NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelor of Engineering Honours Degree Industrial & Manufacturing Engineering

Manufacturing Systems – TIE 3212

2nd SEMESTER EXAMINATIONS AUGUST 2009

Time allowed*: 3 hours*
Instructions: *Answer ANY FOUR (4) questions from section A and The question in Section B*

Question 1

(a) Outline three tangible and three intangible benefits of implementing Group Technology. [6]

(b) Give three differences between the monocode and the polycode coding systems. [4]

(c) Consider the parts summarized in Table 1. The shop is a flow shop.

(i) Find a lower bound on make span [5]

(ii) Generate a permutation schedule using Campbell's procedure [5]

Table 1: Flow shop processing times

	Machine			
Job	A	B	C	D
1	1	4	2	5
2	4	2	9	11
3	1	6	8	3
4	3	4	2	2
5	7	1	1	5

Question 2

Consider the 10-part, 12-machine data of Table Q2. Find the natural grouping s of parts and machines using the Binary ordering Algorithm [20]

Table Q2

Part	**Sequence of Machines Visited**
1	10, 7, 8, 9
2	1, 3, 5, 4, 4, 10
3	6, 12, 2
4	4, 11, 3
5	6, 4, 3, 1
6	9, 8, 7, 12
7	6, 4, 1, 10
8	5, 4, 3, 10
9	10, 9, 8
10	7, 10, 9, 8, 12

Question 3

a) Given eight jobs to be produced on a single milling machine with data Shown in Table 3.1

Table 3.1: Processing time and Due dates

Job I	1	2	3	4	5	6	7	8
Processing time p_I	10	9	2	24	13	1	3	5
Due Date d_i	40	34	8	12	65	42	29	51

i) Schedule the lathe to minimise average flow time [1]

ii) Find the average flow time and maximum tardiness for the schedule Obtained in (i) above [4]

iii) Schedule the lathe to minimise maximum tardiness [1]

iv) Find the average flow time and maximum tardiness for the schedule obtained in (ii) [4]

b) Given that the processing times for the jobs given in Table 3.1 on the polishing machine is as shown in Table 3.2

Table 3.2: Processing time on Polishing machine

Job	1	2	3	4	5	6	7	8
Processing time	13	2.5	2	8	12	10	2.8	9

i) Using Johnson's Algorithm find the sequence for the jobs in the whole Plant (milling and polishing machine) with an aim to minimizing makes span [4]

ii) Find the make span of the jobs for sequence 1,2,3,4,5,6,7,8 [6]

Question 4

Given that NIMESS has eight jobs with the following information given in Table 1.1

Table 4.1: Orders in NIMESS

Job	Processing Times	Due dates
1	13.4	52
2	2.4	24
3	1.8	38
4	7.9	51
5	12.3	47
6	10.5	70
7	2.4	71
8	8.1	72

i. Schedule the jobs to minimise average flow time [1]
ii. Find the average flow time for schedule obtained in (i)above [2]
iii. Schedule the jobs to minimise maximum lateness. [1]
iv. Find the maximum lateness for the schedule in (iii)above [2]

a) Schedule to minimise make span the jobs given in Table 1.2 below [2]

Table 4.2

Job	Welding	Painting
1	4	2
2	5	3
3	12	1
4	8	7
5	6	5
6	4	1
7	8	4

b) Find the make span for job sequence 3,4,2,1. [6]

Table 4.3 Flow shop processing times

	Machine			
Job	1	2	3	4
1	2.0	1.5	2.0	3.5
2	4.5	2.5	1.0	3.0
3	1.5	5.0	0.5	1.5
4	4.0	2.5	0.5	1.0

c) What are six major factors to be considered in selecting a coding scheme? [6]

Question 5

Six jobs are waiting at a milling station. Job data are provided in Table 5 below. Current queue lengths at inspection, grinding, turning, and drilling are 12.0 hours, 4.5 hours, 3.9 hours and 0.0 hours, respectively. However, on the average each station requires a 5-hour wait. Find the corresponding sequence for the following dispatching rules. The current is 20:

(a) SPT [2]

(b) RANDOM [2]

(c) EDD [2]

(d) LTWR [2]

(e) LTWK [2]

(f) MOPNR [2]

(g) MWKR [2]

(h) WINQ [2]

(i) MWKR [2]

(j) S/RO [2]

Table 5: Available Milling jobs

				Operation (machine, pij)		
Job	Arrival to system	Arrival at mill	Due date	1	2	3
1	10	10	30	(Mill, 5)	(Turn, 3)	(Drill, 5)
2	0	0	20	(Mill, 3)	(Grind, 4)	(Inspect, 1)
3	5	12	35	(Drill, 4)	(Mill, 6)	-
4	7	18	26	(Turn, 3)	(Mill, 7)	(Inspect, 3)
5	12	12	45	(Mill, 10)	(Grind, 4)	(Inspect, 3)

Question 6

(a) Describe the following terms used in Group technology:

(i) Design attributes [4]

(ii) Part Manufacturing features. [4]

(b) Explain five structural issues considered in cell design. [5]

(c) A part design is shown in Figure 6.1 below. Develop a form code using the Optiz system. [5]

(d) Describe the family of parts with an optuz form code of 12532 [2]

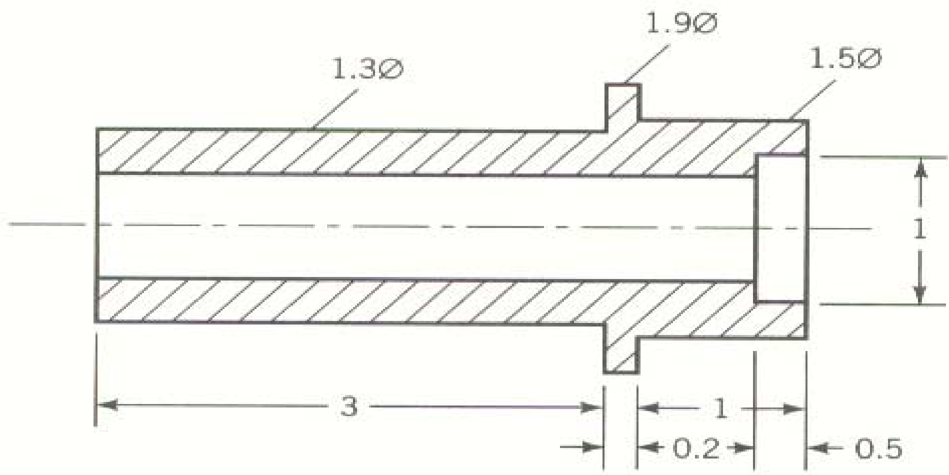

Figure 6.1

SECTION B

Question 7

Table 7 below shows a Machine- Part Matrix

	Part							
Machine	1	2	3	4	5	6	7	8
A	1	1	1		1	1	1	
B		1	1	1	1			1
C		1	1		1			1
D	1		1	1		1	1	

(a) Table 7 above illustrates a machine/part matrix for a toy manufacturing plant.
Use the similarity coefficients method to develop natural manufacturing cells. [4]

(b) Draw the dendogram for the manufacturing cells in (a) [3]

(c) Which cell configuration is the best considering that the total cost of inter cell movements, C1 = \$1.20 and the total cost of intracell movement C2 = \$1.50 [7]

(d) Give 3 benefits of cell based manufacturing over the traditional approaches? [6]

END OF EXAM