

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI.
COLLEGE OF ENGINEERING**

Department of Mechanical Engineering

B.Sc. Engineering, Mid- Semester Examination, 2014/2015

***Third Year, Mechanical Engineering
Third Year, Aerospace Engineering***

ME. 392 – INDUSTRIAL ENGINEERING & ERGONOMICS

26th MARCH, 2015

TIME - 1 HOUR

INDEX NUMBER: _____

PROGRAM : _____

MARKING SCHEME

***INSTRUCTIONS: CIRCLE THE CORRECT ANSWER OF QUESTIONS ON THE
QUESTION PAPER AND SHADE ON THE SCANNABLE FORM.***

1. Operations analysis, as part of methods study, deals with
 - a. analysing the layout for an operation.
 - b. checking all operations in a company to ascertain if they are correctly performed by employees.
 - c. applying the questioning attitude to a method.
 - d. **taking all operation of a method through a series of ten points of scrutiny.**
2. MTM stands for
 - a) Mean Time Measurement
 - b) Micro-Time Measurement
 - c) **Methods Time Measurement**
 - d) Manufacturing Time Measurement
3. Standard time is defined as
 - a) the time it takes a well trained worker to perform a series of tasks under ordinary conditions, allowing for rest periods, fatigue and other unavoidable delays.
 - b) **the time it takes a well trained worker to perform a task under normal conditions, allowing for rest periods, fatigue and other unavoidable delays.**
 - c) the time it takes a new worker to perform a task under ordinary conditions, allowing for rest periods, fatigue and other avoidable delays.
 - d) the time it takes a well trained worker to perform a task under normal conditions, allowing for avoidable delays.
4. As a methods engineer, what chart will you first draw if you were asked to analyse a method?
 - a. flow process chart
 - b. operator process chart
 - c. **operation process chart**
 - d. gang process chart
5. The least preferred method of establishing labour standards is
 - a) Time studies
 - b) Work sampling
 - c) **Historical times standards**
 - d) Predetermined time standards
6. In operation analysis the ten factors that are considered include
 - i. the design of the part
 - ii. the purpose of the operation
 - iii. the operator
 - iv. setup and tools
 - v. working conditions
 - a) ii, iii only
 - b) ii and iv only
 - c) i, ii, iii, iv only
 - d) **i, ii, iv and v only**
7. The stopclocks used for time studies are
 - a. continuous
 - b. snapback
 - c. electronic/digital
 - d. **all of the above**

8. *Methods analysis focuses on:*
- a. *the design of machines used to perform a task*
 - b. *how a task is accomplished***
 - c. *the raw materials that are consumed in performing a task*
 - d. *reducing the number of steps required to perform a task*
9. *Micro hand motions devised by Frank and Lillian Gilbreth are called*
- a. *flow diagrams*
 - b. *activity charts*
 - c. *therbligs***
 - d. *ergonomics*
10. *Methods Engineering is the process that*
- a. *reduces the number of steps required to perform a task*
 - b. *produces designs for new work processes*
 - c. *reduces the labour input of a job*
 - d. *continuously improves the way that methods are performed***
11. *An example of a productive foreign element in time study is*
- a. *stopping to talk to the time study technician*
 - b. *waiting for a machine to be repaired*
 - c. *waiting for material handling equipment*
 - d. *cleaning the chips out of a machine***

Read the following problem and answer questions 12 – 16

The work measurement analyst in the CanCan Company wishes to develop standard data involving fast repetitive manual motions for use in a light assembly department. Because of the shortness of the desired standard data elements, he measures them in groups as they are performed on the factory floor. He is developing standard data for five elements which will be denoted as a, b, c, d, and e. Using a fast decimal minute watch, he studied a variety of assembly and arrived at the following data:

$$a + b + c = 0.070 \text{ min.}$$

$$b + c + d = 0.067 \text{ min.}$$

$$c + d + e = 0.073 \text{ min.}$$

$$d + e + a = 0.061 \text{ min.}$$

$$e + a + b = 0.068 \text{ min.}$$

12. *Element a is _____ minutes long*
- a. *0.003*
 - b. *0.018***
 - c. *0.015*
 - d. *0.022*
13. *Element b is _____ minutes long*
- a. *0.028*
 - b. *0.021*
 - c. *0.022***
 - d. *0.018*
14. *Element c is _____ minutes long*
- a. *0.022*
 - b. *0.001*
 - c. *0.015*
 - d. *0.03* *bonus***

15. Element d is _____ minutes long
- 0.015**
 - 0.018
 - 0.020
 - 0.022
16. Element e is _____ minutes long
- 0.026
 - 0.031
 - 0.022
 - 0.028**
17. As a methods engineer, what process chart will you first draw if you were asked to analyse the work being performed at a workstation?
- flow process chart
 - operator process chart**
 - operation process chart
 - gang process chart
18. A method that has three elements was timed through five cycles and yielded the following results for one of the elements:

	Cycle observed (in minutes)					Performance rating
Job element	1	2	3	4	5	
Element C	8	10	9	21	11	120%

What is the average time for this element C?

