

(Write very clear)

Candidate's Number:..... 190407028 .....

\*1st/2nd Semester Examination, 20..... 23 / ..... 24 ..... Session

Faculty..... ENGINEERING..... Department:..... SYSTEMS .....

Course Code..... SS9 348 .....

Course Title..... INDUSTRIAL ENGINEERING .....

(\*Cross out the word which does not apply)

# UNIVERSITY OF LAGOS

## INSTRUCTIONS TO CANDIDATES

1. Write legibly on both sides of the paper.
2. Begin each answer on a fresh page.
3. Write the number of the question at the top of each page.
4. Cross out rough works.
5. In your own interest you should enter in the space provided below, the number of each question attempted (with sub-sections where necessary).
6. If supplementary books are used they must be fastened at the end of this book and inside the cover.
7. In no circumstances must answer books used or unused be removed from the Examination Room by a candidate.
8. Folding of, or tampering with this booklet in any way will attract severe penalty.
9. Do not write anything on your question paper except your matriculation number.
10. For your rough work, use only (a) the inside cover and (b) the last page of your answer booklet.

For Examiners use only	
Question No	Marks
1	0721
2	14
3	14
	49
Total	

NUMBER OF QUESTIONS in order in which they  
are answered

1, 2, 3, 1

a. (I) Project Management ✓

(II) Quality Assurance

(III) Motion and Time Study      Lean manufacturing

(IV) Six Sigma

Project Management is the application of knowledge, skills, tools and techniques to meet project requirement

Quality Assurance is the systematic activities put in place to ensure product or service satisfies quality standards and specification.

Lean manufacturing is a five step process that aims at eliminating waste in production. Wastes are non-value activities. The different wastes are

(I) Defects                                (V) Inventory

(II) Over production                     (VI) Waiting

(III) Motion                                (VII)

(IV) Transportation                    (VIII)

b. Time Study

Six Sigma is a six step process that aims at reducing output variation, thereby improving quality. The steps include

(I) Define                                (IV) Inspect

(II) Measure                            (V) Control

(III) Analyse

b. (i) Industry 1.0 (pre. 1900s)

The Industrial revolution started by the replacement of human labour with animals, steam and heat engines. Industry 1.0 was characterized by increasing development of factories and mass production.

(ii) Industry 2.0

Industry 2.0 began by the invention of electricity. Companies began to utilize electricity technology in production, distribution and marketing.

(iii) Industry 3.0 (1950s)

The invention of computer and electronic technology introduced the third Industrial revolution.

(iv) Industry 4.0 (1990s) (2000s - present)

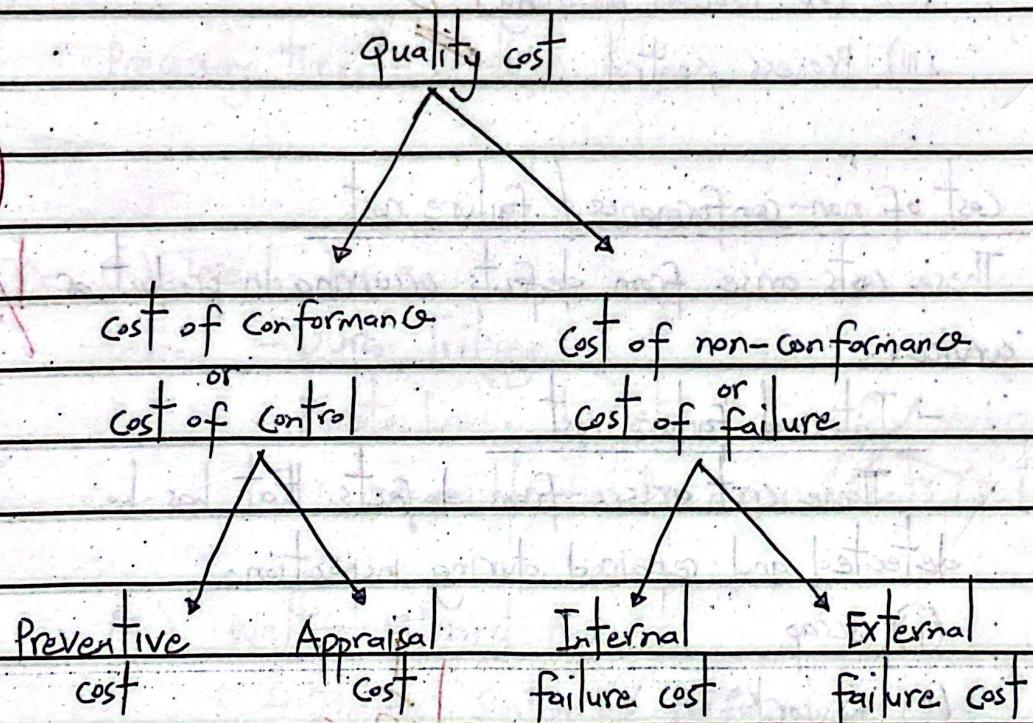
It is a data-driven age. It is characterized by Machine Learning, Artificial Intelligence, Big Data, Internet of Things and some other technologies.

(v) Industry 5.0 (present and future)

This is how Industry 5.0 is used to describe some special technology and future technologies like nano technology.

- a. Quality costs are the cost associated with ensuring a product or service ~~satisfies quality~~ conforms with quality standards and specifications.

