MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATIONS FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 314: MANUFACTURING WORK STUDY

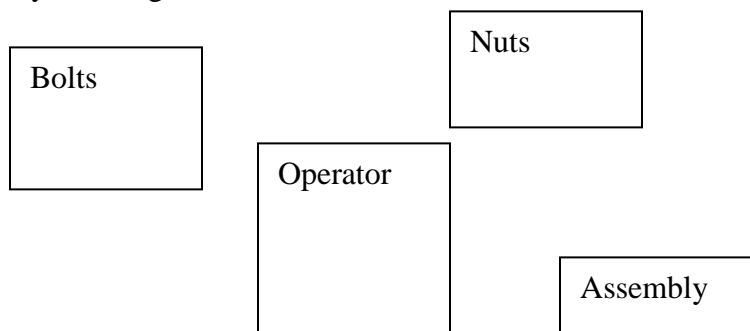DATE: TIME:

INSTRUCTIONS

> ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE- COMPULSORY

a)   An operator in mechanical workshop is tasked to assemble nuts and bolts as shown in the layout in figure 1 below

Fiq 1 work bench layout

  i.   As an Engineer, which method of study can be used under this scenario

                                                                                                                    (2 marks)
  ii.   Explain four benefits of this method   (6 marks)
  iii.   Describe the procedure that will be used in a form of a chart   (6 marks)

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b) Flow chart is one of the tool used in analyze flow movement of material, personnel or equipment in the production shop floor. Figure 2 shows original Flow-line diagram of fettling layout
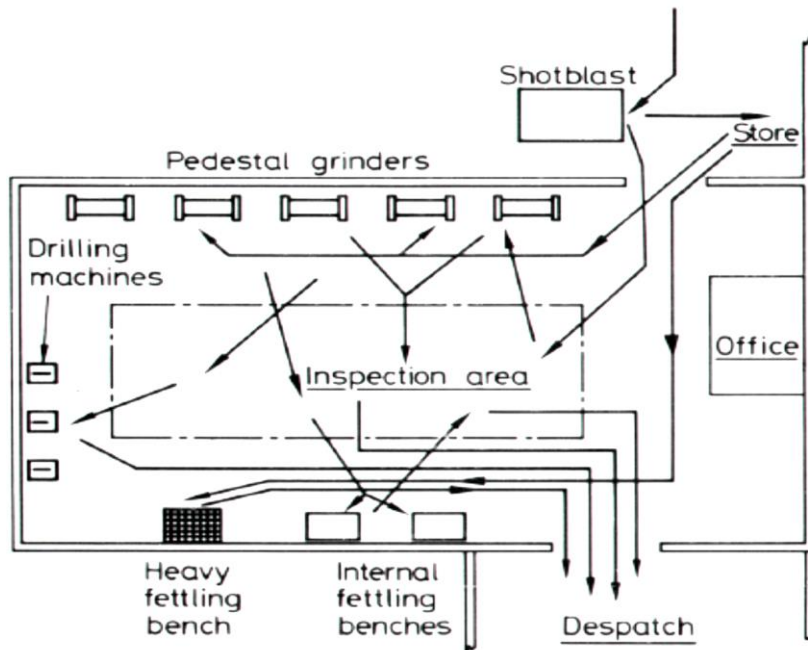
Fig. 2 Flow-line diagram of original fettling layout.

As an Engineer redesign the plant layout so as to increase productivity. (8 marks)

c) Describe any two consideration when selecting method of study (8 marks)

QUESTION TWO (20 MARKS)

a) Certain production process such as forging and casting of molten metal is carried out short duration and are repeated several number of times. A mechanical engineer has realized that productivity of the employees are going down, He decided to carry out micro motion and develop SIMO charts. Describe why he chose this over other method

(6 marks)

b) Explain five applications of pre-determined motion time study (6 marks)

c) A job has been sub-divided into five elements. The time for each element and respective rating are given table 1

Table 1; Element numbers of observed operation

Element Number	Observed Time	Rating Factor %
1	0.7	80
2	0.8	100
3	1.3	120
4	0.5	90
5	1.2	100

Calculate the normal time and standard time for each element and for the job if the allowances are15%. (8 marks)