- 11.8 min.
 - 7.6 min.
 - 9.5 min.**
 - 10 min
19. What is the normal time for this element C?
- 14.16 min
 - 11.4 min**
 - 9.12 min
 - 12 min
20. What is the standard time if the allowance factor is 0.10 of job time?
- 12.54**
 - 12.67
 - 15.58
 - 15.73
21. Motion and micromotion study is used in method study in the following conditions:
- when developing slow motion films
 - when an efficient work centre is being developed**
 - when the equipment is available to be used for the study
 - when management requests for it

22. Reach is a therblig that can be improved in the work cycle by
- Lightening the load of object to be reached for
 - providing fixed locations for objects that are reached for during the work cycle and shortening the distances required for reaching**
 - Improving the type of reach being performed
 - all of the above
23. In process and fixed-position layouts it is important to minimize the costs of
- raw materials
 - material handling**
 - skilled labour
 - special purpose machines
24. A major assumption of stability of large demand is important for using which of the following layout types?
- product**
 - cellular
 - process
 - fixed position
25. Cellular layouts
- are used in metal fabrication and assembly work
 - allocates dissimilar machines into cells to work on products that have similar shapes and processing requirements**
 - try to gain the benefits of product layout in job-shop layout
 - all of the above
26. A precedence diagram is
- drawn using two different conventions
 - used in the analysis of production lines
 - a series of nodes and arcs which indicate the sequence of operations
 - all of the above.**
27. A work sample-study conducted over a 80 hours of a two-week period yielded the following data:

Number of parts produced -	225
Performance rating of the operator	100%
Operator's idle time	20%
Company's allowance	25%

What is the standard time for this operation?

- 17.07 min./part
 - 4.26 min./part
 - 22.76 min/part**
 - 21.34 min./part
28. A fixed-position layout
- deals with low volume, high variety production
 - seeks the best personnel and machine utilization in continuous production
 - addresses layout requirements of large and bulky projects**
 - groups workers, their equipment, and spaces to provide for free flow of materials and information

29. A process layout
- a. **deals with low volume, high variety production**
 - b. seeks the best personnel and machine utilization in continuous production
 - c. addresses layout requirements of large and bulky projects
 - d. groups workers, their equipment, and spaces to provide for free flow of materials and information
30. A product layout
- a. deals with low volume, high variety production
 - b. **seeks the best personnel and machine utilization in continuous production**
 - c. addresses layout requirements of large and bulky projects
 - d. groups workers, their equipment, and spaces to provide for free flow of materials and information
31. In the selection of a worker to time in stopwatch time study, the qualities to look out for are:
- a. the best operator who is using the right method.
 - b. **a typical worker who is using the right method.**
 - c. the fastest worker who is using the right method
 - d. a new worker
32. Methods Engineering is done at least :
- a) Once during the life span of a method.
 - b) Twice before a method is implemented.
 - c) **Twice during the life of a method.**
 - d) Once a year during the life of a method.
33. Methods analysis and motion study determine :
- a. The time it takes to do a job
 - b. **How a job is to be performed**
 - c. The proportion of time a worker spends on a certain aspect of the job.
 - d. The Quality of work life
34. The pioneers of Work Study in the earlier part of the last century were:
- a) Frank and Lillian Therbligs
 - b) **The Gilbreths and Frederick Winslow Taylor**
 - c) Henry Ford and H.B. Maynard
 - d) Bill Gates and Benjamin Niebel
35. Who is responsible for developing work methods in organizations?
- a) I. E. Department
 - b) Consulting firms specializing in methods designs
 - c) Aiding workers to design their own jobs
 - d) **a, b & c.**
36. The choice of charting method to use depends on :
- a) The preference of the one charting
 - b) The chart most frequently used by the organization
 - c) **The activity level of the task or method**
 - d) The type of equipment being used.

