RESUME OF TECHNICAL SUBJECTS

5. PERFORMANCE OF CANDIDATES

The chief examiners reported that an average performance was recorded in Applied Electricity 2, Building Construction 2, Metalwork 2, Technical Drawing 2, Auto mechanics 3, Woodwork 2 and reported an above average performance in Woodwork 3.

They also stated that candidates' performance in Applied Electricity 3, Auto Mechanics 2, Building construction 3, Metalwork 3 and Technical Drawing 3 improved significantly. In addition to these, performance in information and communication studies 3, Building Construction 3 and Electronics 3 was reported to be very good whiles Information and Technology 2 was good. Performance in Electronics 2 was however reported to be fair.

6. SUMMARY OF CANDIDATES' STRENGTHS

(e) Adherence to Rubrics of the Examination

Chief Examiners of Electronics 3, Applied Electricity 2, Information and Communication Technology 2 and Metalwork 2 reported that most candidates adhered to the rubrics of the papers.

(f) Orderly Presentation of Answers

Most candidates according to the Chief Examiners of Woodwork 2 and 3, Building Construction 2 and 3 and Metalwork 2 numbered their work neatly and orderly presented their work.

(g) Demonstration of In-depth Knowledge of Subject Matter.

The Chief Examiners reported that a few candidates demonstrated excellent Knowledge in their subject matter.

Candidates of Applied Electricity 2 showed strength in concepts and principles in magnetic theories and logic gautes; and plotting of graphs in Applied Electricity 3. In Electronics 2 and 3, most candidates showed appreciable Knowledge in application of electromagnetism and performing experiments appropriately respectively. Candidates offering ICT 3 showed strength in spreadsheet application and in Metalwork 3, most candidates were able to cut and file metal parts to size. Candidates demonstrated commendable strength in draughtsmanship in Technical Drawing 2 and 3 and constructed well fitted joints in woodwork 3. Most candidates demonstrated strength in removing the clutch plate in Auto Mechanics 3.

(h) Exhibition of Skills in Sketching and Drawing

The Chief Examiners reported that most candidates of Auto Mechanics 2, Woodwork 2, Building construction 2 and 3 and Technical Drawing 2 and 3 produced very good sketches and drawings to answer their questions.

7. SUMMARY OF CANDIDATES' WEAKNESSES

(e) Lack of Adequate Preparation

The Chief Examiners reported that candidates' responses demonstrated inadequacy in their preparation. In Technical Drawing 2 and 3 most candidates used the wrong grade of pencils for their work. Candidates of Metalwork 3 lacked practical competence in the selection of various bench tools and how to use them effectively. In woodwork 3, some candidates showed lack of adequate preparation through their inability to mark-out accurately and cut out joints neatly. Candidates of ICT 3 could not format background colour of the HTML properly.

Majority of candidates of Applied Electricity 2 demonstrated lack of in-depth Knowledge about circuit analysis and poor arithmetical skills.

(f) Non-Adherence to the Rubrics of the Examination

Some candidates were reported to have disregarded the dictates of the rubrics. Some candidates of Building Construction 2 and 3 were reported to have answered less questions whiles others answered more than demanded by the rubrics. In Technical Drawing 3, almost all the candidates used guided instruments for the freehand sketches which was against the instruction that no guided instrument should be used.

(g) Lack of Practical Exposure

Chef Examiners reported that most candidates demonstrated their lack of practical exposure through their responses to questions. Candidates of Auto Mechanics 3 could not identify parts of the starter motor and the inspection of component parts was poorly done. Most candidates for Metalwork 3 lacked the competence in the selection of various tools and how to use them effectively. Most candidates for Woodwork 3 were unable to mark out accurately and work to the given dimensions.

(h) Poor Handwriting

The Chief Examiners for Auto Mechanics 2 and Building Construction 3 bemoaned the illegible handwriting of most candidates.

8. SUGGESTED REMEDIES

The following were suggested as remedies for the weaknesses:

(i) Practical work should be intensified by instructors and teachers;

(ii) Candidates should be impressed upon to always read and observe the dictates of the rubrics of the examination;

(iii) Teachers should endeavour to complete all sections of the syllabus before the examination;

(iv) Teachers should have all the necessary tools, instruments equipment and textbooks for the training of students.

(v) Candidates should read over their solutions to enable them correct errors such as omissions and poor spellings;

(vi) Candidates should practice various sketches before they sit for the examination.

APPLIED ELECTRICITY 2

1. **GENERAL COMMENTS**

The standard of the paper compares favourably with that of the previous years and covers the syllabus.

Candidates' performance was average.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Most candidates were able to answer the required number of questions demanded by the rubrics.
(ii) Majority of the candidates understood the concepts and principles with respect to magnetic theories.
(iii) Majority of the candidates attempted questions involving logic gates.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Majority of the candidates did not have an in-depth knowledge about circuit analysis.
(ii) Majority of the candidates could not state principles on circuitry correctly.
(iii) Candidates demonstrated poor arithmetical skills.

4. **SUGGESTED REMEDIES**

(i) Teachers should give more class assignments for students to practice.
(ii) Teachers should organize field trips to Akosombo hydroelectric plant for candidates to have a first-hand practical experience on how electricity is generated from hydro.
(iii) Candidates should read widely on Applied Electricity Journals and textbooks to broaden their knowledge in the subject matter.

5. **DETAILED COMMENTS**

Question 1

(a) State two effects of electric current.

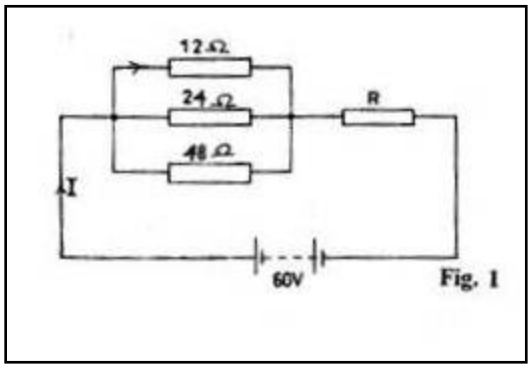


Fig. 1

(b) Fig. 1 is a resistive network. If the power dissipated in the 12Ω resistor is 48 W, calculate the:

(i) current flowing in the 12ω resistor;

(ii) the total current (i) in the circuit;

(iii) value of the resistor (r)

(a) Majority of the candidates did not understand the question very well and as such gave wrong meanings. The question asked for "the effect of electric current"

The correct responses are:

- Magnetic
- Heating
- Chemical

(b) The resistive parallel/ series network should have been solved without much difficulty if they noticed that the 12Ω resistor dissipates a power of been easier likewise the voltage across the parallel circuit.

The formula for power: $P = I^2R \rightarrow (1)$

$$P = IR \rightarrow (2)$$

(i). From equation (1) $\mathrm{I}^2 = \frac{48}{\mathrm{R}} = \frac{48}{12} = \sqrt{4}$ and $\mathrm{I} = 2\mathrm{A}$ and Vparallel at $\mathrm{V} = 2\mathrm{X}12 = 24\mathrm{V}$

The weakness encountered here is basic knowledge in mathematics.

(ii). Once the voltage across the parallel circuit is known, total current can be calculated easily by adding the current through each resistor together.

(iii). Voltage across the series resistor $\mathrm{R} = \frac{60^{\mathrm{VT}} - 24^{\mathrm{VR}}}{\mathrm{I_T}}$

$$= \frac{36}{\text{Total amount}}$$

Candidates' performance was average.

<u>Question 2</u>

(a) State three factors that affect the capacitance of a parallel plate capacitor.

(b) The charge (Q) stored in a capacitor when connected across a 240 V d.c. supply is 0.05 mC. Calculate its capacitance.

(c) State two applications of a capacitor.

(a) Most of the candidates gave the correct answers for stating the factors that affect the capacitance of a capacitor i.e. $\mathrm{C} = \frac{\varepsilon_o\, \varepsilon \mathrm{r} \mathrm{A}}{\mathrm{d}}$. i.e.

- permittivity of the dielectric/Nature of the dielectric material
- area of the plate
- distance between the plates. A good work carried out by the candidate

(b) The charge on a capacitor Q=CV
Making C the subject of the equation and writing the correct unit of the capacitance posed problem to some of the candidates.

Note: the unit of capacitance is expressed in Farad (F) or $\mu F = 10^{-6} F$

(c) Majority of the candidates answered this question very well by stating two applications of a capacitor.

Candidates' performance was good.

Question 3

(a) State two:
(i) causes of over-voltage in electrical installation;
(ii) ways of avoiding over-voltage in electrical installation.
(b) State three tests carried out on a new domestic installation.

(a) The candidates did not encounter much problem in stating two factors each which causes:
(i) Overvoltage in electrical installation
(ii) How to prevent or avoid this over-voltage

(b) Many candidates were unable to state the test to be carried out on a new domestic installation. The tests required are:
- Polarity
- Insulation resistance
- Continuity
- Earth leakage

Candidates' performance was fair

Question 4

(a) State two methods of cooling a transformer
(b) With the aid of a circuit diagram, explain the principle of operation of a single-phase transformer.

(a) A good number of candidates answered the question regarding the methods used to cool transformers.

(b) Many candidates could not draw and label the single-phase transformer correctly. They were also unable to explain clearly the principle of operation to the transformer without mentioning Faraday's Law of electromagnetic induction, or Mutual Induction.

Candidates performance was good.

Question 5

(a) Explain the following terms as applied to semiconductor materials:

(i) intrinsic;

(ii) extrinsic.

(a) Explanation of the following terms (i) Intrinsic (ii) Extrinsic with respect to semiconductors were poorly carried out by many candidates

(b) The question demanded a circuit diagram of a PN junction diode and not a block diagram as some candidates drew in a forward biased mode.

Question 6

(a) Draw the symbols of the following logic gates:

(i) NOR;

(ii) NAND;

(iii) OR;

(iv) NOT.

(b) Write the output (F) Boolean expression for the following logic gates:

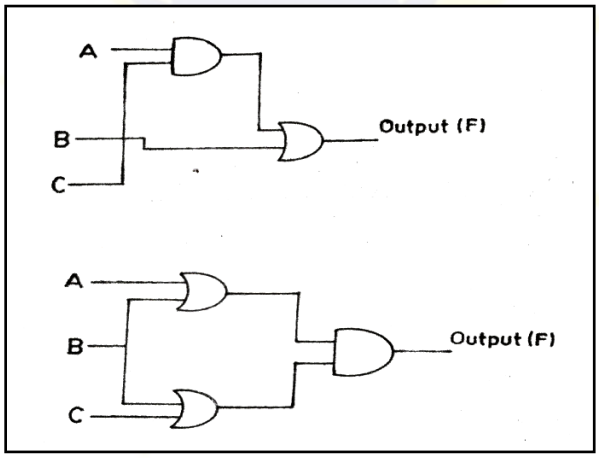


Figure 2

(a) The symbols for the logic gates were correctly drawn by some candidates. Others omitted the usual dot (•) at the output of NOR, NAND and NOT gate.

(b) Candidates who drew the logic gates before writing the output (F) (i.e. the Boolean expression) managed to write some of their output expression correct. However, those who visually wrote the expression had their answers wrong.

Candidates' performance was good.

Question 7

(a) Sketch and label:

(i) **amplitude modulated waveform;**

(ii) **frequency modulated waveform.**

(b) State two differences between Class A and Class B amplifiers.

(a) Poor sketches and unlabelled waveforms for

(i). amplitude modulated

(ii). frequency modulated

Waveforms were not properly drawn

(b) Few candidates know the differences between Class A and Class B amplifiers

It seems the electronic section of the syllabus was not fully covered.

For Class A amplifier collector current flows for the full cycle i.e. 360°, while for class B

- The current conducts for half a cycle of 180°.
- Class B amplifier offers more distortion while Class A offers less distortion.
- Class B amplifier is more efficient than Class A amplifier.

Candidates' performance was good.

APPLIED ELECTRICITY 3

1. **GENERAL COMMENTS**

   The standard of the paper was comparable to that of the previous years. Candidates' performance compared with the previous year was good.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

   (i) Majority of the candidates plotted good graphs.
   (ii) Majority of the candidates were able to complete the two experiments and connected the circuit diagram correctly.
   (iii) Candidates compared the slope of the graph and the lead angle using the slope of the graph.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

   (i) Candidates wasted a lot of time by copying the questions.
   (ii) Most candidates could not select suitable scales to plot their graphs.

4. **SUGGESTED REMEDIES**

   (i) Teachers should use teaching learning aids to enforce their teaching of practical skills.
   (ii) Candidates should read more Journals, and textbooks on the subject to improve their level of understanding.

5. **DETAILED COMMENTS**

   Candidates were provided with the following apparatus:
   one a.c. ammeter (0-250 mA);
   one capacitor, 2.5 μF,240 VW;
   one variable a.c. power supply (0-30V);
   one 1 kΩ, $\frac{1}{2}$ W resistor;
   one100 Ω, $\frac{1}{2}$ W resistor;
   one 200 Ω, $\frac{1}{2}$ W resistor;
   one 300 Ω, $\frac{1}{2}$ W resistor;
   one400 Ω, $\frac{1}{2}$ W resistor;
   one 500 Ω, $\frac{1}{2}$ W resistor;
   three a.c. voltmeters (0-30V);
   one toggle switch;
   one breadboard/veroboard;
   a set of hand tools;
   connecting wires.

Question 1

Aim: To determine the lead angle in an A. C. RC circuit.

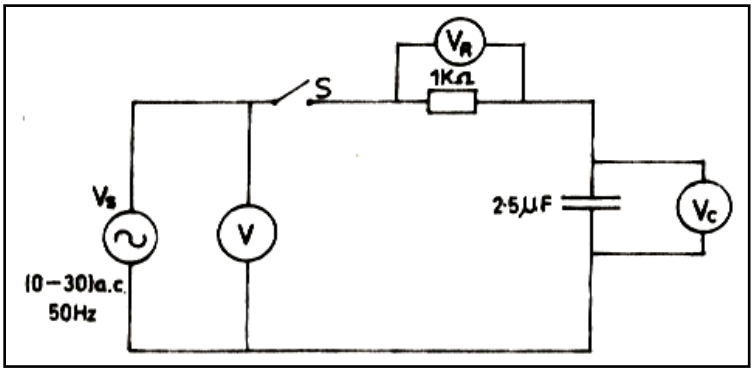


Figure 1

(a) **Connect the circuit as shown in Figure 1.**

(b) **Ask the supervisor to check the circuit connection.**

(c) **Copy Table 1 into your answer booklet.**

Table 1

V_S	V_R	V_C(V)
0		
5		
10		
15		
20		
25		

(d) **Set the variable a.c. power supply to 0V and close the switch (s).**

(e) **Read and record in Table 1, the voltmeter readings of V_R (V) and V_C(V).**

(f) **Open switch, S.**

(g) **Adjust the variable a.c. power supply to 5V and close the switch, S.**

(h) **Read and record in Table 1 the voltmeter readings of V_R (V) and V_C (V).**

(i) **repeat steps (f) to (h) for the other values of V_S in Table 1.**

(j) **Plot a graph of V_C(V) on the vertical axis against V_R(V) on the horizontal axis.**

(k) **Determine the:**

i. **Slope of the graph;**

ii. **Lead angle using the slope of the graph.**

Candidates were to investigate the characteristics of the load angle in an a.c. RC circuit using capacitors, resistor, a voltmeter and an a.c. power source.

Majority of the candidates connected the circuit diagram correctly, completed Table 1 by filling in the required values.

Few candidates could not adjust the variable a.c. power supply to 5V.

Candidates' performance was good.

