These marking guidelines consist of 14 pages.
SECTION A

QUESTION 1

1.1
1.1.1 C ✓✓ (2)
1.1.2 D ✓✓ (2)
1.1.3 B ✓✓ (2)
1.1.4 D ✓✓ (2)
1.1.5 B ✓✓ (2)
1.1.6 A ✓✓ (2)
1.1.7 C ✓✓ (2)
1.1.8 C ✓✓ (2)
1.1.9 C ✓✓ (2)
1.1.10 A ✓✓ (2)

1.2
1.2.1 one way valve/non return valve ✓✓ (2)
1.2.2 timing ✓✓ (2)
1.2.3 Alternator/invertor ✓✓ (2)
1.2.4 Hopper/inlet trough/Thought/A uger/Conveyer belt ✓✓ (2)
1.2.5 Nipple/Pump/Gun ✓✓ (2)

1.3
1.3.1 A ✓✓ (2)
1.3.2 C ✓✓ (2)
1.3.3 H ✓✓ (2)
1.3.4 D ✓✓ (2)
1.3.5 B ✓✓ (2)

TOTAL SECTION A: 40
SECTION B

QUESTION 2: MATERIALS AND STRUCTURES

2.1 2.1.1 TWO elements that decrease magnetism in stainless steel.

Chromium, ✔ Nickel ✔ and Manganese ✔

(Any 2) (2)

2.1.2 THREE properties of copper.

- Excellent conductor of electricity ✔
- Good conductor of heat ✔
- Strong ✔
- Ductile ✔
- Easily joined by soldering or brazing ✔
- Hygienic ✔
- Easy to alloy ✔
- Resists corrosion ✔
- Durability ✔
- Soft metal ✔
- Pliable ✔

(Any 3) (3)

2.1.3 TWO requirements that determine the composition of brass.

- Manufacturing requirements ✔
- Application requirements/purpose ✔
- Cost effectiveness ✔

(Any 2) (2)

2.1.4 Properties of Tin.

- Silvery-white ✔
- Soft ✔
- Malleable metal ✔
- It can be highly polished ✔
- An oxide film form on exposed surfaces ✔
- When tin is bent, a 'tin cry' is heard, due to the breaking of crystals ✔
- Prevent corrosion ✔
- Prevents contamination of food ✔
- Easy to blend/ Use as alloy ✔
- Conduct electricity ✔

(Any 3) (3)

2.2 2.2.1 Description of 'elasticity' of adhesives.

Degree of hardness and brittleness of the adhesive when they dry-off. ✔
Must stay elastic even after it dried. ✔

(2)
2.2.2 **THREE recommendations to improve the strength of an adhesive.**

- Apply a thin base coat if the surface is very porous.
- Apply only a thin layer of adhesive.
- Apply adhesive to both surfaces.
- Avoid thick layer of adhesive on a joint.
- Avoid thick layer of adhesive on a joint.
- Surface must be clean.
- Make the surface rough.
- Correct adhesive.
- Wait till dry before joining.
- Correct kind of adhesive.

(Any 3) (3)

2.3 **THREE safety precautions which are applicable to glass fibre.**

- Catalyst and accelerator should always be stored separately.
- Remove all resin catalyst and accelerator from skin.
- Wear hand gloves if skin is sensitive.
- Glass fibre matting has small pieces of fibre that can penetrate the skin.
- Use nose mask (avoid breathing in glass fibre).
- Use protective glasses (protect the eyes).
- Use acetone in a well-ventilated room.
- Handle resin castings carefully, they are brittle and have sharp edges.
- Wear overall/ protective clothing.

(Any 3) (3)

2.4 **THREE advantages of Vesconite.**

- Easy to fit and remove.
- Does not corrode and is non-conductive.
- Will not wear shafts and liners like traditional materials.
- Resistant to a wide range of materials.
- Bearings will not seize on the axle.
- Will not expand in water.
- Does not delaminate.
- Low friction coefficient.
- Can be used without any lubrication.
- Low maintenance.

(Any 3) (3)

2.5 **THREE substances that do not have an influence on a Teflon coating.**

- Asphalt.
- Dyes.
- Greases/oil.
- Glue.
- Latex.
- Lacquers.
- Paints.
- Acids/chemicals/water.

(Any 3) (3)
2.6 THREE safety standards of insulation material used in buildings.

- Must not be harmful or dangerous to people when inhaled or touched.
- Should not burn easily.
- Rodents and insects must not be able to eat it or build their nests in it.
- Must not be heavy./Must be lightweight.

(Any 3) (3)

2.7 2.7.1 THREE causes of short circuit that appears on an electric fences.

- Vegetation touching the fence
- Leakage
- Faulty joints
- Broken wires
- Faulty insulators
- Moist conditions
- People and animals
- Lightning

(Any 3) (3)

2.7.2 Placing of safety signs on an electric fence.

- Gates/doors
- Fence wire
- Fence poles
- Spacing
- Where people came in contact with the fence

(Any 2) (2)

2.7.3 THREE functions of the covering material used on underground electric fence cables.

- Protect cable against mechanical damage (tractors, spades, etc.)
- Protect from corrosion
- Isolation
- Protect cable against water/moist

(Any 3) (3)
QUESTION 3: ENERGY

3.1 3.1.1 Explanation of the requirements of a suitable location to install a wind turbine.