37. The purpose of doing work measurement is to determine
- a) how a work method should be done
 - b) the most efficient way to accomplish the method
 - c) **how long it takes to accomplish the method**
 - d) which worker to accomplish the method.
38. What charts are used in developing overall production systems or operations?
- a) Simo charts and Operation Process chart
 - b) Operator process chart and Flow process chart
 - c) Flow process chart and Gang process chart.
 - d) **Flow process chart and Operation process chart**
39. An Operator Process chart is used to analyze
- a) **a worker in a fixed workplace**
 - b) a worker interacting with his equipment
 - c) a worker interacting with other workers.
 - d) a complete operation.
40. The objective in studying the overall production system or operation is to
- a) Identify delays, transport distances processes and processing time requirements
 - b) Minimize idle time and balance the cost of worker and machine idle time.
 - c) **Identify points of delays, storage points, points of inspection, transport distances and processing time requirements.**
 - d) To access team effort.
41. All organizations need some form of standard time estimates to do all **except**
- a) scheduling and incentive pay
 - b) planning and budgeting
 - c) **determining the method use**
 - d) Setting of work standards.
42. A structured procedure for observing, measuring, and improving work methods is known as
- a) **methods analysis**
 - b) operations analysis
 - c) work measurement
 - d) work sampling
43. A time study is generally conducted with a stop watch.
- a) **Either on the job site or by analyzing a video tape of the job.**
 - b) By timing a worker instantaneously for many observations.
 - c) By timing several workers doing a job.
 - d) By using standard data tables
44. In Methods Engineering, the information from forecasting is useful in
- a) Doing a motion study
 - b) **Justifying the economic viability of doing a method study.**
 - c) Planning a layout problem.
 - d) all of the above.

45. A preliminary work sample of an operation indicates the following:

Number of times operator is working	60
Number of times operator is idle	40
Total number of preliminary observations	100

What is the required sample size for a 95% confidence level with a 5% accuracy?

- a) **369**
- b) 384
- c) 150
- d) 380

46. **NO QUESTION**

47. Select is classified as a (an) _____ therblig.

- a) effective
- b) good
- c) objective
- d) **ineffective**

48. The conditions for the longest-task-time heuristic's use in line balancing are :

- i. It can be used only when each and every task time is less than or equal to the cycle time.
- ii. There can be no duplicate work stations.
- iii. It can be used when one or more task time is equal to or greater than the cycle time.
- iv. It can be used regardless of the length of task time relative to cycle time.

- a) i only
- b) i. and ii.
- c) ii. and iv.
- d) **i., ii. and iii.**

49. Cycle time in line balancing is defined as

- a) the time that it takes for a well trained worker or unattended machine to perform a task.
- b) **the time between products coming off the end of a production line**
- c) the time that it takes for a method to be done through a cycle and it is the sum of all task times
- d) the time that it takes a well trained worker to perform a task, working at normal pace with allowances factored in.

50. Some of the predetermined time standards used today are

- a) **work factor, MTM, and BMT**
- b) work measurement, BMT and MTM
- c) TMU and BMT
- d) work factor, work sampling and work measurement

SECTION B

51. What process charts are utilised when one wants to study work being done in a work place to analyse a layout problem? Draw one of them. **5 marks**