Question 2

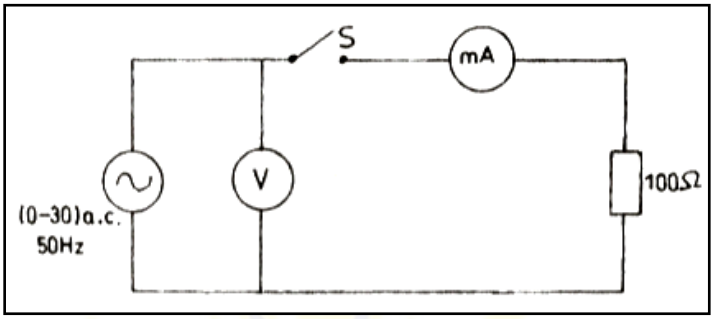


Figure 2

(a) Connect the circuit as shown in Figure 2.
(b) Ask the supervisor to check the circuit connection.
(c) Copy Table 2 into your answer booklet.

Table 2

Resistance	**Current (mA)**
100	
200	
300	
400	
500	

(d) Set the variable a.c. power supply to 25 V.
(e) Close switch, S.
(f) Read and record in Table 2, the ammeter readings.
(g) Open switch, S.
(h) Replace the 100 Ω resistor and close the switch, S.
(i) Read and record in Table 2 the corresponding ammeter reading.
(j) Repeat steps (g) to (i) for the other values of resistors in Table 2.

(k) Plot a graph of current (mA) on the vertical axis against resistance (Ω) on the horizontal axis.

(l) Comment on the graph.

Candidates were to determine the effect of resistance on current in an a.c. circuit.
Majority of the candidates read the various current (mA) in series with the given load resistance provided in Table 2.

Majority of the candidates plotted the required graph of current on the vertical axis against resistance on the horizontal axis.

Few candidates could not select proper scale for plotting their graphs and therefore had a linear graph.

Candidates performance was generally good.

AUTO MECHANICS 2

1. **GENERAL COMMENTS**

The standard of the question paper compared favourably with those of the previous years has been about the same. Candidates' performance has improved significantly in the subject.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Sketches and drawings produced were good.
(ii) Description of concepts was commendable.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Inability to identify names of components labelled in the diagrams.
(ii) Ineligible handwriting making reading of answers difficult.

4. **SUGGESTED REMEDIES**

(i) Candidates should take sketches and drawings more seriously. Names of various components in a unit or assembly must be learnt.
(ii) Workshop teachers must make it a point to make sketches and diagram preparation part of the lesson.
(iii) Candidates must consciously work on improving their handwriting.

5. **DETAILED COMMENTS**

Question 1

(a) State four safety precautions to be observed in an auto mechanic workshop.
(b) (i) Explain the term routine maintenance as applied to motor vehicles.
(ii) List four tools used in carrying out routine maintenance on a motor vehicle.

This question was the most popular question in that, a good number of candidates attempted it and the performance was good.

(a) Correct answers given by candidates include the following;

- Before starting any equipment, one must know how to stop it.
- Protective clothing should always be worn.
- Horse play should be avoided.
- Provision for adequate ventilation should be made.
- Provision for adequate illumination should be made.
- Fire extinguishers should be made available in the workshop.

(bi) Explanations were good but short of salient points. Routine maintenance are sequential activities carried out in a period of time specified by the manufacturer.

(bii) The general performance was good; tools listed include some of the following

- Torgue wrench
- Wheel spanner
- Socket spanner
- Screw driver
- Feeler gauge, etc

Question 2

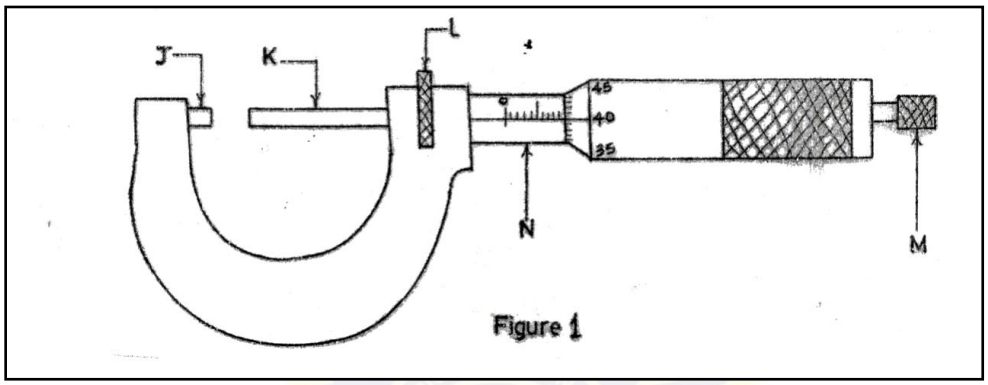


Figure 1

The sketch in Figure 1 is a measuring instrument.

(a) (i) Identify the instrument.

(ii) Name the parts labelled J, K, L, M, and N

(iii) State the function of the instrument.

(b) Sketch a piston and label three of its parts.

(a)(i) Most of the candidates identified the sketch as a micrometre, micrometre gauge and micrometre screw gauge, leaving out the most essential feature. The essential feature expected in the answer is 'External' which makes it External Micrometre Screw Gauge.

(a)(ii) Quite a few candidates did well at this segment.

Per the sketch, J——is anvil

K——spindle

L——lock nut or lock

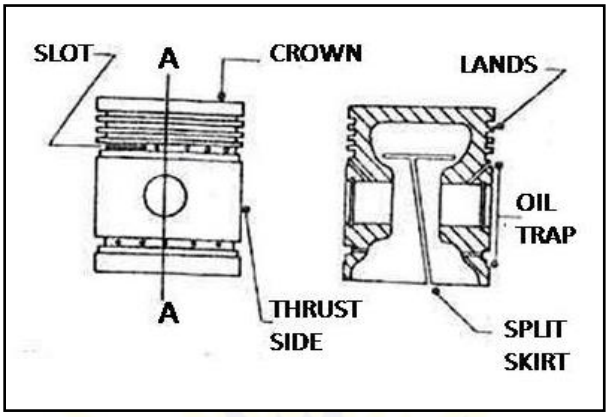
M——ratchet

N——barrel or sleeve

(a)(iii) Most of the candidates stated the function of the instrument as; "it is used to measure gaps interval diameters and thickness of material". The External micrometre screw gauge is used to measure the external diameter of circular objects.

(b) Sketches produced were very poor. Sketches and drawings are very important means of communication in the automobile industry. The few candidates who produced good sketches scored high marks.

An example of a good sketch is provided below

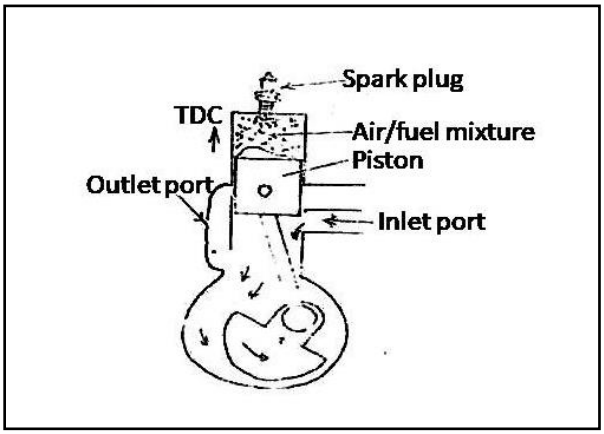


Question 3

(a) Sketch the upward stroke of a two-stroke spark ignition engine and label three parts.

(b) State two merits and demerits each of the two-stroke cycle engine.

(a) Only a few of the candidates sketched the correct diagram, taking into consideration the relative position of the piston with the three ports on the upward stroke. The sketch must be seen 'working' i.e., the two ports, i.e. transfer and exhaust must be covered whilst the inlet port must be seen opened. An example of a good sketch is provided below.



(b) Some good answers candidates gave include

- The engine is lighter

- The engine has fewer parts
- The engine has high running speed
- It is easier to maintain
- It is very portable
- It can be used either on stationary or moving machines

Demerits of the two-stroke engine includes the following

- It easily overheats
- Produces high or loud noise
- Poor lubrication system
- Inadequate cooling process
- Limited to only small engines

Question 4

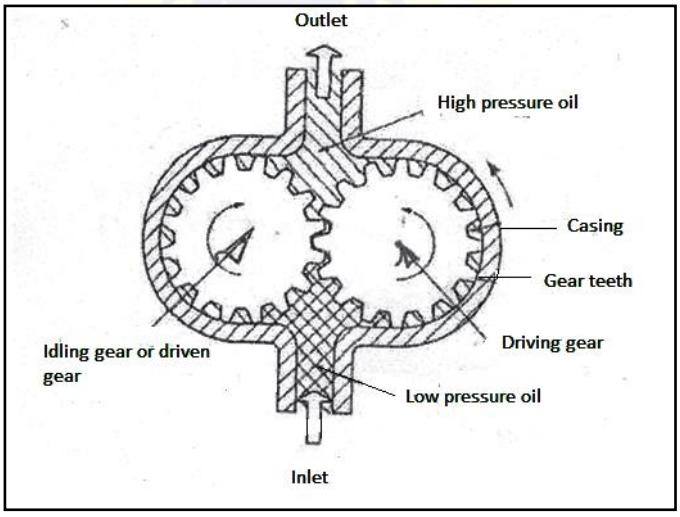
(a) Sketch a gear type oil pump and label four of its parts.

(b) State the function of an oil pump

(c) List four cold starting devices for a compression ignition engine.

(a) A good number of candidates attempted the question but could not produce workable or accurate sketches.

Example of a good sketch is provided below;



(b) Many of the candidates answered the question satisfactorily.
The function of the oil pump is to speed up movement of the engine oil to the lubricating parts of the system in an engine.

(c) Candidates' performance was good.
Acceptable answers include the following:

- Heater plug
- Decompressing device
- Heavy duty battery
- Ether spray
- Pintaux nozzle

Question 5

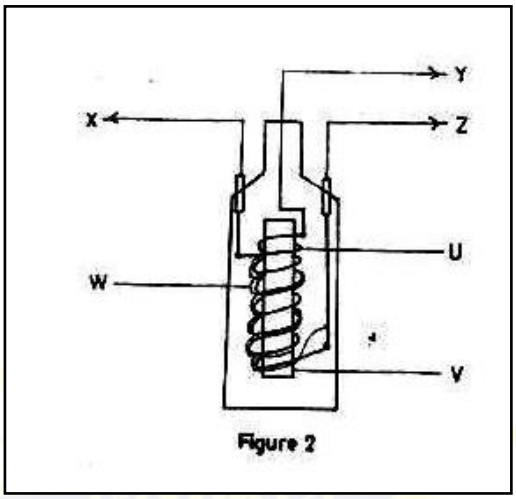


Figure 2

The sketch in Figure 2 is an ignition coil.

(a) (i) Name the units to which cables X, Y, and Z are connected to.

(ii) Name the parts labelled U, V, and W

(b) State three advantages of the electronic ignition system over the coil ignition type.

(c) List three sensors used in electronic ignition system.

(a)(i) Candidates displayed lack of knowledge of how electrical connections are made to the ignition coil.

A sketch of an ignition coil was provided, and candidates were to state the units of the ignition system to which parts labelled X, Y, and Z on the ignition coil are connected to

X—is connected to the battery.

Y—is connected to the distributor.

Z—is connected to the contact breaker.

(a)(ii) Candidates were to name the parts labelled U, V, and W. Performance at this segment was good.

U—represents secondary winding;

V—represents iron core and;

W—represents primary winding.

(b) Very few candidates attempted this question

Answers expected include:

- It does not require periodic checks on ignition timing.
- Due to the absence of contact breaker point there is no change in ignition timing.
- Better starting of engine from cold.
- Its spark plug has longer life span
- It is less liable to arching around spark plugs

(c) Very few candidates attempted this question but were quite impressive in the responses given.

- Optical Sensors
- Inductive Sensors
- Hull Sensors
- Speed Sensors

AUTO MECHANICS 3

1. **GENERAL COMMENTS**

   The standard of the paper was comparable to that of the previous years.
   The performance of candidates was average, the same as that of last year.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

   (i) Most candidates were able to remove the clutch plate.
   (ii) Candidates were able to give a good observation of clutch and pressure plate after inspection.
   (iii) Candidates gave good report on inspection of the driving face of the clutch.
   (iv) Refitting of the clutch unit was well done by most candidates.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

   (i) Candidates removed the clutch pressure wrongly.
   (ii) Candidates could not explain themselves well when answering two relevant questions from the examiner.
   (iii) Removal pinion was a problem for most candidates.
   (iv) Candidates could not identify parts of the starter motor.
   (v) Inspection of the component parts was poorly done by most of the candidates.

4. **SUGGESTED REMEDIES**

   (i) Teachers should guide students in the selection of tools.
   (ii) Instructors should teach students to stager the process of the removal of the pressure plate holding bolts.
   (iii) Teachers should lecture candidates on the working principles of the clutch assembly and give them frequent oral tests.
   (iv) Candidates should be guided in the process of removing of the pinion and other parts of the starter.
   (v) Candidates should be taught names of components parts and the related faults upon inspection.

5. **DETAILED COMMENTS**

   Question 1

   From the engine provided:

   (a) remove the clutch unit. report to the examiner;
   (b) identify three parts as specified by the examiner;
   (c) inspect the clutch plate. report to the examiner;
   (d) inspect the pressure plate. report to the examiner;
   (e) inspect the driving face of the clutch. report to the examiner;

(f) refit the clutch unit. report to the examiner;
(g) answer two relevant questions from the examiner.

(a) Although most candidates were able to remove the clutch unit, candidates removed the holding bolts of the pressure plate serially instead of being staggered.
(b) Candidates were able to identify the parts of the clutch unit. They are the clutch plate, clutch disc and fly wheel.
(c, d & e) Most candidates were able to comment correctly on the state of the clutch plate, pressure plate and driving face. They could identify where they were weak or scratched.
(f) Candidates were able to correctly refit the clutch unit. The process is the reverse of removing the clutch unit.
(g) Two relevant questions from the examiner were fairly answered.

QUESTION 2

From the starter motor provided:

(a) dismantle the starter motor. report to the examiner;
(b) identify three parts as specified by the examiner;
(c) remove the pinion. report to the examiner;
(d) inspect the component parts. report to the examiner;
(e) refit the pinion. report to the examiner;
(f) reassemble the starter motor. report to the examiner;
(g) answer two relevant questions from the examiner.

(a) Dismantling of the starter motor was a problem for most candidates. candidates were unaware of the process of removing the locking circlip.
(b) Identifying the parts of the starter motor was difficult for candidates.
Some of the parts expected to be listed are:
  (i) armature motor
  (ii) carbon brushes
  (iii) solenoid
  (iv) commutator
(c) This question posted a great challenge to candidates.
(d) Some of the candidates performed averagely in this task. Physically, the inspection of the parts was good but when asked to use instruments such as the multimeter they were very poorly done.
To examine the condition of the parts by visual inspection, one checks for wear and cracks and weak springs. The multimeter checks for short circuiting.
(e) Candidates found difficulty refitting the pinion since most of them could not remove it correctly.

(f) Reassembling the starter motor was correctly done by majority of the candidates.

(g) Questions from the examiner were poorly answered. For instance, candidates did not know the function of the commutator. The commutator drives the brushes which draws current from the armature.

BUILDING CONSTRUCTION 2

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of the previous years. Candidates performance was average.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Most Candidates' handwriting were legible enough for easy communication.
(ii) Some candidates produced good sketches to explain their responses.
(iii) Candidates numbered their responses neatly.
(iv) Most candidates correctly used jargons associated with the subject in their responses.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Some candidates answered less questions whiles others answered more than demanded by the rubrics.
(ii) Most candidates did not label their sketches well or did not label them at all.
(iii) Some candidates could not spell certain terminologies correctly.

4. SUGGESTED REMEDIES

(i) Teachers must do in-depth teaching and endeavour to complete the syllabus with candidates.
(ii) Teachers must give candidates lots of class exercises and assignments to expose them to the demands of the final examination.
(iii) Candidates interest in the subject must be stimulated by positive influence by teachers by visiting sites and organising practical lessons with them.
(iv) Candidates must be encouraged to read novels, handouts, textbooks and related materials to improve upon their vocabulary and spellings.