### classification of Quality cost



Q. Quality cost can be classified into

- i. Cost of Conformance / cost of control

This These cost arise from ensuring a product meets quality requirements. They are further sub-classified into

- Preventive cost

These cost arises from ensuring defects in product do not occur at all. Example are

(i) Quality ~~traceability~~ Audit

(ii) Document Review (iii) Balancing

(III). Testing and Inspection for Incoming materials

- Appraisal cost

These cost arises from adhering to quality standards and processes.

(I) Training

(II) Pre Process planning

(III) Process control

2. Cost of non-conformance / failure cost

These costs arise from defects occurring in product or services.

- Internal failure cost

These cost arises from defects that has been detected and repaired during inspection.

(I) Scrap

(II) Rework

(III) Loss / Missing information

- External failure cost

These cost arises from defects that actual reaches the final customer

(I) Legal Litigation

(II) Warranty

(III) Loss of customer goodwill

b. processing rate of cocog = 100 batches per day  
 batches of cocog = 1500 batches

$$\text{Processing time} = \frac{\text{Number of batches}}{\text{Processing rate}} = \frac{1500}{100} \text{ days}$$

• Processing time = 15 days

c. (i) Joseph Juran

- Juran Trilogy

- Pareto Law. It states that a few minor (20%) is responsible for the major effects (80%).

(ii) Walter Edward Demings

- Deming's System of Profound Knowledge, SOPK

- Seven deadly disease of Management

- 14 principles of management

(iii) Philip Crosby introduced the following concepts

- Zero defects

- Do It Right the First Time, DIRTFT

- Crosby Quality Vaccine

(iv) Kaoru Ishikawa

- Ishikawa diagram / Fishbone / cause-and-effect diagram

a. (I) Economic considerations

Cost of processes are the main indications that a job should be studied. Because method study aim at reducing cost. Jobs with overheads and monotonic activities should be considered for study.

(II) Technological considerations

Jobs that can be improved by automation and robotics technology should be selected for study.

(III) Human consideration

Jobs that causes dissatisfaction to workers due to environmental hazard and working condition and other working factors should be selected for study.

b. Method study is the systematic recording and critical examination of the way an activity is carried out in order to improve efficiency.

The steps involved

(I) Select

(II) Record

(III) Examine and measure

(IV) Develop

(V) Define

(VI) Install

(VII) Maintain

d. (i) Method study objectives

- (i) Method study aims to improve efficiency
- (ii) To increase profit
- (iii) To reduce and eliminate waste

c. Method study objectives are to

- (i) Increase efficiency ✓
- (ii) Increase profit ✓
- (iii) Reduce cost or possibly eliminate waste
- (iv) Reduce cost of production
- (v) Increase quality by reducing output variation

Q

### C (i) Quality Planning

This involves the activity of obtaining quality standards related to a product / service and determining the procedures for meeting these requirements.

INPUT	TOOLS/TECHNIQUES	OUTPUT
i. standards and specifications	i. Benefit cost analysis	i. Qu

specifications

The inputs to quality planning includes

- (i) Scope definition
- (ii) Project description
- (iii) Standards and specifications
- (iv) Output of other processes

The tools and technique used are

- (i) Benefit cost analysis
- (ii) Benchmarking
- (iii) Flowcharting

The output of quality planning includes

- (i) Quality Management plan
- (ii) checklist
- (iii) Quality definition.

c(ii) Quality Assurance are systematic quality activities put in place to ensure a product / service meets quality requirements

INPUT to quality assurance process

- (i) Quality definition
- (ii) checklist ✓
- (iii) Measurement from quality control
- (iv) Output of other processes

3  
2

6 Tools and techniques used

- (i) Quality Audit

Output of quality assurance

- (i) ✓
- (ii) Input to other processes

Quality improvement? ??

(iii) Quality Control is the process that involves quality inspection of product / services to ensure the product / services conform with quality requirements

INPUT to quality control

- (i) checklist ✓
- (ii) Quality Management plan ✓

3  
2

Tools and Technique used

- (i) Control chart
- (ii) Pareto diagram
- (iii) Trend analysis
- (iv) Six Sigma
- (v) Lean manufacturing

Output of quality assurance

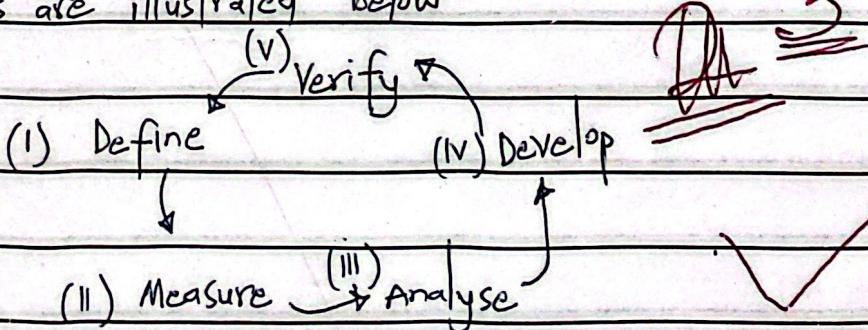
- (i) Product Specification
- (ii) Rework
- (iii) completed checklist

d. "Engineering design is both iterative and cyclic"

Engineering design is iterative meaning it is a continuous process and repeated

d. "Engineering design is both iterative and cyclic"

It means Engineering design is a repetitive process involves steps that are repeated continuously, over and over again. The steps are illustrated below



- (I) Define
- (II) Measure
- (III) Analyze
- (IV) Develop
- (V) Verify

(I)

Ques.

- e. Work Breakdown structure is a logical and goal-oriented breakdown of task into smaller components or activities.