

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

MECHANICAL ENGINEERING – 4TH YEAR DEGREE

FIRST SEMESTER EXAMINATIONS – 2023

ME 414 – FLEXIBLE MANUFACTURING SYSTEMS

MONDAY, 29TH MAY 2023 – 8.20 AM

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper. You **must not** begin writing during this time.
2. Answer **All** questions and you can do them in any order.
3. Use **only ink**. Do not use pencil for writing except for drawings and sketches.
4. Start each question on a new page and show all your calculations in the answer book provided. No other written material will be accepted.
5. Write your **NAME** and **NUMBER** clearly on the front page. **Do it now**.
6. Calculators are permitted in the examination room. Notes and textbooks are not allowed.

MARKING SCHEME:

Question Number 1	08
Question Number 2	08
Question Number 3	06
Question Number 4	06
Question Number 5	06
Question Number 6	06

Question number 1 Full Marks 8

Define the various aspects of FMS layout configurations with neat sketch

Question number 2 Full Marks 8

- 2 List and explain functions of various components of Flexible Manufacturing Systems with neat sketch

Question number 3 Full Marks 6

- 3 Four machines will constitute a GT cell. The from-to data for the machine are as follows.

		From			
		1	2	3	4
	1	0	5	0	25
To	2	30	0	0	15
	3	10	40	0	0
	4	10	0	0	0

- (i) Determine the sequence of machine according to/from ratio
- (ii) Construct a flow diagram
- (iii) Where do the parts enter cell and exit the cell

Question number 4 Full Marks 6

Following are the data of AGV system:

Vehicle Velocity = 45 m/min.

Average distance travelled/delivery = 135m

Pick up time = 45 sec.

Drop off time = 45sec.

Average distance traveling empty = 90 m

Traffic factor = 0.9

Determine the number of vehicles required to satisfy the delivery demand if the delivery demand is 40 deliveries per hour. Also determine the handling system efficiency.

Question number 5 Full Marks 6

You are given the following data regarding the processing some jobs on three machines I, II, and III. The order of processing is I-II-III. Determine the sequence that minimizes the total elapsed time (T) required to complete the jobs. Also evaluate T and idle time of I and II.

Jobs	I	II	III
A	3	4	6
B	8	3	7
C	7	2	5
D	4	5	11
E	9	1	5
F	8	4	6
G	7	3	12

Question number 6 Full Marks 6

A flexible manufacturing system consists of two machining workstations and a load/unload station. Station 1 is the load/unload station. Station 2 performs milling operation and consists of two servers. Station 3 has one server that performs drilling operation. The stations are connected by a part handling system that has four work carriers. The mean transport time is 3 min. The FMS produces parts A and B. The part mix fractions and process routing for the two parts are presented in the given table. The operation frequency $f_{ijk} = 1$ for all operations.

Determine (a) Maximum production rate of FMS. (b) Corresponding production rates of each product.

Part j	Part Mix P_j	Operation k	Description	Station i	Processing time t_{ijk} (min)
A	0.7	1	Load	1	4
		2	Mill	2	30
		3	Drill	3	10
		4	Unload	1	2
B	0.3	1	Load	1	4
		2	Mill	2	40
		3	Drill	3	15
		4	Unload	1	2