5. DETAIL COMMENTS

Question 1

(a) State one duty of each of the following construction personnel:
- **(i) Architect;**
- **(ii) Quantity surveyor;**
- **(iii) Building inspector.**

(b) Sketch each of the following bricklayer's tools:
- **(i) Spirit level;**
- (ii) **Wooden float**.

(c) State three activities involved in site clearing.

(a) Few candidates were able to answer this question very well. Most candidates' responses were not clear and convincing enough. The expected responses include:

(i) Architect: - He designs the building

- He oversees the construction of the building.

(ii) Quantity Surveyor: - Prepares bill of quantities;

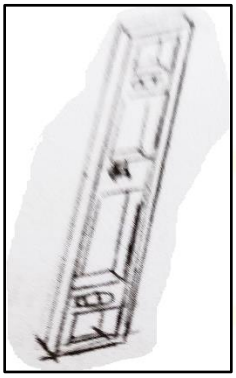
- Measures and keeps checks on variations.

(iii) Building Inspector: - Is responsible for ensuring that a building project is approved by the local authorities before work commences on site.

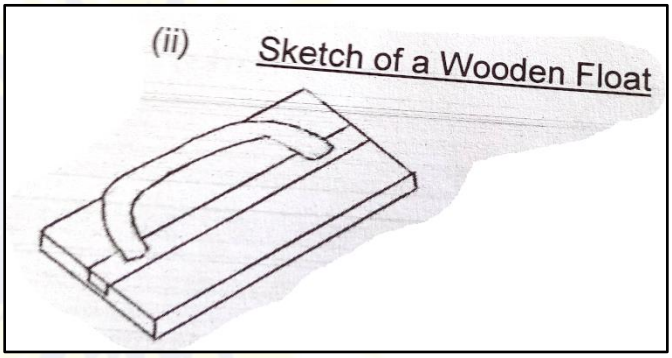
- Ensures that the local authority bye-laws are observed or enforced on site.

(b) Most candidates were able to produce the sketches of the tools. A few however sketched the tools in two-dimensional instead of pictorial. The correct sketches are shown below:

(i) A sketch of Spirit level



(ii) Sketch of a Wooden Float



(c) Candidates produced very good responses to this question.

Question 2

(a) State one use of each of the following building drawing:

(i) site plan;

(ii) sectional drawing.

(b) Sketch to illustrate a method of supporting the sides of a trench in a firm soil and label the following parts:

(i) poling board;

(ii) folding wedges.

(c) State the function of each of the following elements in a suspended timber ground floor:

(i) air brick;

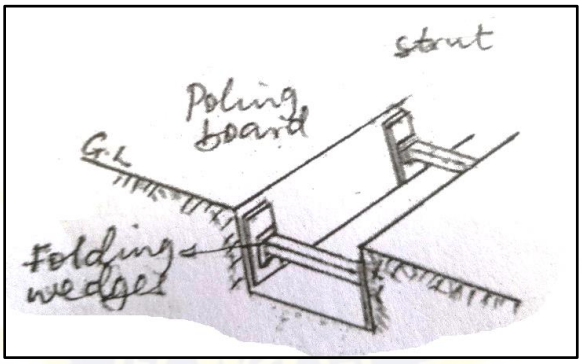
(ii) sleeper wall;

(iii) oversite concrete.

(a)(i) Most candidates who answered this question could not differentiate between building plan and a site plan. A site plan is used to: show the location of utility services; show boundaries of other owners; show the positions of natural features on the site or area.

(ii) Most candidates correctly stated the use of sectional drawings.

(b) Most candidates were able to show a sketch of the trench in place with some of the supporting members in the right position. The sketch of the folding wedges to keep the timber members firm was not shown. Most candidates also did not label the parts to be labelled well. The required sketch is shown below:



(c) Most candidates were able to state the function of the elements listed.

Question 3.

(a) List three methods of transporting fresh concrete from the ground to an upper floor.

(b) Sketch a straight flight timber stair and label the following parts:

(i) string;

(ii) newel post;

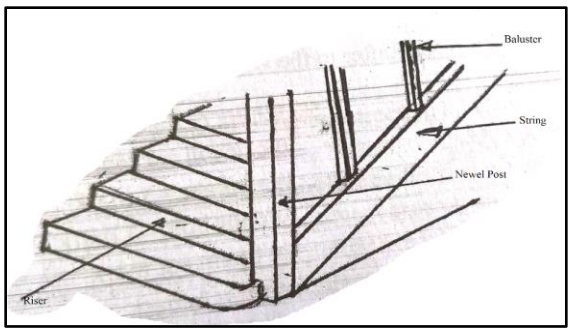
(iii) riser;

(iv) baluster.

(c) List three materials used for the construction of a window sill.

(a) Reasonable responses were given by most candidates.

(b) Most candidates were able to sketch the straight flight staircase. However, instead of the straight flight timber stair, some candidates sketched a concrete stair. The sketch is shown below:



(c) Most candidates were able to list the correct materials used for construction of a window sill. The materials include: wood, plastic, metal, clay tiles, bricks, stones.

Question 4.

(a) State three functional requirements of a roof.

(b) Use a sketch to illustrate the method of fastening a roof rafter to the ring beam.

(c) List three materials used for the manufacture of drain pipes.

(a) Candidates who answered this question answered it very well. They demonstrated their understanding in roof covering.

(b) A few candidates were able to produce good sketches to answer the question. However, some candidates sketched the rafter and the tie beam or collar beam without the wall plate. Others also could not position the ragbolt at the right place.

(c) Most candidates could not answer this question well. Most candidates mentioned sand, cement, water, iron rods, etc which showed their lack of understanding of the question. The expected answers include; pitch fibre, vitrified clay, cast iron, asbestos cement, concrete. This question was well answered by many candidates.

Question 5

(a) State two activities involved in landscaping work.

(b) List three materials used for pavement construction.

(c) State two reasons for the construction of kerbs on access roads.

(a) and (b) These questions were very popular among candidates. Most candidates were able to answer them very well.

(c)Most candidates stated the two reasons for the construction of kerbs. A few however stated wrong responses such as; to beautify the road; and to know the length of the road. Kerbs are actually used in road construction to:

- define pedestrian walkway;
- prevent erosion on the sides of the road;
- define the width of the vehicular road.

BUILDING CONSTRUCTION 3

1. **GENERAL COMMENTS**

   The standard of the paper compares favourably with that of the previous years. The performance of the candidates was very good compared with that of the previous year.

2. **SUMMARY OF CANDIDATES STRENGTHS**

   (i) Most candidates expressed themselves very well in the English Language.

   (ii) Most candidates showed improvement in producing neat sketches of constructional details.

   (iii) Most candidates numbered their work very well and presented well-arranged work that made for clarity and ease of reading.

3. **SUMMARY OF CANDIDATES WEAKNESSES**

   (i) Most candidates could not label their sketches well especially in the use of arrow heads.

   (ii) Most candidates did not read and follow the dictates of the rubrics.

   (iii) Some candidates exhibited poor handwriting skills.

4. **SUGGESTED REMEDIES**

   (i) Teachers and candidates should devout much time to teach and practice the use of arrow heads when labelling objects in sketching.

   (ii) Candidates should be impressed upon to read the rubrics of every paper before they start answering questions.

   (iii) Candidates should be encouraged to practice how to write clearly when writing examinations.

5. **DETAILED COMMENTS.**

Question 1

Fig. 1 shows a cross-section through a domestic building, with a trussed rafter roof construction over the main building and a reinforced concrete flat roof over the garage. Use it to answer the following questions:

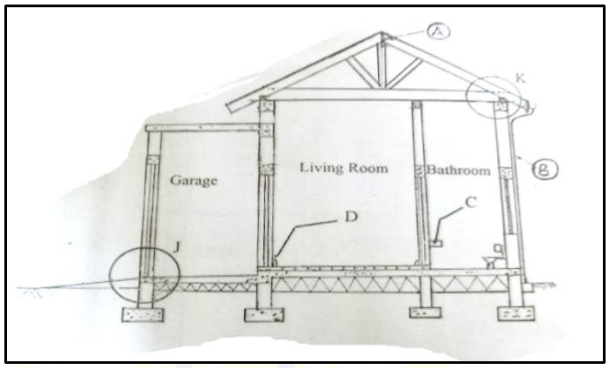


Figure 1

(a) (i) Identify the elements labelled A, B and D;

(ii) State one function of each of the elements A, B and D.

(b) Sketch the constructional detail at J and label the following elements:

(i) sub structural wall;

(ii) hardcore filling;

(iii) concrete floor slab;

(iv) concrete ramp.

(c) Sketch the constructional detail of the roof portion labelled K and label the following elements:

(i) rafter;

(ii) fascia board;

(iii) wall plate;

(iv) concrete tie beam;

(v) rag bolt.

(a) Most candidates answered this question very well. A few however could not spell the names of some of the elements correctly.

A few also could not state the function of the element **D** which is a "skirting board". The skirting board is used to cover the joint or space between the floor and the wall.

(b) Most candidates answered this question very well. However, majority of those who answered this question left out the sketch of the concrete ramp. A few also placed the

concrete ramp far below the ground floor level in front of the garage which was inappropriate. The required sketch is shown below.

Concrete ramp

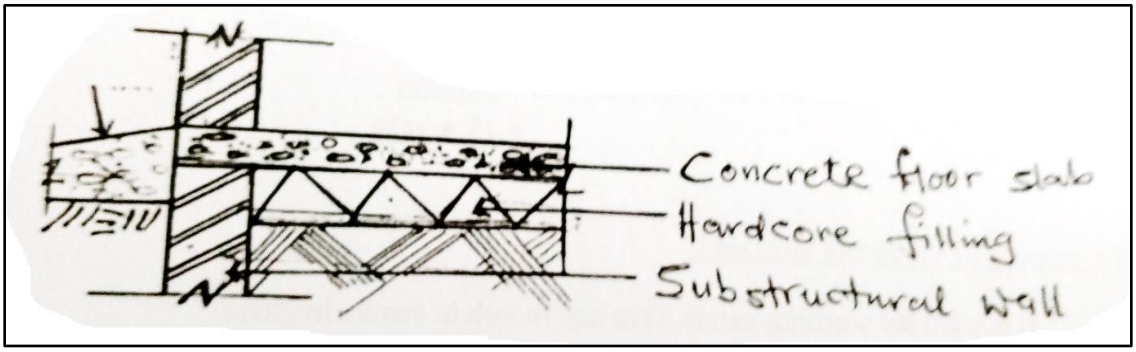


Figure 2

(c) Most candidates produced good sketches to answer this question. A few however left out the sketch of how the rag bolt is used to anchor the timber roof structure to the concrete tie beam and mixed up the labelling of the roof tie beam and a concrete tie beam. The required sketch is shown below:

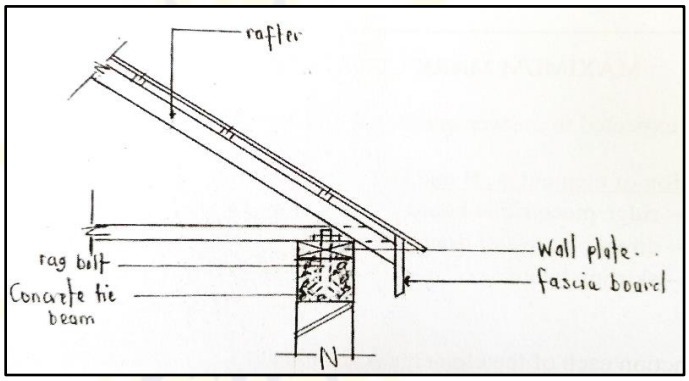


Figure 3

This question was appropriately answered by most of the candidates.

<u>Question 2.</u>

(a) State three factors that must be considered when choosing a timbering system for supporting the sides of a foundation trench.

(b) (i) List three tools used for setting out a building.

(ii) List three materials used for setting out a building.

(c) Sketch a wide strip foundation for a sand crate block wall and label the following parts:

(i) wide strip;

(ii) blinding;

(iii) steel reinforcement;

(iv) wall.

(a) Candidates responses to this question were mixed. While the question demanded factors that determine the type of timbering system, some mistook the factor to be those to be considered when choosing a wooden material for the timbering system and stated responses like; resistance to insect attack; availability of materials; etc. The required answers include:

- Nature of soil;
- depth of the trench;
- how long the trench is to be left opened;
- topography of the ground to be excavated.

(b) This was a very popular question among candidates and most of them answered it very well.

(c) Most candidates were able to produce the sketch of the wide strip foundation. A few however produced ordinary strip foundation instead of the strip. Again, a few candidates could not place the steel reinforcement appropriately in position. Others also used the representative symbol for brick wall instead of the block wall demanded by the question.

The required sketch is shown below:

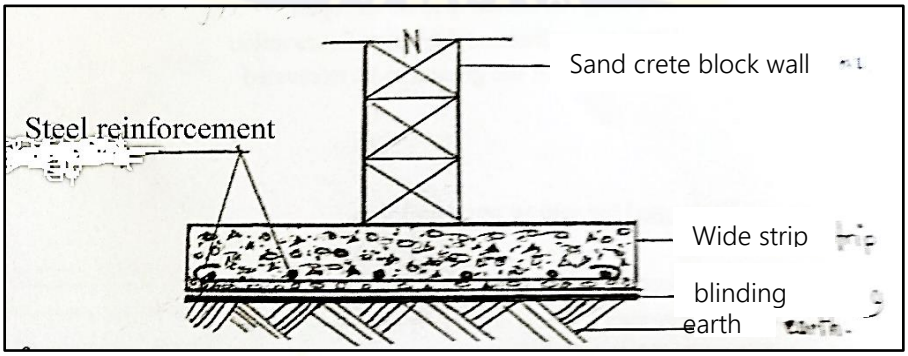


Figure 4

<u>Question 3</u>

(a) Explain the reason for using steel reinforcement bars in a suspended concrete floor slab.

(b) Sketch in elevation to illustrate each of the following in brickwall construction:

(i) English bond;

(ii) Flemish bond.

(c) State one function of each of the following in stair construction:

(i) landing;

(ii) handrail;

(iii) balustrade.

(a) Most candidates could not answer this question well. Most of those who attempted this question said reinforcement bars are used to "strengthen the concrete floor slab to make it last for a long time" which technically is incorrect. The reason for using steel reinforcement bars in suspended concrete floor slab is:

- The loads (self-weight and imposed) on the slab causes the slab to bend (in flexure). The bending of the slab induces internal compressive and tensile stresses in the thickness of the slab. The steel reinforcement bars are used to resist the internal tensile stresses.
- They are also used to resist temperature stresses as a result of changes in temperature induced expansion and contraction in the slab.

(b) Candidates performance in this question was very poor. Most candidates produced stretcher bond for both the English bond and the Flemish bond. Others also drew double lines for perpends and the bed joints even in elevation. The required sketch is shown below:

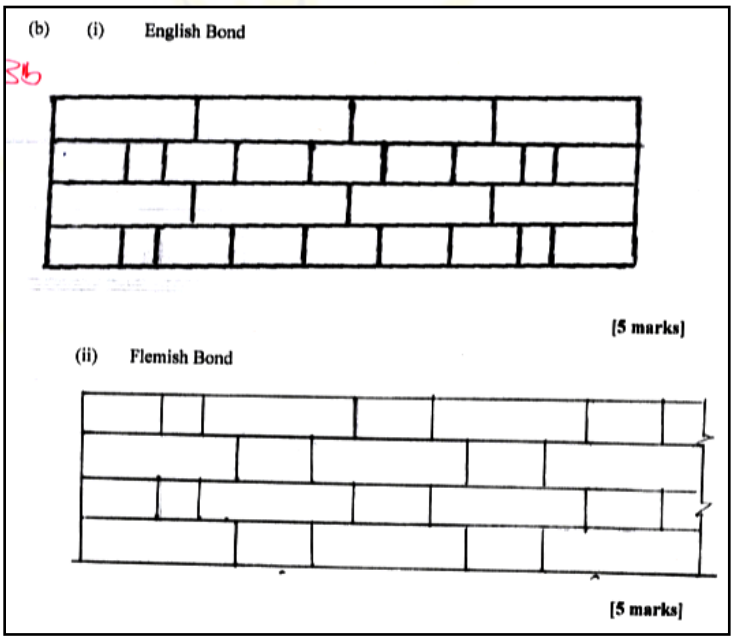


Figure 5

(c) Majority of candidates performed very well in this question. Most answers were apt.