QUESTION THREE

a) Explain the following terms
- i. Rework Allowance (2 marks)
- ii. Small Lot Allowance (2 marks)
- iii. Fatigue Allowance (2 marks)

b) An Operator is manning two machines, a washing machine and a dryer. The operator is supposed to clean clothes received from the customers. The layout is as shown in figure 3 below
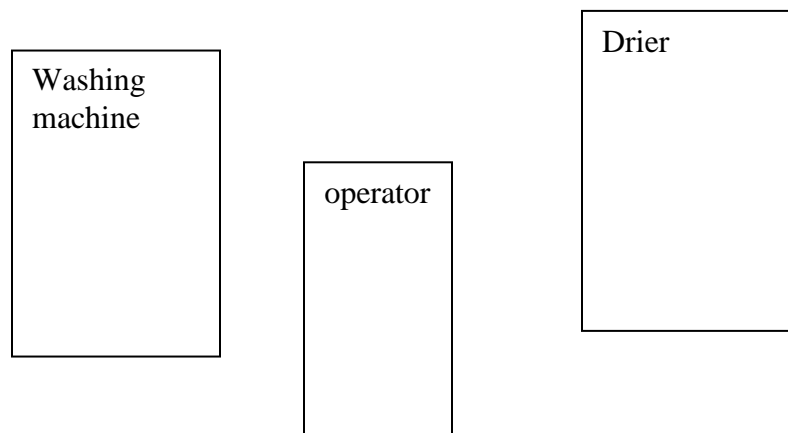
Figure 3. Operator in dry cleaner

As an Engineering student, develop a Multi activity chart for the operator so that efficiency can be improved. (6 marks)

A. For a particular task 15 observations were taken by a time study observer as shown in Table 2. Check whether the number of observations is sufficient for 5% limit of accuracy and 95% confidence level.

Table 2: work sampling

Time (x) in minutes	Frequency (f)
1	2
2	3
3	3
4	4
5	5

Determine the minimum number of observations required. (8 marks)

QUESTION FOUR (20 MARKS)

a) Explain the following
      i. Normal Performance (2 marks)
      ii. Performance Rating (2 marks)
      iii. Westinghouse System of Rating (2 marks)

b) In a welding shop, a direct time study was done on a welding operation as shown in Table 2. One inexperienced industrial engineer and one experienced industrial engineer conducted the study simultaneously. They agreed precisely on cycle time but their opinion on rating the worker differed. The experienced engineer rated the worker 100% and the other engineer rated the worker 120%. They used a 10% allowance.

Table 2 Welding cycle time

Cycle time in minutes	Number of observation
20	2
24	1
29	1
32	1

From the above statement,
    i. Determine the standard time using the experienced industrial engineer's worker rating **(3mks)**
    ii. Find the standard time using the worker rating of inexperienced industrial engineer **(3mks)**

c) A work sampling study was made of a cargo loading operation for the purpose of developing its standard time. The study was conducted for duration of minutes during which 3000, 1500 instantaneous observations were made at random intervals. The results of study indicated that the worker on the job was working 80 percent of the time and loaded 360 pieces of cargo during the study period. The work analyst rated the performance at 90 %. If the management wishes to permit a 13 % allowance for fatigue, delays and personal time, what is the standard time of this operation? (8 marks)

QUESTION FIVE (20 MARKS)

a) A Company sells hex nut and bolt assemblies. Their rather primitive assembly method is to have the operator place the bolt, head down, into the holding fixture. The operator then places the hex nut on the threaded end and manually tightens the nut. The completed assembly is then removed from the fixture and placed in the shipping barrel. Each operator is provided with two fixtures, two stockpiles of raw material, and two shipping barrels. These permit the operator to simultaneously assemble two products at one time. Develop six elements for performing the above time study (6 marks)

b) Time study is not economical in the case of long and/or irregular work cycles manufacturing process hence work sampling is the only alternative. Describe the procedures adopted for carrying out work sampling (4 marks)

c) Four workers were seeking to be employed in a workshop to operate a lathe machine. The time needed to machine a shaft was measured for all of them. First worker took 15 minutes second worker: 16 minutes while third and fourth worker took20 and 10 minutes respectively. The performance of the 1st worker is considered to be 100%.

   i. Determine the normal time of the task. (2 marks)

   ii. Compute the performance rate for all the workers based on the normal time.

         (2 marks)

   iii. Calculate the standard time if the personal time allowance is 5%, the fatigue time allowance is 7% and the delay allowance is 5%. (3 marks)

   iv. How many times will it take to repeat the task 20 times for a worker with 100% performance? (3 marks)