## 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

## SUPPLEMENTARY EXAMINATIONS OCTOBER 2009

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

### **QUESTION 1**

Table 1 illustrates a machine/part matrix for a toy manufacturing plant. Use the similaritycoefficients method to develop natural manufacturing cells.[14]

	Part							
Machine	1	2	3	4	5	6	7	8
A	1	1	1		1	1	1	
В		1	1	1	1			1
С		1	1		1			1
D	1		1	1		1	1	

 Table 1
 Machine- Part Matrix

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

### **QUESTION 2**

Table 2.1 shows the machine-part matrix for a specific job shop. You are required to form<br/>manufacturing cells with the aid of Binary ordering Algorithm.[20]Table 2.1: Part/Machine matrix

	Part							
Machine	1	2	3	4	5	6	7	8
A	1	1			1			
В			1					1
С		1	1			1	1	
D				1				1
E			1	1		1	1	
F								
G	1	1			1			

#### **QUESTION 3**

a) Given eight jobs to be produced on a single milling machine with data

shown in Table 3.1

Job I	1	2	3	4	5	6	7	8
Processing	10	9	2	24	13	1	3	5
time p <sub>I</sub>								
Due Date d <sub>i</sub>	40	34	8	12	65	42	29	51
				~				

Table 3.1: Processing time and Due dates

- 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) [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	13	2.5	2	8	12	10	2.8	9

i) Using Johnson's Algorithm find the sequence for the jobs in the wholePlant (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**

Consider the set of jobs and processing times shown in Table 4.1

- (a) Generate the schedule assuming jobs are processed in the order {2, 4, 1, 3). Calculate the make span for this sequence. [10]
- (b) Is this the best make span for the jobs? Justify using some calculations [10]

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

Table 4.1: Flowshop Processing times

### **QUESTION 5**

Current time is 10. Machine B has just finished a job and it is time to select its next job. Table 5.1 provides information on the four jobs available. For each of the dispatching rules, determine the corresponding sequence.

(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 5.1: Available Milling jobs

			Operation (machine, p <sub>ij</sub> )			
	Arrival to					
Job	System	Arrival at B	Due Date	1	2	3
1	10	10	30	(B,5)	(A,1)	(D,6)
2	0	5	20	(A,5)	(B,3)	(C,2)
3	0	9	10	(C,3)	(D,2)	(B,2)
4	0	8	25	(E,6)	(B,4)	(C,4)

### **QUESTION 6**

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

(i) Design attributes	[4]
	E 4 1

- (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]

[2]

(d) Describe the family of parts with an Optiz form code of 53213



#### Figure 6.1

## **SECTION B**

#### **QUESTION 7**

- (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 7.1. 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 7.1 : Flow shop processing times

	Machine						
Job	А	В	С	D			
1	2	5	1	4			
2	9	11	4	2			
3	8	3	1	6			
4	2	2	3	4			
5	1	5	7	1			

#### END OF EXAM