Question 4

(a) State four desirable qualities of a floor finish.

(b) Sketch a longitudinal section through a sandcrete blockwalled inspection chamber and label the following parts:

(a) blockwall;

(b) benching;

(c) concrete base;

(d) concrete cover.

(c) List two parts of a cold-water storage tank.

(a) Most candidates who answered this question did very well. They provided the required responses for the question.

(b) The question asked for the sketch of the longitudinal section but most of the candidates produced the cross-sectional section. The required sketch is shown below:

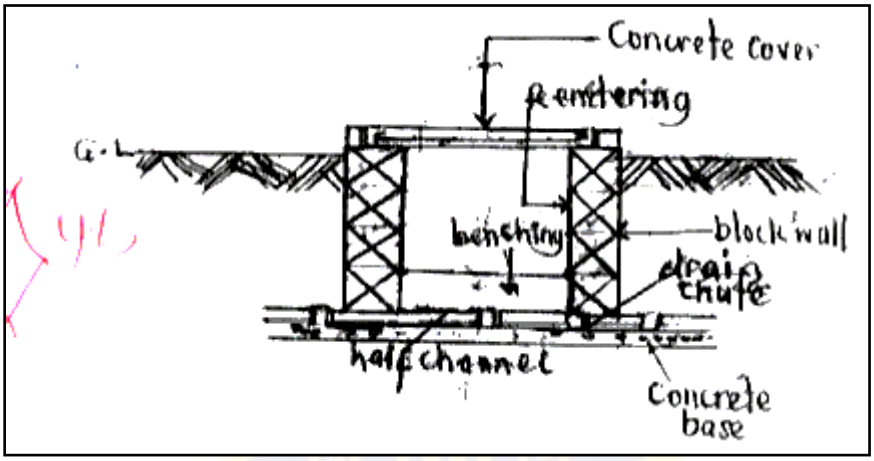


Figure 6

(c) A few candidates were able to list the parts of the cold-water storage system correctly. Most candidates listed components such as air vent pipe, air lock, etc which were not correct.

The required answers include: Inlet pipe; outlet pipe; cover; overflow pipe; ball valve, etc.

<u>Question 5.</u>

(a) Sketch the ledged, brace and battened door and label the following parts:
- **(i) ledge;**
- **(ii) brace;**
- **(iii) batten.**

(b) State one function of each of the following parts of a fence wall:
- **(i) foundation;**
- **(ii) wall;**
- **(iii) coping.**

(c) Sketch the representative symbol for each of the following electrical fittings:
- **(i) one-way switch;**
- **(ii) filament lamp;**
- **(iii) fuse.**

(a) This question was the best answered. Most candidates produced neat sketches of the match boarded door and labelled the parts correctly. A few however could not label the neat sketches they produced.

(b) This question was answered correctly by most candidates. Some candidates however answered the question out of context. Their answers were related to parts of a building instead of a fencewall.

The required functions include:

(i) **Foundation**: - supports the fence wall; provides a firm base for the wall.
(ii) **Wall:** - defines the property boundaries; for beautification.
(iii) **Coping:** - it ties the fence wall elements together; it prevents infiltration of rainwater into the wall.

(c) Most candidates could not sketch the representative symbols of the stated fittings. Instead most of the candidates sketched the pictorial sketches of the fittings. The required symbols are shown below:

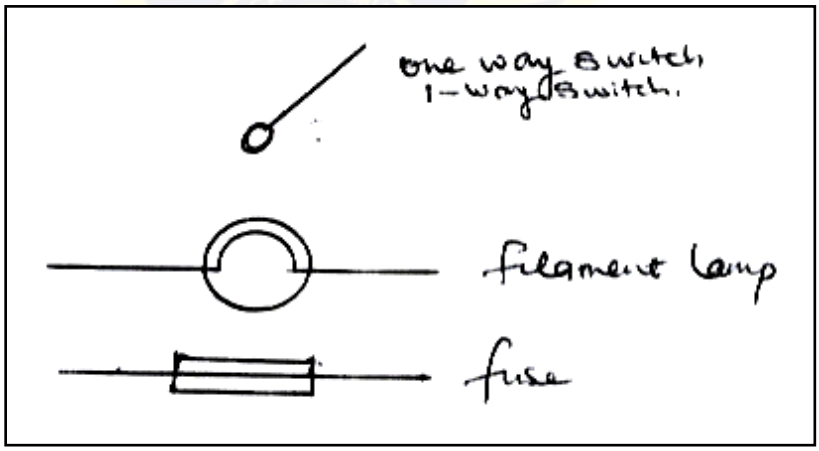


Figure 6

Question 6

(a) State three reasons for underpinning a building.
(b) State the use of each of the following construction activity documents:
(i) interim valuation certificate;
(ii) minutes book;
(iii) delivery note.
(c) List five parts of an independent metal scaffold.

(a) Very few candidates were able to answer this question correctly.
The required answer include:

- Stabilise an existing weak foundation of a building or to strengthen weak foundation;
- Strengthen a shallow foundation;
- Deepen an existing foundation for it to rest on a firm stratum.

(b) and (c) These questions were answered by very few candidates and they answered them correctly.

(b)(i) Interim certificate: enables the contractor to receive payment of work done or executed.

(ii) Minutes book: It contains the official record of the business of meeting related to the project.

(iv) Delivery note: a document which the foreman or a recipient signs to indicate the quality of goods and their condition at the time of delivery.

(c) Parts of independent scaffold include: standard, sole plate, base plate, platform, ledger, brace.

ELECTRONICS 2

1. **GENERAL COMMENTS**

The standard of the paper and the candidates' performance as compared to previous years was fair.

There were no ambiguous questions. All the seven questions were from the topics within the syllabus.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Candidates were able to respond appropriately to most of the questions.
(ii) Most of the candidates followed the instructions on questions very well.
(iii) The time allocated for the paper was judiciously used hence the candidates need to be commended.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Most of the candidates were not able to respond to questions about explanation and calculations.
(ii) Candidates' performance on communications topics were poor.
(iii) Candidates' ability to recall basic formulae was poor.

4. **SUGGESTED REMEDIES**

(i) Candidates should be encouraged to memorize the basic formulae and be able to recall as such.
(ii) Candidates should be encouraged to read text books or use the internet facilities to broaden their knowledge in the subject.

5. **DETAILED COMMENTS**

Question 1

(a) Explain the following terms:
  (i) primary cells;
  (ii) secondary cells.
(b) List three types of oscillators.
(c) State three applications of secondary cell.

Most of the candidates did not do well in explaining the terms as in the (a) part of the question but did well in the (b) and (c) parts.
Candidates' performance was on the average.

Question 2

Figure 1 is the circuit diagram of a series L – C circuit.

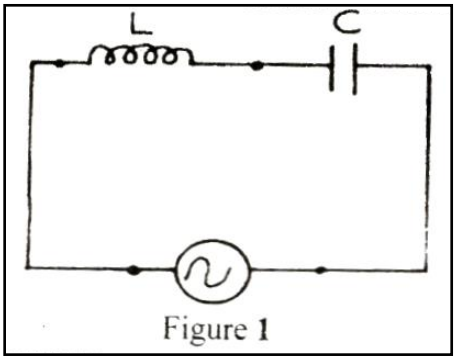


Figure 1

(a) Derive a formula for the resonance frequency.

(b) In Figure 1 if the inductance (L) and capacitance (C) are 2 mH and 4 μA respectively, calculate the

(i) resonance frequency;

(ii) inductive reactance.

Candidates were asked to derive a formula for the resonance frequency and;

(b) calculate (i) resonance frequency $f_0 = \frac{1}{2\pi\sqrt{LC}}$

(ii) inductive reactance. $2\pi fL$

Most of the candidates could not recall the steps in deriving the formulae as in **(a)** but were able to calculate the inductive reactance.

Candidates' performance was below average.

Question 3

A transistor has a common emitter gain (β) of 100. If the base current is 20 μA, calculate the:

(i) collector current;

(ii) emitter current;

(iii) common base current gain (α);

(iv) common collector current gain (γ).

The question was about common emitter amplifier (CE). Candidates were asked to calculate for the following;

(i) Collector current (Ic)

(ii) Emitter current (Ie)

(iii) Common base current gain

(iv) Common collector current gain

The performance was poor since those who attempted the question could not recall the formulae therefore the answers were wrong.

Question 4

(a) Explain the following terms with respect to control systems:

(i) command;

(ii) controlled variable.

(b) Classify the following devices into open loop or closed loop control systems:

(i) gas cooker;

(ii) microwave oven;

(iii) bathroom water heater;

(iv) deep freezer;

(v) a stopwatch;

(vi) soldering iron.

The question was about control systems where candidates were asked to explain the following terms in a part of the questions.

(i) Command (ii) Controlled variable

(b) Classify some devices into open and closed loop control systems.

Majority of the candidates could not explain the terms as in a part but were able to classify the devices accordingly.

Performance was on the average.

Question 5

(a) Define the term voltage gain of an amplifier.

(b) Figure 2 is an inverting operational amplifier circuit.

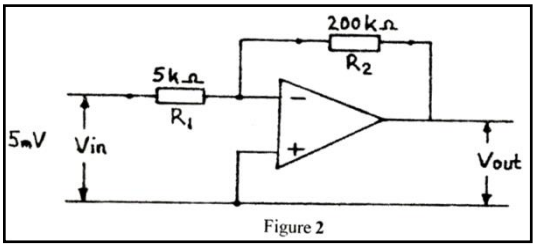


Figure 2

Calculate the:

(i) voltage gain;

(ii) output voltage (Vout)

(c) List two applications of operational amplifier.

The question was about operational amplifier candidates were asked to

(a) Define voltage gain of an amplifier.

(b) Calculate (i) voltage gain

(ii) output voltage

(c) List two applications of operational amplifier.

(i) $Av = \frac{R_2}{-R_1}$ (ii) $Av \frac{Vout}{Vin}$

Although most of the candidates attempted the question, the performance was poor due to lack of recall of basic formulae.

Question 6

(a) Explain the following processes:

(i) modulation in transmitters:

(ii) mixing in radio receivers.

(b) State the type of modulation used in transmitting the PAL television signals:

(i) video;

(ii) sound.

(c) State the values of the following in PAL television receivers:

(i) horizontal frequency;

(ii) vertical frequency.

The question was about communication. The candidates were asked to explain the following:

(i) modulation process in transmitters

(ii) mixing process in radio receivers.

(b) state the type of modulation used in transmitting PAL television signals.

(i) Video (AM) (ii) Sound (FM)

(c) (i)State the horizontal frequency = 15625Hz

(ii) The vertical frequency = 50Hz.

Most of the candidates could not explain the terms but were able to state the modulations and the frequencies correctly.

Performance was on the average.

Question 7

(a) Figure 3 is the switching arrangement of a logic circuit.

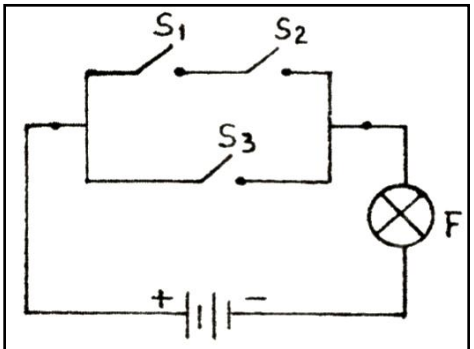


Figure 3

Copy and complete Table 1 using Figure 3 stating condition of output lamp (F) either on or off.

Table 1

S_1	S_2	S_3	*Output* (F)
open	open	open	
open	open	close	
open	close	open	
open	close	close	
close	open	open	
close	open	close	
close	close	open	
close	close	close	

(b) Write the Boolean expression for the output (F) in terms of the inputs S_1, S_2, and S_3.

a. The question was about logic gates. Candidates were asked to complete a table based on three switching arrangements.

b. Write the Boolean expression for the inputs S_1, S_2, and S_3.
$(S_1 . S_2) + S_3 = F$

Most of the candidates were able to complete the table correctly but could not write the Boolean expression.

The performance was very good.

ELECTRONICS 3

1. **GENERAL COMMENTS**

The standard of the paper and the performance of the candidates this year was good.
The overall performance of this year's paper as compared to previous year was very good.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Majority of the candidates were able to perform both experiments appropriately.
(ii) Candidates were able to use the readings to draw the graph according to their scales.
(iii) Candidates followed the rubrics outlined in the questions.
(iv) Most candidates did well in using the given formulae to calculate for the V_x per the question in the experiment 2.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Some of the candidates were not able to transfer the theory knowledge into practical activities so as to reflect on the performance.
(ii) Candidates provided irrelevant information such as drawing the circuit diagrams from the questions before answering them which was not demanded in the rubrics.
(iii) Majority of the candidates had problem with multimeter readings and calibrations.

4. **SUGGESTED REMEDIES**

(i) Candidates should be encouraged to relate theory knowledge to the practical understanding of every electronics topics.
(ii) Candidates should be provided sufficient measuring instruments if possible during the exams.
(iii) Teachers should be allowed more periods for practical activities during training.

5. **DETAILED COMMENTS**

Candidates were provided with the following apparatus:
One d.c. stabilized power supply unit (0-12 V);
Two voltmeters;
One LM 317 IC voltage regulator;
Two 1.0 kΩ, ¼ W resistors;
One 2.2 kΩ, ¼ W resistors;
One 3.3 kΩ, ¼ W resistors;
One 4.7 kΩ, ¼ W resistors;
One 5.6 kΩ, ¼ W resistors;
One toggle switch (S);
One soldering iron with resin-cored solder;
Veroboard/Quick test board;

Connecting wires;
Long nose plier;
Side cutter

Question 1

AIM: To investigate the effect of varying input voltage on the output of an LM 317 IC voltage regulator.

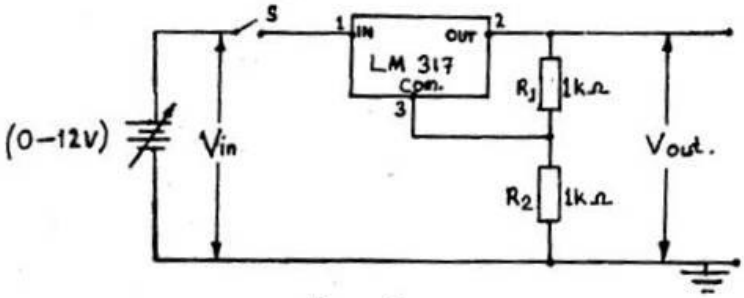


Figure 1

(a) Connect the circuit diagram as shown in Figure 1.
(b) Ask the supervisor to check the circuit connection.
(c) Copy Table 1 into your answer booklet.

Table 1

***V*in (V)**	***V*out (V)**
1	
3	
5	
7	
9	
11	

(d) Close switch (S)
(e) Set *V*in to 1 V by adjusting the power supply unit.
(f) Read and record in Table 1, the corresponding value of *V*out.
(g) Repeat steps (e) to (f) for the other values of *V* in Table 1.
(h) Open switch (S)
(i) Plot a graph of *V*out (V) on the vertical axis against *V*in (V) on the horizontal axis.
(j) From your graph deduce the regulation voltage of the voltage of the LM 317 IC for the circuit.

The question required that the candidates should perform experiment using voltage regulator IC.

Candidates were asked to investigate the effect of varying input voltage on the output of an LM317 IC.

Candidates were to use the readings to draw a graph of *V*out (V) on the vertical axis against *V*in (V) on the horizontal axis.

