UNIVERSITY
OF
JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : INDUSTRIAL*
SUBJECT	:	**MECHANICAL MANUFACTURING ENGINEERING III**
CODE	:	**IMV321**
		Main Examination
DATE	:	14 NOVEMBER 2017
DURATION	:	12:30 - 3:30
TOTAL MARKS	:	100
ASSESSOR	:	Dr. KAPIL GUPTA
MODERATOR	:	MR. NKWANYANA NTOKOZO CRISE
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS:

A Calculator of any make or model is permitted

REQUIREMENTS:

NIL

INSTRUCTIONS TO STUDENTS

1. Read the questions carefully.
2. All questions are compulsory.
3. Show all calculations.
4. Number your answers strictly according to the questions.
5. Sketch the block diagrams wherever required.

QUESTION 1 **[20 Marks]**

1a. Name six typical products that are made by manual assembly. [3]
1b. Write a note on CNC Machining Centre. [5]
1c. What are the various types of Mechanized Work Transport? Briefly explain. [6]
1d. Discuss three cases of product variety in manufacturing systems. [6]

QUESTION 2 **[20 Marks]**

2a. The required production rate = 50 units per hour for a certain product whose assembly work content time = 1.2 hours. It is to be produced on a production line that includes four workstations that are automated. Because the automated stations are not completely reliable, the line will have an expected uptime efficiency = 90%. The remaining manual stations will each have one worker. It is anticipated that 8% of the cycle time will be lost due to repositioning at the bottleneck station. If the balance delay is expected to be 0.07. Determine:

(a) the cycle time, [2]

(b) number of workers, [4]

(c) number of workstations needed for the line, [2]

(d) average manning level on the line, including the automated stations, and [2]

(e) labor efficiency on the line. [2]

2b. What are the various components of a manufacturing system? Provide a detailed classification of production machines. [8]

QUESTION 3 **[20 Marks]**

3a. What are the benefits of Automated Production Lines? [4]
3b. What are the important reasons of using Storage Buffers in production lines? [4]
3c. Write short note on the following: [12]

(i) Walking Beam Transfer System
(ii) Vibratory Bowl Feeder
(iii) Dial Indexing Machine
(iv) Storage Buffers

QUESTION 4 **[20 Marks]**

4a. A single model assembly line is being planned to produce a consumer appliance at the rate of 200,000 units per year. The line will be operated 8 hours per shift, two shifts per day, five days per week, 50 weeks per year. Work content time = 35.0 min. For planning purposes, it is anticipated that the proportion uptime on the line will be 95%. Determine:

(a) average hourly production rate, [2]

(b) cycle time, [2]

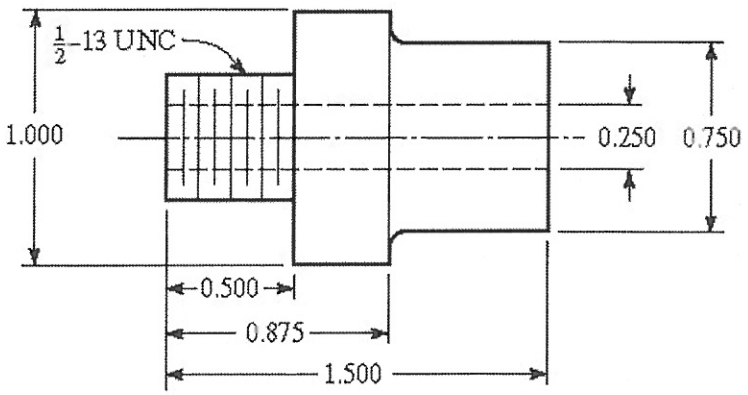
(c) theoretical minimum number of workers required on the line, [2]

(d) if the balance efficiency is 0.93 and the repositioning time = 6 sec, how many workers will actually be required? [4]

4b. Apply the rank order clustering technique to the part-machine incidence matrix in the following table to identify logical part families and machine groups. Parts are identified by letters, and machines are identified numerically. [5]

	Parts								
Machines	A	B	C	D	E	F	G	H	I
1	1								1
2		1					1		
3			1		1			1	
4		1				1	1		
5			1					1	
6						1	1		
7	1			1					
8			1		1				

4c. Develop the form code (first five digits) in the Opitz System (with the help of chart) for the part illustrated in Figure below [5]



Digit 1		Digit 2			Digit 3			Digit 4	Digit 5		
Part class		External shape, external shape elements			Internal shape, internal shape elements			Plane surface machining	Auxiliary holes and gear teeth		
0	Rotational parts: L/D 0.5	0	Smooth, no shape elements		0	No hole, no breakthrough		0 No surface machining	0	No gear teeth	No auxiliary hole
1	Rotational parts: 0.5 < L/D < 3	1	Stepped to one end or smooth	No shape elements	1	Smooth or stepped to one end	No shape elements	1 Surface plane and/or curved in one direction, external	1	No gear teeth	Axial, not on pitch circle diameter
2	Rotational parts: L/D 3	2	Stepped to one end or smooth	Thread	2	Smooth or stepped to one end	Thread	2 External plane surface related by graduation around the circle	2	No gear teeth	Axial on pitch circle diameter
3	Rotational parts	3	Stepped to one end or smooth	Functional groove	3	Smooth or stepped to one end	Functional groove	3 External groove and/or slot	3	No gear teeth	Radial, not on pitch circle diameter
4	Rotational parts	4	Stepped to both ends	No shape elements	4	Stepped to both ends	No shape elements	4 External spline (polygon)	4	No gear teeth	Axial and/or radial and/or other direction
5	Rotational parts	5	Stepped to both ends	Thread	5	Stepped to both ends	Thread	5 External plane surface and/or slot, external spline	5	No gear teeth	Axial and/or radial on PCD and/or other directions
6	Rotational parts	6	Stepped to both ends	Functional groove	6	Stepped to both ends	Functional groove	6 Internal plane surface and/or slot	6	With gear teeth	Spur gear teeth
7	Nonrotational parts	7	Functional cone		7	Functional cone		7 Internal spline (polygon)	7	With gear teeth	Bevel gear teeth
8	Nonrotational parts	8	Operating thread		8	Operating thread		8 Internal and external polygon, groove and/or slot	8	With gear teeth	Other gear teeth
9	Nonrotational parts	9	All others		9	All others		9 All others	9	With gear teeth	All others

QUESTION 5 [20 Marks]

5a. Write a comprehensive note on Flexible Manufacturing System. [10]

5b. Define the terms Group Technology and Cellular Manufacturing. [4]

5c. What are the various ways to identify the part families? Explain briefly. [6]

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