Cost, Q = units per order

Statistical Process Control: Mean Chart

Upper Control Limit (UCL) = $\bar{x} + z\sigma_{\bar{x}}$
Lower Control Limit (LCL) = $\bar{x} - z\sigma_{\bar{x}}$

$\bar{x}$ = mean of the sample means or a target value set for the process
z = number of normal standard deviations (2 for 95.45%, 3 for 99.73%)
$\sigma_{\bar{x}}$ = standard deviation of the sample means = $\frac{\sigma}{\sqrt{n}}$
σ = population (process) standard deviation
n = sample size

Statistical Process Control: *p*- Chart

$$\sigma_{\hat{p}} = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$$

$$UCL_p = \bar{p} + z\sigma_{\hat{p}}$$

$$LCL_p = \bar{p} - z\sigma_{\hat{p}}$$

$\bar{p}$ = mean fraction defective in sample
z = number of standard deviations (2 for 95.45%, 3 for 99.73%)
$\sigma_{\hat{p}}$ = standard deviation of the sampling distribution

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LIST OF FORMULA

Job Sequencing

Average completion time = Sum of total flow time / Number of jobs

Utilization metric = Total job work (Processing Time) / Sum of total flow time

Average number of jobs in the system = Sum of total flow time / Total job work (processing) time

Average job lateness = Total late days / Number of jobs

Critical Ratio (CR) = Time Remaining / Worksdays Remaining = (Due date – Today's Due) / Work time remaining

Just-In-Time Inventory & Scheduling

$$Q^* = \sqrt{\frac{2DS}{H[1-(d/p)]}}$$

D = Annual Demand, S = Setup Cost, H = Holding Cost, d = Daily demand, p = Daily production

Number of Kanbans = (Demand during lead time + Safety Stock) / Size of container

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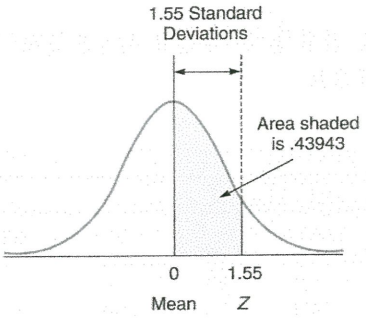
NORMAL DISTRIBUTION TABLE



As an alternative to Table I.1, the numbers in Table I.2 represent the proportion of the total area away from the mean, μ, to one side. For example, the area between the mean and a point that is 1.55 standard deviations to its right is .43943.

TABLE I.2

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.00000	.00399	.00798	.01197	.01595	.01994	.02392	.02790	.03188	.03586
0.1	.03983	.04380	.04776	.05172	.05567	.05962	.06356	.06749	.07142	.07535
0.2	.07926	.08317	.08706	.09095	.09483	.09871	.10257	.10642	.11026	.11409
0.3	.11791	.12172	.12552	.12930	.13307	.13683	.14058	.14431	.14803	.15173
0.4	.15542	.15910	.16276	.16640	.17003	.17364	.17724	.18082	.18439	.18793
0.5	.19146	.19497	.19847	.20194	.20540	.20884	.21226	.21566	.21904	.22240
0.6	.22575	.22907	.23237	.23565	.23891	.24215	.24537	.24857	.25175	.25490
0.7	.25804	.26115	.26424	.26730	.27035	.27337	.27637	.27935	.28230	.28524
0.8	.28814	.29103	.29389	.29673	.29955	.30234	.30511	.30785	.31057	.31327
0.9	.31594	.31859	.32121	.32381	.32639	.32894	.33147	.33398	.33646	.33891
1.0	.34134	.34375	.34614	.34850	.35083	.35314	.35543	.35769	.35993	.36214
1.1	.36433	.36650	.36864	.37076	.37286	.37493	.37698	.37900	.38100	.38298
1.2	.38493	.38686	.38877	.39065	.39251	.39435	.39617	.39796	.39973	.40147
1.3	.40320	.40490	.40658	.40824	.40988	.41149	.41309	.41466	.41621	.41174
1.4	.41924	.42073	.42220	.42364	.42507	.42647	.42786	.42922	.43056	.43189
1.5	.43319	.43448	.43574	.43699	.43822	.43943	.44062	.44179	.44295	.44408
1.6	.44520	.44630	.44738	.44845	.44950	.45053	.45154	.45254	.45352	.45449
1.7	.45543	.45637	.45728	.45818	.45907	.45994	.46080	.46164	.46246	.46327
1.8	.46407	.46485	.46562	.46638	.46712	.46784	.46856	.46926	.46995	.47062
1.9	.47128	.47193	.47257	.47320	.47381	.47441	.47500	.47558	.47615	.47670
2.0	.47725	.47778	.47831	.47882	.47932	.47982	.48030	.48077	.48124	.48169
2.1	.48214	.48257	.48300	.48341	.48382	.48422	.48461	.48500	.48537	.48574
2.2	.48610	.48645	.48679	.48713	.48745	.48778	.48809	.48840	.48870	.48899
2.3	.48928	.48956	.48983	.49010	.49036	.49061	.49086	.49111	.49134	.49158
2.4	.49180	.49202	.49224	.49245	.49266	.49286	.49305	.49324	.49343	.49361
2.5	.49379	.49396	.49413	.49430	.49446	.49461	.49477	.49492	.49506	.49520
2.6	.49534	.49547	.49560	.49573	.49585	.49598	.49609	.49621	.49632	.49643
2.7	.49653	.49664	.49674	.49683	.49693	.49702	.49711	.49720	.49728	.49736
2.8	.49744	.49752	.49760	.49767	.49774	.49781	.49788	.49795	.49801	.49807
2.9	.49813	.49819	.49825	.49831	.49836	.49841	.49846	.49851	.49856	.49861
3.0	.49865	.49869	.49874	.49878	.49882	.49886	.49889	.49893	.49897	.49900
3.1	.49903	.49906	.49910	.49913	.49916	.49918	.49921	.49924	.49926	.49929

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Net Requirement Planning Sheets

Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
	Scheduled Receipts												
	Projected on Hand												
	Net Requirements												
	Planned Order Receipts												
	Planned Order Releases												

Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
	Scheduled Receipts												
	Projected on Hand												
	Net Requirements												
	Planned Order Receipts												
	Planned Order Releases												

Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
	Scheduled Receipts												
	Projected on Hand												
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Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
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Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
	Scheduled Receipts												
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	Net Requirements												
	Planned Order Receipts												
	Planned Order Releases												

Item		Period (Week, Day)											
		1	2	3	4	5	6	7	8	9	10	11	12
	Gross Requirement												
	Scheduled Receipts												
	Projected on Hand												
	Net Requirements												
	Planned Order Receipts												
	Planned Order Releases												

*Pencil written answers are acceptable on this sheet.