From the graph, candidates were to deduce the regulation voltage of the LM 317 IC.

Candidates' performance was good.

Question 2

AIM: To investigate how to set the output voltage of LM 317 IC voltage regulator.

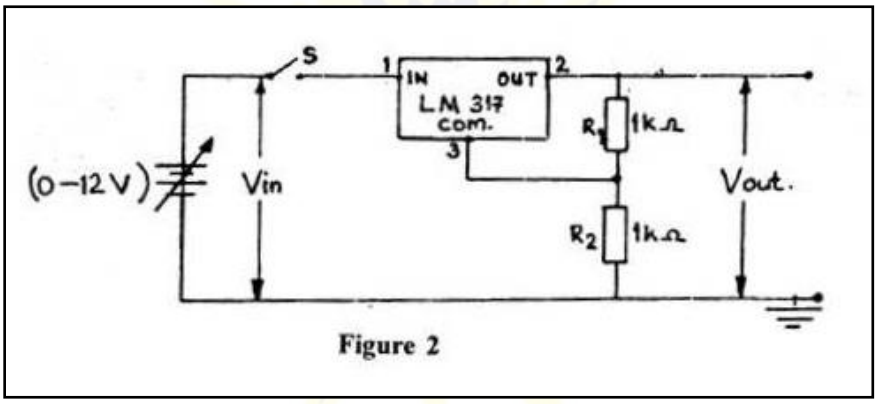


Figure 2

(a) Connect the circuit diagram as shown in Figure 2.

(b) Ask the supervisor to check the circuit connection.

(c) Copy Table 2 into your answer booklet.

Table 2

R_2 (KΩ)	*V*out (V)	$V_x=1.25(\frac{R_2}{R_1}+1)$
1.0		
2.2		
3.3		
4.7		
5.6		

(d) Close switch (S).
(e) Set *V*in to 12 V by adjusting the power supply unit.
(f) Read and record in Table 2, the corresponding value of output voltage (*V*out).
(g) Open switch (S)
(h) Replace R_2 with the 2.2 KΩ resistor.
(i) Repeat steps (e) to (g) for the other values of (R_2) in Table 2.
(j) Complete Table 2, by computing the values of V_x
(k) From your results in (j) compare the values of *V* out and V_x
(l) State how the output voltage of the LM 317 IC voltage regulator circuit is set.

The question required that the candidates should perform experiment using the same IC LM 317.
Candidates were asked to investigate how to set the output voltage of LM 317 IC voltage regulator.

Candidates were to change the value of R_2 as in Table 2 respectively.

From the results, candidates were to compare the values of *V*out and V_x for the different values of R_2 using the given formular in Table 2.

Candidates performance was good.

INFORMATION AND COMMUNICATIONS TECHNOLOGY (ELECTIVE) 2

1. GENERAL COMMENTS

The standard of the paper compared favourably with the previous papers in the areas of content and level of difficulty.

The paper was within reach of the candidates and besides, the general performance was good.

2. SUMMARY OF CANDIDATES' STRENGTHS

(i) Candidates answered the questions as demanded by the rubrics.
(ii) A greater number of the candidates expressed themselves much better in the English Language than it had been the practice in previous years.
(iii) Most candidates gave correct and brief answers.
(iv) The coherence and concise way most candidates responded to questions under digital culture and computer monitor should be commended and encouraged.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Majority of the candidates did not plan their answers before writing them down.
(ii) Some of the candidates had bad handwriting.
(iii) Most of the candidates had difficulty in the command of programming concept and lack of expression.

4. SUGGESTED REMEDIES

(i) Candidates should read through the questions carefully, select those that they can answer; and then plan the answers before writing them out.
(ii) Handwriting of candidates should be checked and advice appropriately during class assignments.
(iii) Candidates should learn with suitable textbooks, materials on ICT and carefully use the Internet as a learning tool.
(iv) Teachers should be encouraged to take students through practical and theory aspects of the syllabus.

5. DETAILED COMMENTS (QUESTION BY QUESTION)

Question 1

Convert the following hexadecimal fractions to binary:

(a) 0.3B;
(b) 0.4DE;
(c) 0.5C8.

A large proportion of the candidates answered the question by first converting the hexadecimal fractions into decimal and then followed by binary. Most of the candidates had it difficult in converting from decimal to binary. The safest approach was to treat each digit in the given numbers as a decimal and convert them separately into binary. Ensure that each digit was made up of **four** binary digits, but preced each of them which was less than **four** digits with zeros to make up of the four digits.

The following is the solution:

DIGIT	BINARY EQUIVALENT
3	0011
B	1011
4	0100
D	1101
E	1110
5	0101
C	1100
8	1000

Hence:

(a) $0.3B_{16}$ converts to 0.00111011_2

(b) $0.4DE_{16}$ converts to 0.010011011110_2

(c) $0.5C8_{16}$ converts to 0.010111001000_2

Question 2

(a) What is e-learning?

(b) List five learning technologies used in the classroom.

(c) What is multimedia as used in education?

Most of the candidates who attempted this question exhibited a good knowledge was exhibited by candidates who answered this question.

The required solution follows:

(a) E-learning refers to a network-enabled transfer of skills and knowledge, and the delivery of education made to a large number of recipients at the same or different times.

(b) Learning Technologies include the following:

i. Digital projector/Projector
ii. Digital camera
iii. Smart board

iv. Tablet
v. Desktop computer
vi. Laptop computer
vii. Cellular phone
viii. WhatsApp
ix. Spreadsheet
x. Word processor
xi. Presentation software
xii. Database application
xiii. Digital watch
xiv. Social media
xv. Audience feedback systems
xvi. Electronic whiteboard
xvii. Flipped learning
xviii. Video conferencing classroom technologies
xix. Television
xx. Computer networks

(c) Multimedia refers to the use of computers to present text, graphics, video, animation and sound in an integral way.

Question 3

(a) What is computer monitor?

(b) List:

(i) three types of computer monitors;

(ii) three ports on the system unit that the computer monitor can be connected to;

(iii) two colours of light generated by a computer monitor.

This question attracted an average number of fairly good answers. In b(ii), candidates could not distinguish between ports in general and the ports on the system unit that the computer monitor can be connected to.

The suggested solution follows:

(a) A computer monitor is a hardware that displays the video and graphics information generated by the computer through the video card.

(b) (i)

(1) Cathode Ray Tube (CRT)
(2) Liquid Crystal Display (LCD)
(3) Light Emitting Diode (LED)

(4) Organic Light Emitting Diode (OLED)
(5) Plasma/Plasma Gas
(6) Touch Screen.

(ii)
(1) High density multimedia interface (HDMI) port
(2) Digital visual interface/Digital video interface (DVI) port
(3) Video graphic array (VGA) adapter
(4) Universal serial bus (USB) port
(5) Display port
(6) Thunderbolt
(7) S-Video port
(8) Parallel port
(9) Component port
(10) e-Serial Advanced Technology Attachment (e-SATA) port.

(iii)
(1) Red
(2) Green
(3) Blue

Question 4

(a) What will the following commands return in an electronic spreadsheet application?
(i) NOW();
(ii) MIN().

(b) Using the NESTED IF function in spreadsheet packages, write a program code that calculate the grades of students using the information below, assuming cell A2 holds the mark 65.

MARKS	**GRADES**
From 80 to 100	**A**
From 70 to 79	**B**
From 60 to 69	**C**
From 40 to 59	**D**
Below 40	**F**

Less than fifty percent of the candidates who attempted this question produced satisfactory answers. The performance on the (a) part was slightly better than the (b) part.

The solution is as follows:

(a) (i) NOW () - This will return the date and time of the day.

(ii) MIN () - This will return the minimum/least number/value among a group of numbers/values.

(b) =IF(A2>=80," A", IF(A2>=70," B", IF(A2>=60,"C", IF(A2>=40," D", "F"))))

Question 5

(a) What is an algorithm?

(b) Write an algorithm to convert a temperature in Celsius (C) to Fahrenheit (F) scale. NB: $\frac{9}{5}$C + 32.

(c) State *two* differences between the END and STOP statements in QBASIC programming.

There were a few satisfactory answers to part (a), but parts (b) and (c) were not approached well by most of the candidates who attempted this question.

The solution is as follows:

(a) An algorithm is the step-by-step procedure designed to perform an operation which will lead to the desired result of a user if followed correctly. It has a definite beginning and a definite ending.

(b) START
Accept the value of the temperature in Celsius
Compute the value in Fahrenheit using the accepted Celsius value
Display the value in Fahrenheit
END

(c)

(d) (i) STOP statements terminate execution of a BASIC program while the END statements mark the textual end of a BASIC program.

(ii) A STOP statement marks the logical end of a program while the END marks the physical end of a program.

(iii) There can be multiple STOP statements in a program but only one END statement to a program.

(iv) STOP is executable while END is non-executable.

INFORMATION AND COMMUNICATIONS TECHNOLOGY (ELECTIVE) 3

1. GENERAL COMMENTS

The standard of the paper and that of the previous year compared favourably. It was noted that, candidates' performance was very good.

2. SUMMARY OF CANDIDATES' STRENGTHS

Candidates were able to:

(i) code in HTML and created indentation for readability;
(ii) create table in spreadsheet application;
(iii) declare QBASIC variables and read input data;
(iv) write codes for finding prime factors using QBASIC.

3. SUMMARY OF CANDIDATES' WEAKNESSES

(i) Candidates could not format background colour of the HTML properly. Even though some of them produced background colours, the contrast made reading of the texts very difficult.
(ii) There were difficulties in the creation of hyperlinks to allow flow between appropriate web pages.
(iii) Most of the candidates did not create loops in the QBASIC code to allow inputting different data which would be used to verify whether the two different types of results (PRIME and NOT PRIME) can be outputted.

4. SUGGESTED REMEDIES

(i) Teachers must continue to make efforts to improve the logical reasoning skills in candidates to help them develop good programming skills.
(ii) Teachers must pay attention to the curriculum requirements. They must stress on the technical approach in teaching ICT.
(iii) Candidates must be encouraged and assisted to pick up personal ICT projects. This project must be structured in a manner which will compel them to eventually be practical in their approach to the subject.

5. **DETAILED COMMENTS (QUESTION BY QUESTION)**

Question 1

HTML

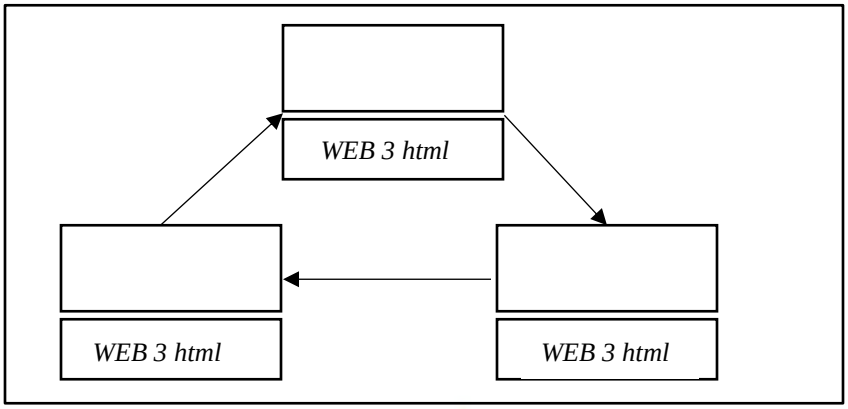


Figure 1

The question required candidates to create 3 html web pages and create hyperlinks that will allow the flow between pages as shown in Figure 1. It required the use of a *Text Editor*.

The solution to the question is expected to follow the pattern explained below.

HTML is a standard and the layout follows a specific structure to allow for correct interpretation for presentation. The structure of an html document is as follows:

```
<!DOCTYPE html>
<html>
<head>
<title>Title of the document</title>
</head>
<body ATTRIBUTES>
The content of the document.
</body>
</html>
```

It must be noted that the title is part of the head tag. Placing it outside the head is not a correct structuring even though you can have the title correctly displayed.

The body tag is not part of head tag as some have sort to do.
Setting the background colour
This is explained according to W3Schools.com as follows:
HTML <body> **bgcolor** Attribute

HTML <body> tag

Example
Specify a background color for an HTML document:

```
<html>
<body bgcolor="#E6E6FA">
<h1>Hello world!</h1>
<p><a href="https://www.w3schools.com">Visit W3Schools.com!</a></p>
</body>
</html>
```

Definition and Usage
The **bgcolor** attribute specifies the background color of a document.
Syntax
<body bgcolor="*color_name*|*hex_number*|*rgb_number*">
Attribute Values

Value	Description
color_name	Specifies the background color with a color name (like "red")
hex_number	Specifies the background color with a hex code (like "#ff0000")
rgb_number	Specifies the background color with an rgb code (like "rgb(255,0,0)")

(a)
(i) Compatibility Notes
The <body> bgcolor attribute is not supported in HTML5. Use CSS instead.
CSS syntax: <body style="background-color:#E6E6FA">
CSS Example: Set the background color of a document

```
<!DOCTYPE html>
<html>
<body style="background-color:#E6E6FA">
<h1>Hello world!</h1>
<p><a href="https://www.w3schools.com">Visit W3Schools.com!</a></p>
</body>
</html>
```

(b) Creation of hyperlink to allow movement from
i. **Error! Reference source not found.** TO **Error! Reference source not found.**
ii. **Error! Reference source not found.** to **Error! Reference source not found.**
iii. ***Error! Reference source not found.*** *to* ***Error! Reference source not found.***

It should be noted that the flows are specific. This flow is designed using the HTML <link> tag.

According to W3Schools we have the following:

HTML **Links**

Links are found in nearly all web pages. Links allow users to click their way from page to page.

HTML links are hyperlinks. You can click on a link and jump to another document.

When you move the mouse over a link, the mouse arrow will turn into a little hand.

Note: A link does not have to be text. It can be an image or any other HTML element.

1. HTML Links - Syntax

Hyperlinks are defined with the HTML <a> tag:

link text

Example

Visit our HTML tutorial

The href attribute specifies the destination address (https://www.w3schools.com/html/) of the link.

The **link text** is the visible part.

Clicking on the link text will send you to the specified address.

Note: Without a forward slash at the end of subfolder addresses, you might generate two requests to the server. Many servers will automatically add a forward slash to the end of the address, and then create a new request.

Local Links

The example above used an absolute URL (a full web address).

A local link (link to the same web site) is specified with a relative URL (without https://www....).

Example

HTML Images

(W3Schools, nd)

Use of HTML header tags

The question required candidates to display date of birth on WEB1, surname on WEB2, and home town on WEB3 using header 1, header 2, and header 3 tags respectively. This means header 1 should be used in writing date of birth; header 2 should be used to write surname, and header 3 should be used to write home town.

Most of the candidates used only one header throughout while some did not use any at all.

According to W3Schools,

HTML **<header>** Tag

Definition and Usage

The <header> element represents a container for introductory content or a set of navigational links.

A <header> element typically contains:

- one or more heading elements (<h1> - <h6>)
- logo or icon
- authorship information

You can have several <header> elements in one document.

Note: A <header> tag cannot be placed within a <footer>, <address> or another <header> element.

Example

A header for an <article>:

```
<article>
 <header>
  <h1>Most important heading here</h1>
  <h3>Less important heading here</h3>
  <p>Some additional information here</p>
 </header>
 <p>Lorem Ipsum dolor set amet....</p>
</article>
```

Candidates were required to use the <h1></h1>, <h2></h2>, and <h3></h3> tags on web pages 1, 2, and 3 respectively.

A solution to the question therefore will look as follows:

The following will be the solution if the CSS alternative is used:

WEB1.html	<!DOCTYPE html> <html> <head> <title>Your full name and index number</title> </head> <body bgcolor="#E6E6FA";> WEB 2 <header> Put your date of birth here </header> </body> </html>

WEB2.html	<!DOCTYPE html> <html> <head> <title>Your full name and index number</title> </head> <body bgcolor="#E6A6FA"> WEB 3 <header> Put your surname here </header> </body> </html>
WEB3.html	<!DOCTYPE html> <html> <head> <title>Your full name and index number</title> </head> <body bgcolor="#E6EDFA"> WEB 1 <header> Put your home town here </header> </body> </html>

Question 2

SPREADSHEET

The requirement is to use a spreadsheet application to create a table and save it as RESULT in the folder created on the computer desktop.