Operation process chart

Flow process chart

Flow diagram

From – to chart

Operator process chart for work station design

2 1/2 pts

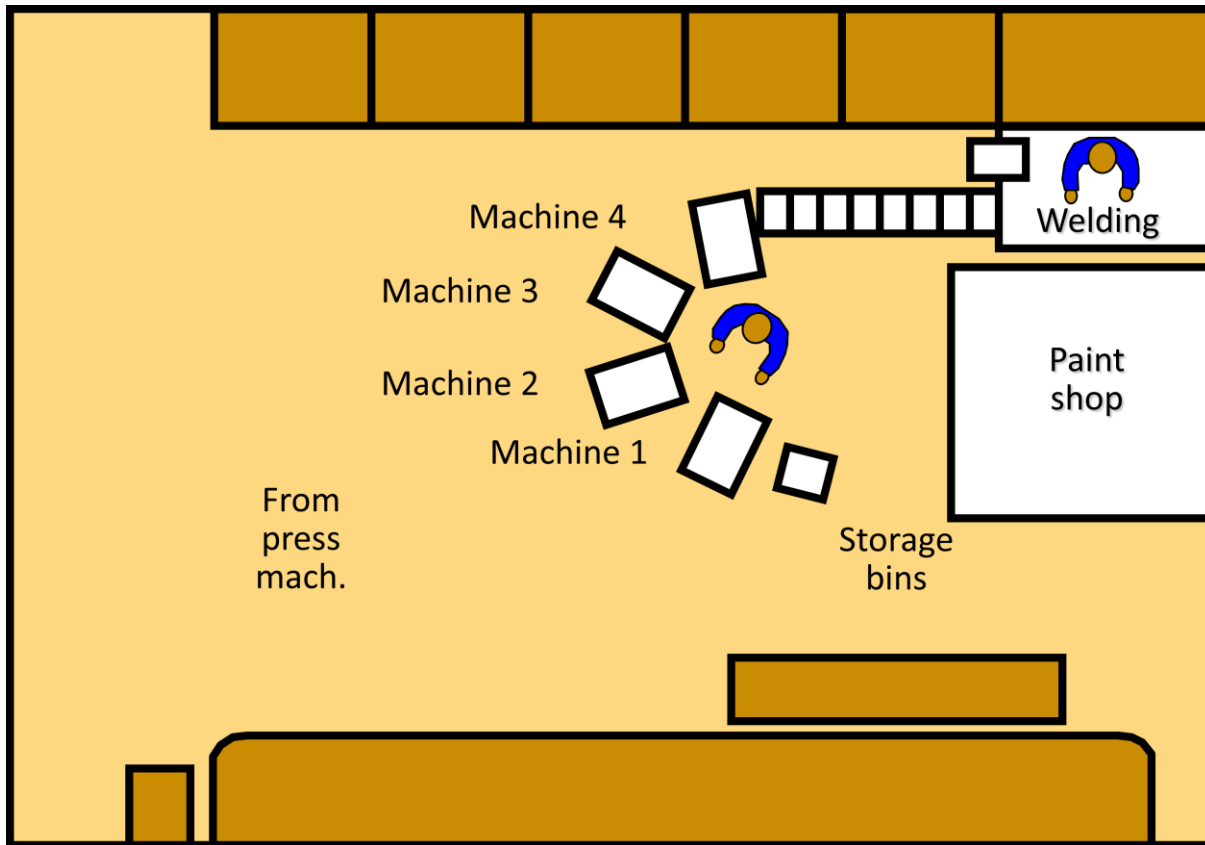
Below are any two examples

Any one of them – 2 1/2 pts

Present Method <input type="checkbox"/>		PROCESS CHART	
Proposed Method <input checked="" type="checkbox"/>			
SUBJECT CHARTED <u>Axle-stand Production</u>		DATE <u>8/1/05</u>	
		CHART BY <u>JH</u>	
		CHART NO. <u>1</u>	
DEPARTMENT <u>Work cell for axle stand</u>		SHEET NO. <u>1</u> OF <u>1</u>	
DIST. IN FEET	TIME IN MINS.	CHART SYMBOLS	PROCESS DESCRIPTION
50			From press machine to storage bins at work cell
	3		Storage bins
5			Move to machine 1
	4		Operation at machine 1
4			Move to machine 2
	2.5		Operation at machine 2
4			Move to machine 3
	3.5		Operation at machine 3
4			Move to machine 4
	4		Operation at machine 4
20			Move to welding
	Poka-yoke		Poka-yoke inspection at welding
	4		Weld
10			Move to painting
	4		Paint
97	25		TOTAL

= operation; = transportation; = inspection; = delay; = storage

2 marks



FLOW DIAGRAM

2 marks

52. Draw a Left-Hand, Right-Hand Chart and say when it is used in method study.

5 marks

LEFT-HAND, RIGHT-HAND CHART

OPERATION CHART					
SYMBOLS	PRESENT		PROPOSED		
	LH	RH	LH	RH	
○ OPERATION	2	3			
⇒ TRANSPORT.	1	1			
□ INSPECTION					
D DELAY	4	3			
▽ STORAGE					

PROCESS: Bolt-washer assembly

EQUIPMENT: _____

OPERATOR: KJH

STUDY NO: _____ ANALYST: _____

DATE: 8 / 1 / 05 SHEET NO. 1 of 1

METHOD (PRESENT / PROPOSED)

REMARKS:

LEFT-HAND ACTIVITY <u>Present</u>	DIST.	SYMBOLS	SYMBOLS	DIST.	RIGHT-HAND ACTIVITY <u>Present</u>
METHOD					METHOD
1 Reach for bolt		○⇒□□D▽	○⇒□□D▽		Idle
2 Grasp bolt		○⇒□□D▽	○⇒□□D▽		Idle
3 Move bolt	6"	○⇒□□D▽	○⇒□□D▽		Idle
4 Hold bolt		○⇒□□D▽	○⇒□□D▽		Reach for washer
5 Hold bolt		○⇒□□D▽	○⇒□□D▽		Grasp washer
6 Hold bolt		○⇒□□D▽	○⇒□□D▽	8"	Move washer to bolt
7 Hold bolt		○⇒□□D▽	○⇒□□D▽		Place washer on bolt

3 marks

It is used to study the work being done at a workstation and assembly work to eliminate waste such as unproductive motions etc

2 marks

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