The exact naming of the table is critical. Its placement in the folder created is critical. You can manually search for a document on the computer through various techniques even if you forgot the name. However, during the execution of a program, the name and its location must be ***exact*** otherwise the program cannot find it.

Table 1 is the table provided as data for the work.

Table 1

STUDENT NAME	ICT	MATHEMATICS	ENGLISH	HISTORY
Arthur Raphael	40	90	60	75
Asuande-Eshun Famiye	80	50	70	65
Ganyo Akosua	30	70	40	80
Ackah-Artur ruth	90	60	50	40
Appiah Joy Geogette	50	80	60	30
Ashokoor Akweley	70	45	80	20
Sampson Kofitse Kwesi Yao	60	80	75	35

Most of the candidates carried out further work in this table. Some candidates did all the work in one table and saved it in one filename of their choice.

The question required candidates to

(a) format the STUDENT NAME column using word wrap command.

Most of the candidates did not do this. Word wrap automatically flows text unto the next line if the typed text is more than the number of characters allowed on the line defined by setting the width of that line in that section of the screen. Candidates could have verified the correctness of their format table by reducing the width of the STUDENT NAME column of the table and noting its effect on the typed text.

(b) Inserting the title "SECOND TERM EXAMINATION RESULTS" on top of the created table using merge and center feature.

The solution to this part of the question is not a page header. It is to be inserted directly on top of the table.

To fulfil the requirements of this question, we have to first insert a blank row on top of the table depending on whether we started entering the table from the first row or a row other than the first. If we started from a row other than the first, then there will be no need to insert a new row.

(c) We are required to save up to this point in our work as MODIFIED in the folder created.
(d) The next level of work was to be carried out as a continuation of what we have done so far. Thus, we save a copy of it in the name of the next required file (SORTED) and then continue working.

The next section of the question required that we create two columns for

i. Total Score
ii. Lowest Score

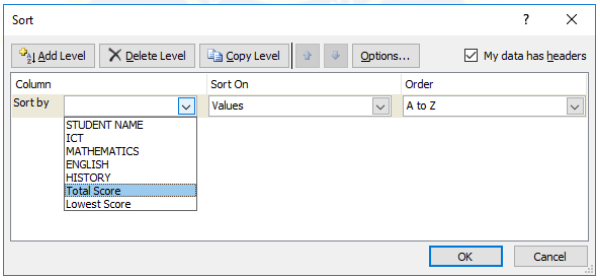
We achieve this by simply typing these column titles on fresh columns next to the right of the HISTORY column →

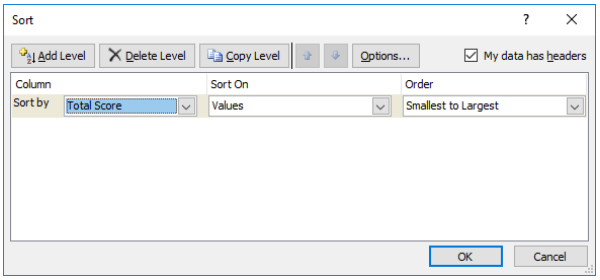
(e) The question at this point requires the computations of the values for Total Score and Lowest score. This is not the total of all the scores entered in the table, nor the lowest of all the scores entered in the table. It is required for each candidate row by row. Thus, we insert the formula for doing this computation row by row in the Total Score and Lowest score cells for the rows.

(f) The worksheet was to be sorted in descending order of the total score and saved as SORTED.

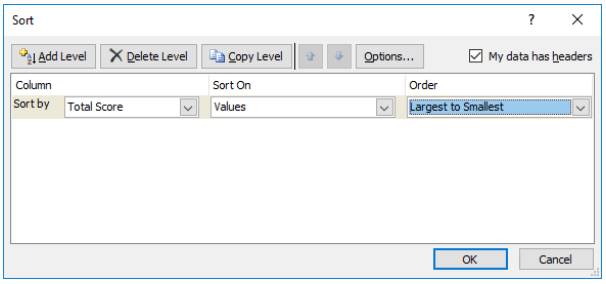
To perform the sort, we select the table cells *without selecting the title.* We will select the column headings but not the table title we inserted in the merged cells →

Select the *Data* menu tab and then select *Sort* from the Sort & Filter section. The resulting screen will be as follows →
Select *Total Score* in the *Sort By* dropdown list →





Ensure that the order is Largest to Smallest for sorting in descending order



Click OK to complete the work.

(g) To this point, we save our work. Remember we have already made a copy of the previous saved work and saved it as SORTED before doing this portion of the work. Having finished for SORTED, finally save this level of work. Just issue shortcut CTRL-S to save and continue to the next level because the file is already named SORTED.

The remaining work is to be carried out as a continuation of what we have done so far. Thus, we save a copy of it in the name of the next required file (FINAL_RESULT) and then continue working →

(h) Candidates were to use the Auto-Filter feature of Excel to extract records of students whose total score are above 280

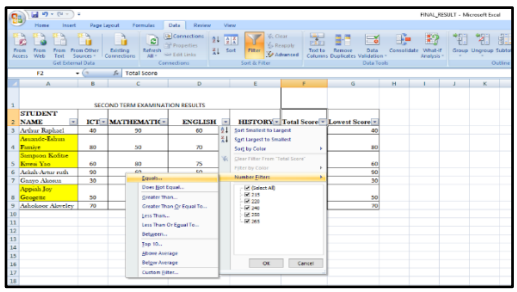
To do this, select any cell within the table. Select the Data menu tab and select *filter* feature from the Sort & Filter section→

Note the dropdown button against all the table headers. Because we are filtering according

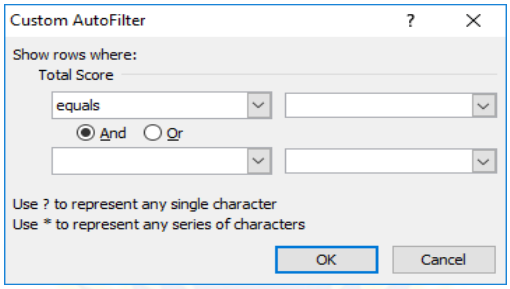
Note that there is no 280 in the list of numbers. At first, we might say we will select the numbers we don't want. That will result in the following screen→

Notice that after deselecting all the numbers because they do not match our needed selections, we are not able to complete the task by clicking OK. The OK button is not available to us to be clicked. That implies we needed to do something different from just deselecting unwanted numbers.

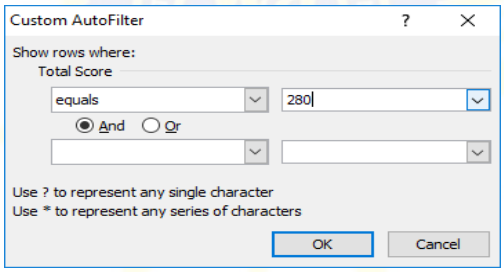
We need to use the *Number filter* option and select the criteria *Equals*→



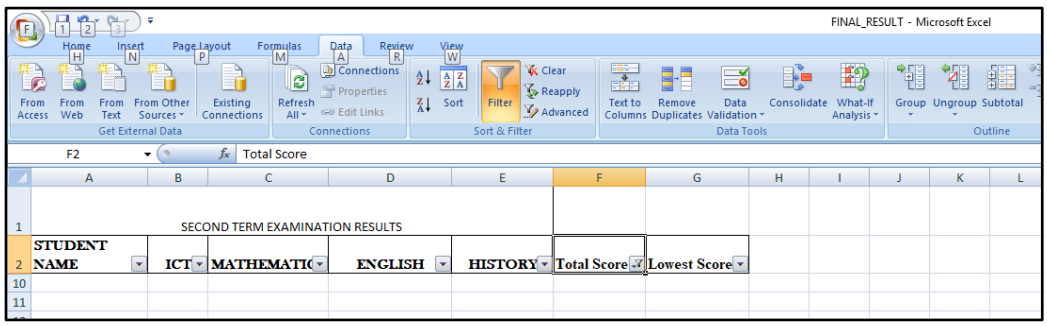
We get the following screen that gives us the chance to complete the definition of our criteria →



We will type 280 as the number we wanted filtered out→



The result will be as follows→



Notice that there are blank rows of students. This is because no student got scores that match 280.

Question 3

QBASIC

There has been a much-improved attempt on this question. That notwithstanding, majority of candidates did not attempt it.

A good number of candidates wrote algorithms that tested beyond the possible limit for reaching the possible result of whether the number is a prime number or not. Even though this algorithm will still determine the result, it would have run for a wasted period of time before coming out with the result.

Many also run codes that were for determining prime numbers in the range from 2 to the inputted number. This is not what the question required.

Since there are two types of results expected from the running of the code, the algorithm needed to be looped for not less than 2 times to allow for the input of a possible PRIME number and a possible NOT PRIME number. This loop was lacking in the code of candidates.

A prime number is a number which has only two prime factors made up of itself and 1. Hence to test if a number is a prime number or not, we can check for its prime factors and see if they are only two.

The following is a basic outline pseudo code. Sample codes have also been added to assist test coding for solving the problem.

```
Declare variable for the number as Numeric type (N)
Declare a counter (C)
Start loop 1
Set initial value of the counter
Input a number (N)
Start Loop 2
        Determine a prime factor of N
        If prime factor found, then increment counter (C=C+1)
End loop 2
Based on the value of the counter, determine if the number is a PRIME NUMBER
Otherwise it is NOT A PRIME number.
Format the result as the number and indication of whether it is PRIME or NOT PRIME
Print output on screen
End loop 1
```

Algorithm for Prime Factorization

The simplest algorithm to find the prime-factor is by repeatedly dividing the number with a prime factor until the number becomes 1.

Prime factor Algorithm

```
FOR j = 1 TO 15
   INPUT N
   Ntemp = N
   p = 2
   DO WHILE N >= p * p
      IF N MOD p = 0 THEN
         N = N / p ' (divide by prime number)
      ELSE
         p = p + 1
      END IF
   LOOP
   IF Ntemp = N THEN PRINT "Prime number"
NEXT j
```

Since this algorithm is testing for prime factors, we modify it to check the number of prime factors found apart from 1. If the prime factor found is the number itself, then the number is a prime NUMBER. Otherwise, it is NOT a PRIME NUMBER. Or, if we countered the prime factors and it is only one (being the number itself) or 2 being the count of the number and one, then the number is a prime number. Otherwise it is not.

```
FOR i = 0 TO 10 ‘a dummy number used for iteration
   INPUT "Enter number"; N
   p = 2
   count = 0
   DO WHILE N >= p * p
      IF N MOD p = 0 THEN
                  ‘a prime number has been found
         N = N / p '/ (divide by prime  number)/
         count = count + 1
      ELSE
         p = p + 1
      END IF
   LOOP
   IF count = 0 THEN
```

```
      PRINT N; "is a PRIME NUMBER"
   ELSE
      PRINT N; "is NOT A PRIME NUMBER"
   END IF
NEXT i
```

A candidate's solution

CLS INPUT "Enter any number "; N PRINT "Prime factor(s) of "; N; "="; FOR i = 1 TO N c = 0 FOR j = 1 TO i IF i MOD j = 0 THEN c = c + 1 NEXT j IF N MOD i = 0 AND c = 2 THEN PRINT i; NEXT i END	This candidate's algorithm only finds the prime factors from 1 to the number N that has been inputted. There is the need to use the result to determine whether the input number is a prime number or not. Hence the solution is not complete for testing for prime numbers. To make this code determine whether the input number is a PRIME NUMBER or NOT A PRIME NUMBER, the prime factors obtained from this algorithm must be tested to be only two numbers which should be equal to the number inputted and 1.

METAL WORK 2

1. **GENERAL COMMENTS**

The standard of the paper was comparable to that of previous years. The questions were straight forward and within the scope of the syllabus.

Performance of candidates was average.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Candidates who prepared well provided good responses.
(ii) Candidates answered the required number of questions.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Lack of knowledge of the subject.
(ii) Inability to painstakingly select questions they can reasonably answer.

4. **SUGGESTED REMEDIES FOR THE WEAKNESSES**

(i) Candidates need to take the study of the subject seriously. It was noted that in most cases candidates did not even understand the questions. Metal work tutors need to do a little extra to make the subject understandable to candidates.
(ii) There is the need for candidates to read all the questions well before selecting those ones they can answer.

5. DETAILED COMMENTS

Question 1

(a) State two safety precautions to be observed in forging operation.

(b) (i) What is extraction of metals?
(ii) List the two methods of metal extraction;
(iii) State two methods of preparing iron or prior to smelting operations

(c) State three effects for not applying finishes on a finished metal article.

(a) This was a popular question. Most candidates provided good responses.
(b) Majority of the candidates stated safety precautions to be observed in forging operation.
(c) Some of the candidates failed to understand the demands of the question.

Almost all candidates who attempted this question were able to state the effects for not applying finishes on a finished metal article.

Question 2

(a) (i) List three types of cooling media for heart treatment of metals.
(ii) Which cooling medium is appropriate for hardening?
(b) State three importance of heat treating metals.
(c) State one use of each of the following hand tools:
(i) Scriber;
(ii) Try square.

Majority of the candidates answered this question and provided good responses.

Question 3

(a) (i) What is casting?
(ii) State three sequential processes involved in casting.
(iii) What is porosity?
(b) With the aid of a labelled sketch, explain upsetting in forging.

The question proved popular with candidates most of whom produced reasonable answers. However, some of the candidates had problems with stating three sequential processes involved in casting and providing a labelled sketch and explaining upsetting in forging. The sequential processes involved in casting include; making a pattern, preparing a mould (that is; cavity) and pouring the molten metal into the cavity.

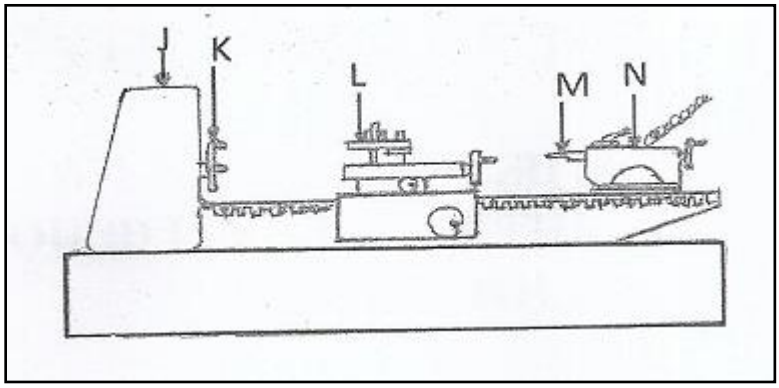
Question 4

(a) Sketch the following tools;
(i) Bick iron;
(ii) Round bottom stake.
(b) Explain the term tinning the bit.
(c) (i) What is ergonomics?
(ii) State three ergonomic statements in designing.

(a) Majority of the candidates could not produce good sketches.
(b) Some candidates successfully explained the term
(c) Majority of candidates failed to state the ergonomic statements.

Question 5

(a) Use the sketch below to answer the questions that follow:



(i) Identify the parts labelled J, K, L, M, and N;

(ii) State one function each of the parts J, K, and L.

(b) State the purpose of the following parts of ball pein hammer:

(i) wedge;

(ii) pein.

(a) Some candidates could not identify and state the function of some parts identified. The responses required are; J-Head stock, K-Driving plate, L-Tool post, M-Dead centre, and N-Tail stock. Function of parts J, K, and L are; J-Head stock contains all the gears and mechanisms necessary to obtain a suitable range of spindle speeds; K-Driving plate-it is an accessory used to hold the work piece; L-tool post-it is used for holding lath turning tools

(b) The second part of the question was satisfactorily answered.

METAL WORK 3

1. **GENERAL COMMENTS**

Generally, the 2019 WASSCE - Metalwork 3 paper was up to the required standard. It was expected that every average candidate with all the basic skills at hand could perform the exercises with less difficulty. The various skills which were tested were all activities required to be studied within the syllabus specification.

The questions were valid and relevant. The marking scheme which was designed to assess candidate's performance was broad in content and capitalized the needed skills required to realize the artefact.

Many candidates performed marvellously well with distinction. As compared to those of previous years, this year's candidates' performance could be graded high.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Candidates' ability to cut metal parts and filing the size had improved.
(ii) Candidates interpreted the detailed drawing perfectly well.
(iii) Majority of the candidates attempted the fitting exercise and could finish it within the stipulated time period.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Candidates refused vigorous marking out before cutting out and filing
(ii) Candidates lacked proper and effective handling of tools and equipment required to be used for the exercise. Lack of practical competence in the selection of various bench tools and how to use them effectively and productively. The practical test was time-bound.
(iii) Majority of the candidates opted to perform the fitting exercise in lieu of the machining exercise.

4. **SUGGESTED REMEDIES FOR THE WEAKNESSES**

(i) Candidates should be encouraged to mark out profiles on work pieces before commencing any cutting or filing.
(ii) Candidates should be given enough opportunity to work and practice in the school workshop.
(iii) Candidates should be purposely trained to use and work on the centre lathe machine tool.
(iv) Candidates should be trained to appreciate the use of the metric calibration scale in performing the exercises.
(v) Candidates should overcome stage fright and develop confidence to use various machine tools e.g. lathe machine and the drilling machine for the machining exercise.

5. DETAILED COMMENTS

Candidates were given two questions involving a practical fitting exercise and a practical machining exercise and candidates were required to choose only one of the two questions and practically work through to realize the final artefact.

Question 1

Candidates were given the following materials; flat mild steel plates, 52mm x 52mm x 3mm (2 OFF) to enable them to prepare the parts per the dimensions and sizes specified on the detailed drawing attached to the question. After finishing the preparation of the parts, candidates were also required to assemble the pieces in the right order of arrangement to manifest the final realization of the product.

After obtaining the work piece material, the candidates were expected to mark out the profile of work as indicated on the working drawing, by applying the dimensions specified on the work piece.

When that was done, candidates were further required to dot punch through the defined profile to make it more conspicuous.

After this stage, candidates were expected to cut through the dot punched profile, close to the finished dimensions hence, leaving just few thons of material to be finished; filed to size.

These processes ought to be followed through to obtain the two parts; that is, Part A and Part B which constitute the assembly of the artefact.

Question 2

Candidates were supplied with one piece free cutting mild steel rod, ϕ50mm x 70mm.

Candidates were required to use the material to produce a machine part in accordance with the dimensions and sizes stated on the detailed view of the machine part in the diagram attached to the question.

This was not a popular question and only few candidates attempted to produce the part by using the lathe machine. Most of the schools lacked the lathe machines and those schools who have the machines, have left them in deplorable state lacking the necessary maintenance.

Candidates were expected to follow these steps to enable them to produce the part.

They were required to mount the work piece supplied to them between the lathe centres – that is, the spindle centre (life centre) and the tailstock centre (dead centre) after centre drilling the two ends of the work piece.

Prior to carrying out these activities, the two ends ought to be faced smooth and square.

Candidates were again expected to turn down the work piece from 50mm diameter to 46mm diameter by applying heavy cuts; that is rough machining and finishing to the exact size with round nose tool.

After performing the parallel turning, obtaining the 46mm diameter of the stock, the undercut 5mm x 3mm depth on the work ought to be machined with specially ground tool having the required shape (5mm wide).

After performing the undercut within the middle halve of the stock, one end of the work piece ought to be gripped in a chuck for the hole diameter 10mm to be drilled to depth length of 25mm.

Upon completing these activities, both ends of the work ought to be machined to a chamfer 2 x 45^{o} to finish the exercise. The few candidates who attempted to produce the (machine part) failed to work to the specified dimensions and sizes. The exercise could not be completed.

Candidates had excess material to remove to reach the final expected size.

TECHNICAL DRAWING 2

6. **GENERAL COMMENTS**

The standard of the paper and candidates' performance as compared with those of the previous years were on the average.

7. **A SUMMARY OF CANDIDATES' STRENGTHS**

(i) Most candidates used correct type of pencils for their constructions. The pencil work was sharp thus they produced neat work. Outlines were clearly differentiated from construction lines.

(ii) Candidates did well by copying all the given views that they were asked to construct and placed their respective auxiliary views at their appropriate positions. Few candidates did exceedingly well by showing all the faces on the auxiliary views.

(iii) Few candidates did well to construct the true shape of the lamina and had the angle of inclination of the lamina to the horizontal. Few candidates constructed the true lengths of the lamina separately and then used the lengths so obtained to construct the lamina. A perfect achievement, but by so doing, the required angle of the lamina to the horizontal plane was not found.

(iv) Most candidates followed the procedure for the construction of the cycloid and did very well. Only few of the candidates who attempted the question had the correct position of the given point, on the cycloid and constructed the normal and the tangent accurately.

(v) Candidates used the given scales and constructed the space diagram accurately as well as the force diagram. The construction of the link/furnicular diagram was perfect.

(vi) Candidate's construction in general was neat and accurate. The shear force and bending moment diagrams were neat and accurate.

8. **A SUMMARY OF CANDIDATES' WEAKNESSES**

(i) Majority of the candidates did not use the correct type of pencils. They used BB pencil and thus their work was dirty. Some candidates produced double lines for the construction.

(ii) Candidates used different dimensions in copying the given views. Thus, the views were far away from each other. The auxiliary projections were at different angle other than 45° and the shape produce were wrong.

(iii) The given circle was not equally divided, and arcs were larger than others. The perimeter/circumference was unevenly divided. Candidates' work was poor and produced irregular curve. Their pencil work made their work very dirty

(iv) The position of the lamina was copied wrongly for both the front and plan views. The dimensions candidates selected were inaccurate and hence produced wrong shapes of lamina for the two given views.

(v) Candidates used wrong scale for the construction of the space diagram. The position of the loads were not perfect. Thick lines were used without arrow heads for the loads and reactions. Candidates used wrong scale for the force line therefore the force diagram was very large. The link polygon, shear force diagram and bending moment diagrams were wrongly constructed.

9. **SUGGESTED REMEDIES**

(i) Candidates should always use the correct type of pencil for their work. BB pencil is not recommended for constructional work.

(ii) When candidates were asked to copy views, they must always follow the given dimensions.

(iii) Views are always projected in one type of projections, either first or third angle orthographic. Candidates should always draw in one projection only for an object, but they should not combine the two projections for a given object.

(iv) Candidates must always adhere to the given dimensions only. The construction of the true shape of lamina requires constant practice and candidates are advised to make constant practices on the topic.

(v) Candidates are advised to do constant practice. In the construction of cycloid, shear force and the bending moment diagrams.

10. **DETAILED COMMENTS**

Question 1

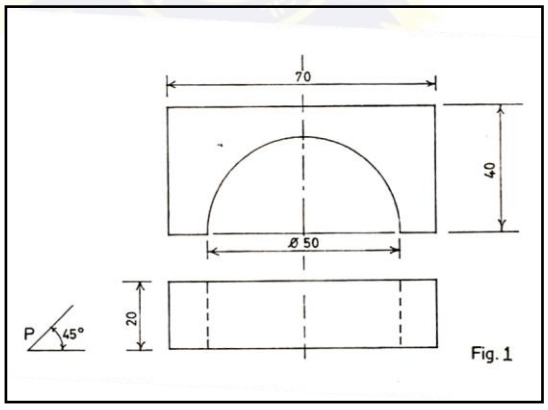


Fig.1 shows two views of a block. Copy the given views and draw the auxiliary elevation in the direction of arrow P. show hidden details.

Candidates did not copy the two given views accurately. Most of them increased or reduced the space between the front elevation and the plan. For the construction of the auxiliary elevation, candidates should have used all the dimensions. The semi-circular portion of the front view is divided into a number of equal parts i.e 6 parts. A vertical line is drawn besides the front elevation. Horizontal lines from the points on the circumference of the circular portion are drawn to intersect the vertical line and each intersecting point labelled. Lines at

45° are projected up from the plan on every intersecting point on the plan to the right end of the front elevation (position of auxiliary elevation). A common line 'XY' is drawn at 90° across the 45° lines indicating as a common base line of the front elevation and to be used at datum. Dimensions are taken separately and transferred on to the 45° line using the base line 'XY' while ensuring that each point on the face of the front elevation has been located. Straight lines and arcs are used to join the points together so as to obtain the various faces of the auxiliary elevation.

Most candidates projected the 45° line up and to the right of the elevation but did not continue. Candidates performance was fair.

Question 2

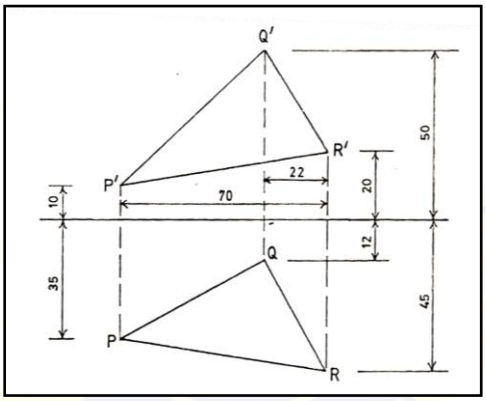


Figure 2

Two views of a triangular lamina *PQR* are shown in fig. 2. Copy the given views and determe:

(c) (i) the true shape of the lamina;

(ii). Angle to the horizontal plane.

(d) Measure and state the lengths of its sides.

Candidates constructed the given lamina in the front elevation and plan and performed very well in the construction. Few candidates tried to construct the true shape that would produce the angle of the lamina to the horizontal plane, but the method used was wrong. Few candidates used each side of the lamina and constructed the true length of the side which they later used the length or side so obtained to construct the true shape of the lamina. The method was acceptable but in this case the angle to the horizontal plane could not be obtained.

The method used to obtain the true shape is to draw the lamina into a single line thereby drawing parallel lines to each corner or edge. Then using the dimensions from the front elevation to locate each corner of the lamina.

Most candidates who attempted the question adopted the method of finding the true length of each side before using the sides so obtained to draw the true shape of the lamina.

Question 3

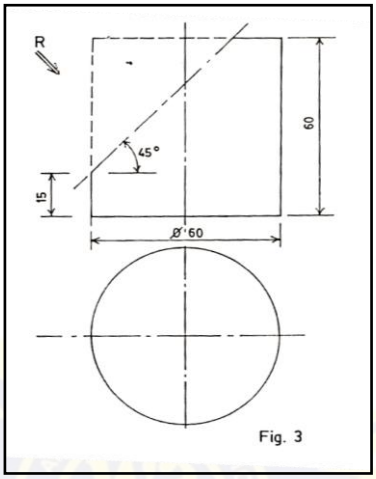


Fig. 3

Fig. 3 shows two views of a truncated cylinder. Copy the given views and draw the following:

(a) Complete plan;

(b) Auxiliary plan in the direction of arrow R. (Show hidden details)

Few candidates copied the front elevation and the plan, but their works were on the average. The plan was completed without hatching of the cut surface.

Few candidates produced development of the truncated object of the front elevation instead of projecting down at 45° to draw the auxiliary view.

Only few candidates projected down at 45° from the front elevation but they constructed two escribed circle and hatched one surface as the auxiliary plan.

Question 4

Plot the locus of a point P on the circumference of a circle diameter 60 rolling along a straight line without slipping.

Construct a tangent and a normal to the locus at a point 50 from the right end of the locus.

The given diameter Ø60 of the circle is divided into 12 equal parts and the circumference is drawn tangential and horizontal to the circle. Then the circumference is divided into same divisions as the circle vertical lines are drawn from the divisional points on the

circumference and horizontal lines from those on the circle. The intersecting points from both the horizontal and vertical lines are then used to obtain a smooth curve for the cycloid. The point P on the curve is measured from50 from the right end of the curve. The procedure for constructing tangent and normal are used at point P to complete the work.

Most candidates divided the circle Ø60 and drew the circumference or perimeter tangential but constructed the method of super trochoid other candidates constructed hyperbola. The second part of the question was not attempted by most candidates. Few candidates did wrong procedure for the construction of the tangent and normal.

Question 5

A simply supported beam of 5 metres span has loads of 2kN and 3kN at 2 metres and 3.5 metres from the right-hand support.

(a) Draw, to a scale of 1 mm = 0.05m the space diagram of the beam.

(b) Using a scale of 1 mm = 0.1kN, determine by construction, the magnitude of the reations at the supports.

(c) (i) Construct the shear force diagram.

(ii) State the value of shear force under the 2kN.

(d) Construct the bending moment diagram.

Most candidates drew the space diagram with wrong scale of the beam which made the diagram very large or small. Likewise, the force line so they become very large which covered almost half of the drawing sheet so after completing the construction, the whole page of the sheet. The link polygon, shear force and bending moment diagrams were wrongly constructed and they either became large or small.

Using the given scale of 1 mm = 0.05, the beam length 5m, is constructed to length 100mm with the 2kN and 3kN correctly positioned. The force line, 2kN and 3kN, is converted to 20mm and 30mm (i.e. 1mm = 0.1kN) and choosing a convenient pole distance the force diagram is drawn, using the radial lines. The link or furnicular polygon is constructed by drawing parallel lines to the radial lines from the force diagram and the corresponding intersecting points of the vertical lines from the space diagram. The shear force and bending moment diagrams are then constructed using the reverse shear force diagram. The two areas of the diagram are hatched.

Candidates did average work on the force diagram, link polygon, shear force and bending moment diagrams. Majority of candidates who attempted the question did not measure and convert the intersecting point of the force line. The intersecting point helps to obtain the magnitudes of the two reactions.

TECHNICAL DRAWING 3

1. **GENERAL COMMENTS**

   The standard of the paper has not changed as compared to previous years. The rubrics were clearly stated and well understood by candidates.

   The candidates' performance has shown an improvement compared to the previous years.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

   (i) The draughtsmanship in most cases is highly commendable.
   (ii) Most candidates were able to assemble the components parts in the mechanical option and drew to expectation.
   (iii) General performance of candidates compared to the previous years was on the average, quite encouraging.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

   (i) Pencil work was poor, most candidates did not use the right grade of pencils for their work.
   (ii) The right drawing conventions for building parts like, hardcore, earth filing, concrete slab and finished floor were not properly represented. Concrete roof with parapet wall and copping was not well drawn.
   (iii) Scaling was also a challenge, most candidates didn't adhere to the scales provided by the questions, especially in the building drawing.
   (iv) Almost all candidates used guided instruments for the Freehand sketches which the rubrics clearly stated that no instruments should be used other than the pencil.
   (v) Sectioning of different component parts was poorly done.
   (vi) Centrelines in the mechanical drawing were poorly drawn.

4. **SUGGESTED REMEDIES**

   (i) Teachers must do well to teach the use of various grades of pencils used in technical drawing.
   (ii) Teachers are advised to give enough exercises in freehand sketching for candidates to practice and also show them the techniques involved in freehand sketching.
   (iii) Teachers should take their students to building sites and show them the parts of the building from foundation to the roof. The teachers are advised to give more exercises to include the use of the scale-rule.
   (iv) Assembly drawing which is a challenge to candidates can be addressed by teachers taking students on field trips to appreciate the assembling of machine components especially in engines and mechanical components assembly.

5. DETAILED COMMENTS

Question 1

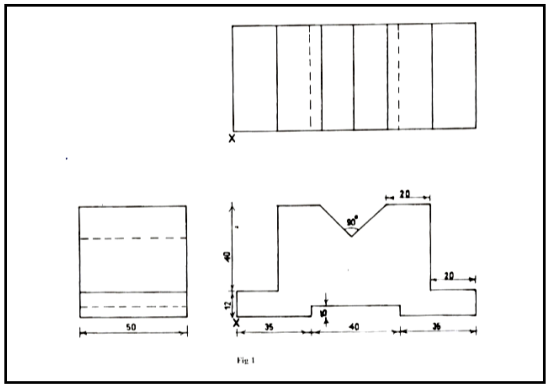


Figure 1 shows the third angle orthographic projection of a vee-block.
Make a freehand isometric drawing of the block, making X the lowest point.

Three views of a vee – block was drawn in third angle projection. Candidates were asked to sketch freehand isometric view of the block, making a particular point "X" as the lowest point.

Most candidates produced good sketches as answers, but with guided instruments. Majority of the candidates who used the guided instruments again used free-hand to go through their previous work.

The candidates' performance was above average.

Question 2

Make a neat freehand pictorial sketch of a straight pein hammer.

Most of the candidates could not differentiate between straight pein hammer from ball pein and cross pein hammers.

Majority of the candidates had problem in sketching the tool in pictorial form. A few of the candidates provided good sketches as answers.

The performance of the candidates was on the average.

Question 3

Make a neat freehand pictorial sketch of a twist drill.

This question was also to test candidate's knowledge of the common tools used in the workshop. Candidates were asked to make a pictorial sketch of a twist drill.

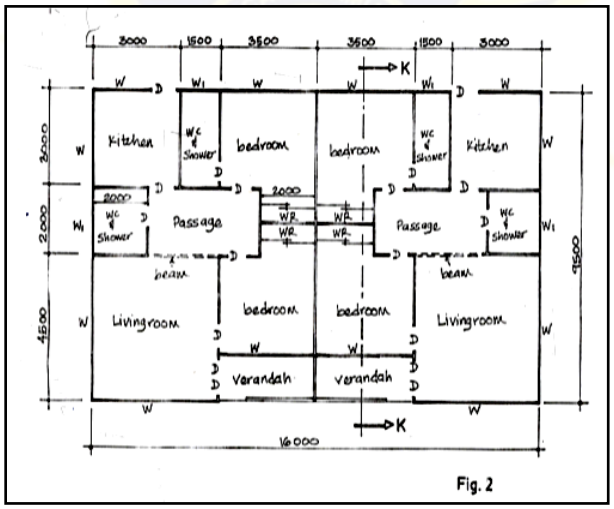
The candidates who attempted this question could not produce any good sketches as answers. The performance was poor.

Most of the sketches lack certain features and proportionality. Candidates should be taught how to draw or sketch in pictorial form. Candidates must be helped to use the technique in making pictorial sketches.

Candidates performance was good.

Question 4

Figure 2 shows the sketch plan of a twin 2-bedroom bungalow. Study the specifications and answer the questions that follow.



FOUNDATION: **675 X 225 concrete strip on 15 blinding at 1000 below the ground level.**

FLOOR: **250 hard core; 150 concrete; 25 terrazzo floor finish; floor level is 150 above the ground level; floor to ceiling 3100.**

WALLS: **All walls 225 with 13 mortar rendering on both sides.**

DOORS: **D-2100 X 900 X 38 flush in 150 X 50 timber frame; D_1D_1-2100 X 1200 X 25 glazed metal door.**

WINDOWS: **All casement glazed in metal frame; W_1-900 X 600;**

W-1800 X 1200.

WARDROBES: **WR-2100 X 2000 wooden with sliding doors.**

BEAMS/LINTEL: **225 x 225 reinforced concrete at 2100 above floor level;**
beams are located at entrances into veranda and passage.

VERANDA: **75 cylindrical hollow aluminium pipe fixed at 50 above 1000 high dwarf wall.**

ROOF: **25 bituminous felt roof finish;**
150 reinforced concrete slab;
300 X 300 X75 parallel concrete coping placed on high parapet wall;
25 deep roof gutters;
eaves projection 900.

(a) Draw, to a scale of 1: 100, the:
(i) floor plan;
(ii) front elevation.

(b) Draw, to a scale of 1:50, the sectional view on plane K-K.

A sketch plan of a house with the specification from the foundation to the roof was provided for candidates to study and answer the questions that followed.

Candidates were asked to draw to a scale of 1:100, the floor plan and front elevation of the building. They were also asked to draw the sectional elevation on plane K-K.

Most of the candidates provided good answers to this question but could not draw the concrete roof with the parapet wall and the copping on it.

Majority of the candidates did not have knowledge of the parapet wall and the copping. Few candidates drew the concrete roof.

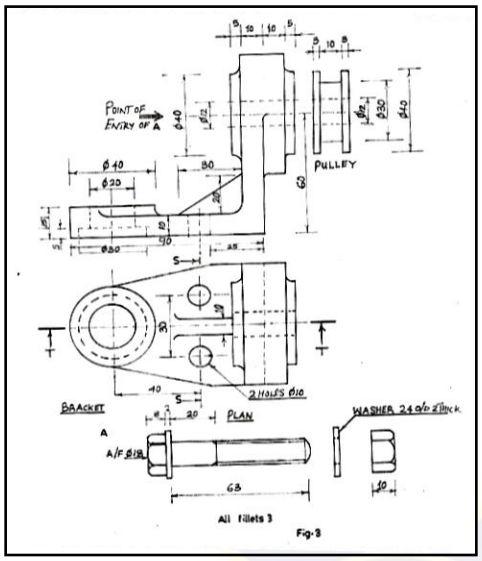
Candidates had problems with the arrangements of the following parts of the building, foundation footings, earth filling, hardcore, groundline, concrete slab and the floor finish.

The performance of the candidates was on the average.

Question 5

Figure 3 shows the parts of a bevel pulley mounting bracket. With the parts assembled, draw full scale, in first angle projection the:

(a) section from elevation on cutting plane T-T;



(b) sectional end elevation on cutting plane S-S;

(c) plan.

(Hidden details are not required)

A detailed part of a pulley bracket assembly was provided for candidates to assemble and draw, the sectional front elevation plan, and the sectional end elevation in first angle orthographic project of the pulley assembly.

Some candidates provided good answers, except that in few cases, the candidates could not place some of the parts in their correct places.

Most of the candidates drew holes without centrelines circles were also drawn without centrelines.

Sectioning of the various parts was a problem to some of the candidates. The performance of the candidates was good.

Writing the names of the various views was not properly done.

WOODWORK 2

1. **GENERAL COMMENTS**

The standard of the paper was good and compared favourably with that of the previous year. However, the general performance of the candidates was average as compared to the previous year.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

A few of the candidates performed very well in both section A and B as follows:

(1) Section A:

(i) Candidates were able to state correctly two (2) reasons for steaming a log for veneer production.

(ii) Candidates were able to list four (4) types of woodwork marking out tools correctly.

(iii) Candidates were able to list correctly methods of converting timber

(2) Section B:

Candidates were able to:

(i) Produce neat freehand pictorial sketches of the bookshelf with required features/specifications.

(ii) Present drawings of the bookshelf in the First Angle Orthographic Projection.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

Majority of the candidates demonstrated the following weaknesses:

(1) Section A:

Candidates were not able to:

(i) Arrange correctly in the sequence of planing a piece of timber.

(ii) State a method of testing for keenness of cutting edge of a tool when honing.

(2) Section B:

Candidates were not able to:

(i) Provide the necessary features of the bookshelf, i.e. 3 shelves, plinth and back covering.

(ii) Indicate the cutting plane on the front elevation.

(iii) Dimension the drawings.

(iv) Draw border lines and the title block.

4. **SUGGESTED REMEDIES FOR THE WEAKNESSES**

(i) Teachers should teach students the difference between First Angle and Third Angle Orthographic Projection and how to present them.

(ii) Candidates must be given enough exercises to enable them to acquire the skills necessary for satisfactory performance.

(iii) Candidates should be encouraged to use the appropriate pencils and clean their drawing instruments before using them.

5. DETAILED COMMENTS

SECTION A

Question 1

(a) Arrange in sequence the planing of the following on a piece of timber:

- **(i) Second end;**
- **(ii) Back face;**
- **(iii) Face edge;**
- **(iv) Face side;**
- **(v) Back edge;**
- **(vi) First end.**

(b) Two reasons for steaming a log for veneer production.

(a) All the candidates except a few attempted this compulsory question. A few of those who attempted were able to arrange the operation in the correct sequential order as follows:

(i) Face side;
(ii) Face edge;
(iii) Back edge;
(iv) Back edge;
(v) First end;
(vi) Second end.

(b) Most of the candidates answered this question correctly.

Question 3

(a) List four types of marking-out tools.

(b) State two ways of maintaining the efficiency of hand tools which are not in daily use.

(c) State one method of testing for keenness of a cutting edge when honing.

(a) Majority of the candidates answered this question very well.

(b) Most of the candidates lacked the knowledge and skill for maintenance of hand tools in the workshop. However, a few of them stated correctly the two ways.

(c) A few candidates were able to answer this question correctly.

The required answers are:

(i) Cutting a thin strip of paper with the edge;

(ii) Cutting thin wood shavings with edge
(iii) Cutting finger nails with the edge.

Question 4

(a) State two reasons for seasoning timber
(b) List two methods of converting timber
(c) Use a sketch to show cupping defect in timber

(a) Majority of the candidates were able to answer this question correctly.
(b) All candidates who attempted this question listed two methods of converting timber correctly.
(c) Majority of candidates were able to sketch the cupping defect in timber. A few however, sketched the bowing defect instead

SECTION B

A bookshelf is to be designed to the following specifications:

Overall height-1200;
Width-1200;
Depth-400.

(All dimensions are in millimetres)

The bookshelf is mounted on a plinth. It has three shelves.

1. **Make two preliminary pictorial sketches each for a different design of the bookshelf.**
2. **Select one of the sketches in question 1 and indicate the sketch selected with a tick (√).**

To a scale of 1:10, draw in the First Angle Orthographic Projection the following views of the selected sketch:

(a) the front elevation;
(b) the sectional end elevation.

1. Preliminary Freehand Pictorial Sketches:
   A few candidates presented the two designs that agreed with the given specifications. However, majority of the candidates produced the preliminary freehand pictorial sketches with the aid of drawing instruments. Most of them also provided only two shelves instead of the three and omitted the plinth.
2. (a)Front elevation:
   All candidates presented the view as required. However, most of the drawings omitted the plinth, cutting plane, dimensions, and name of the view.

(b)Sectional End Elevation:

This view was poorly presented and wrongly placed against the front elevation considering the principles of First Angle Orthographic Projections.

Majority of the candidates failed to show the following members in section and elevation:

- Carcase details (top and bottom pieces, shelves, side and plinth).
- Back covering details (plywood and rebates)

Draughtsmanship

(i) Border lines:

Majority of the candidates failed to draw the border lines.

(ii) Title block:

Majority of the candidates failed to provide the title block.

(iii) Layout:

Majority of the candidates demonstrated lack of adequate knowledge in presentation of views in the First Angle Orthographic Projection. Hence the views were placed anyhow on the drawing paper.

(iv) Neatness:

Most of the sketches produced by candidates were dirty. Candidates should endeavour to clean their equipment's before using them.

WOODWORK 3

1. **GENERAL COMMENTS**

The standard of the paper was within the scope of the syllabus.

The paper was well constructed and satisfactory enough to cater for the level under review.

The performance of the candidates as compared to the previous year was above average.

2. **A SUMMARY OF CANDIDATES' STRENGTHS**

A few candidates demonstrated detailed knowledge and understanding of the appropriate areas of the syllabus by:

(i) Marking-out the required joints accurately particularly their ability to use the acceptable ratios to set out the dovetail pitches;

(ii) Constructing well fitted joints;

(iii) The ability to assemble the work.

3. **A SUMMARY OF CANDIDATES' WEAKNESSES**

Some weaknesses observed in candidates' performance include the following:

(i) Inability to read and interpret the working drawings correctly;

(ii) Lack of the requisite skills to cut out joints neatly;

(iii) The use of work pieces which were far above the required dimensions.

4. **SUGGESTED REMEDIES FOR THE WEAKNESSES**

(i) Teachers should intensify the teaching of Orthographic drawings.

(ii) Teachers should give adequate practical exercises which involve the reading and correct interpretation of working drawings;

(iii) Teachers should do more to help students to master the correct procedure for marking-out practical exercises.

(iv) Candidates should be guided to acquire the required skills in sawing and chiselling timber perfectly.

(v) Teachers should desist from preparing very hard interlocked grain for candidates to work with.

(vi) Work pieces prepared for candidates should not be above the sizes specified as this eventually causes candidates to lose marks for the three major dimensions of the assembled work.

5. DETAILED COMMENTS

Question 1

Candidates were given working drawings of a model tool box. They were required to interpret the working drawings and construct the model using already prepared work pieces.

The work involved the following processes: -

(a) Construction of through dovetail joints;
(b) Construction of box pin joints;
(c) Construction of stopped housing joints;
(d) Shaping bevels and handle slot;
(e) Fitting plywood bottom;
(f) Finishing

1. Through Dovetail Joints

The construction of the through dovetail joints was attempted by all the candidates. A good number of the candidates were able to mark-out accurately and produced fairly good joints. However, a few of the candidates constructed through dovetail joints at all the four main corners of the box instead of constructing the box pin joints at one end of the box.

Few others on the other hand constructed box pin joints at all the four corners of the box. Very few of the candidates could not mark-out the dovetail pitches accurately. The pitches they marked-out were at variance with the acceptable range of 1:6 to 1:8.

A few others lacked the requisite skills to cut and remove waste wood from the tails and the sockets of the joints and as a result produced very poor work which could not be fitted.

2. Box Pin Joints

The construction of the box pin joints at one end of the box was to complement the through dovetail joints at the opposite end to form the body of the tool box. This question was attempted by almost all the candidates. Some of the candidates constructed reasonably well-fitting joints worthy of emulation. However, a few candidates made the joints too lose that they could not be assembled. The bottoms of the sockets of the joints were poorly cleaned.

This was the result of the use of blunt chisels by the candidates.

3. **Stopped Housing Joints**

Candidates were expected to construct the stopped housing joints to partition the box into two equal compartments.

This question was attempted by majority of the candidates. Majority of the candidates constructed ordinary through housing joints instead of the stopped housing joints. Few other candidates could only mark-out but failed to cut the joints.

4. **Shaping Bevels and Handle Slot**

Candidates were expected to cut the bevels to add beauty to the box. The handle slot was to be cut out to enable the box to be lifted or carried about. Most of the candidates attempted this question. A good number of the candidates were able to saw the two bevels but failed to plane to clean off. Others marked-out but did not saw off the waste wood.

The handle slot was attempted by majority of the candidates. More than half of the candidates were able to mark-out accurately and chiselled out the waste wood to produce fairly good slots. Others cut out very rough slots while the rest only marked-out but failed to chisel out the waste wood.

5. **Plywood Bottom**

Candidates were expected to plane the sides and ends of the plywood and screw them in place using the four countersunk wood screws provided to complete the box.

A few candidates were able to prepare the sides and ends of the given plywood and fixed them to the bottom of the box as required. A few others did partial planing before fixing while the rest fixed the plywood bottom without preparing the sides and edges. Others were able to fix only two or three screws instead of all the four.

6. **Finishing**

a. Assembling

Candidates were expected to put all the work pieces together to form the complete box. Most of the candidates were able to assemble the work, a few did partial assembling while very few could not assemble the work but tied the workpieces together for easy identification.

b. Squareness

Almost half of the candidates who assembled their work got the four corners of the finished box meeting at right angles (90º). The rest of the candidates assembled works were out of square.

c. <u>3 major dimensions</u>

A few candidates were able to produce the box to the exact dimensions i.e. length, width and Height. Few other candidates got two dimensions right, others got only one dimension correct.

The rest of the candidates however worked with far bigger work pieces which eventually made their finished work to be of extra-large sizes.

d. <u>Dressing</u>

Almost all the candidates failed to dress their work to give it the needed appeal.