- Wind turbines require a substantial wind speed to generate electricity efficiently.
- The faster the wind, the more output in watts you can generate, but you cannot go over your turbines capacity.
- The location must be surrounded by open fields.
- If there are any large hills or mountains close by, then the placement of wind turbines may not be your best option.
- If there is a forest or collection of trees nearby, then you cannot optimize wind energy.
- Make sure your turbine is facing the most common wind direction.
- Not close to overhead electric cables.
- Not close to houses. (Any 4) (4)

3.1.2 THREE advantages of wind energy.

- Wind power has no fuel costs.
- Low or negligible costs for maintenance.
- No carbon tax costs.
- Natural gas and oil imports can be reduced.
- Wind turbines are emissions-free, which means they do not contribute to air pollution.
- Wind is a renewable energy source unlike fossil fuels, which are an exhaustible source of energy.
- As a result, large numbers of wind turbines could reduce dependence on other energy sources, providing a more dependable source of energy in the long term.
- Wind energy is much cheaper than other sources of energy.
- Wind turbines are a great resource to generate energy in remote locations, such as mountain communities and remote countryside.
- Wind power has no clean-up costs, fossil fuels do. (Any 3) (3)

3.2 FOUR factors that will have a negative influence on the efficiency of a photovoltaic solar panel system.

- The cell is not working to its full potential due to some electrons being lost.
- When the electrons release heat; the panel also becomes warm, interfering with other aspects of the solar cells.
- Number of solar panels determines the efficiency of the system.
- Expensive natural energy technologies produce more efficiently than cheaper ones.
- Obviously nearer the equator, you will receive a slightly better output with a given cell (location).
- Solar cells should always be facing the direction of the sun.
- No objects blocking the sun’s rays.
- Electrical short (Any 4) (4)
3.3 **TWO problems associated with the generation of geothermal energy.**

- You must not pump too much cold water into the earth, as this could cool your geothermal heat source. ✓
- Geothermal power plants must be protected from escaping gases from deep within the earth. ✓
- Location of the geothermal power plant. ✓
- Cost of generating electricity. ✓
- Water pollution ✓
- Cost ✓
- Contamination of the water ✓

(Any 2) (2)

3.4 **The material that is suitable for manufacturing Biofuel and an explanation.**

Any plant matter or animal waste ✓ that can combust. ✓ (2)

3.5 **TWO processes that are used in the manufacturing of ethanol.**

- Fermentation ✓
- Distillation ✓

(2)

3.6 **THREE advantages of methanol as an alternative fuel.**

- It offers lower exhaust emissions. ✓
- Produces higher vehicle performance. ✓
- It can easily be made into hydrogen. ✓
- Can be used in methanol direct fuel cells. ✓
- Methanol has a lower risk of flammability than gasoline. ✓

(Any 3) (3) [20]
QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 Comparison of MIG-welding and Arc-welding under given headings.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>MIG-welding</th>
<th>Arc-welding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding speed.</td>
<td>Higher welding speed ✓</td>
<td>Slower welding speed ✓</td>
</tr>
<tr>
<td>Forming of slag</td>
<td>No slag formed on welding run ✓</td>
<td>Slag is formed on the welding run ✓</td>
</tr>
<tr>
<td>Start-up cost</td>
<td>Higher initial cost ✓</td>
<td>Lower initial cost. ✓</td>
</tr>
<tr>
<td>Equipment working in windy condition</td>
<td>Cannot weld in windy conditions ✓</td>
<td>Can weld in windy conditions ✓</td>
</tr>
</tbody>
</table>

4.2 4.2.1 Function of the MIG part.

- This device adjusts the tension ✓ on the welding wire. ✓
- Wire Feeder ✓ ✓ (Any 1) (2)

4.2.2 FIVE safety measures that must be followed when welding with the MIG-welding machine.

- Remove all materials that can catch fire. ✓
- Protect eyes by wearing a welding shield/screens. ✓
- Wear welding gloves to handle hot metal. ✓
- Wear leather/cotton apron for UV protection and heat. ✓
- Weld in well-ventilated area for fumes. ✓
- Prevent burns or sparks on the face by wearing a welding shield. ✓
- Do not wear open shoes. ✓
- Stand on rubber matt. ✓ (Any 5) (5)

4.3 THREE different types of welding movements that can be used for arc-welding run and make a drawing of each welding figure.

<table>
<thead>
<tr>
<th>Type of run</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 8 ✓</td>
<td>8 ✓</td>
</tr>
<tr>
<td>U-shape ✓</td>
<td>☐ ✓</td>
</tr>
<tr>
<td>Zigzag ✓</td>
<td>☐ ✓</td>
</tr>
<tr>
<td>Triangle ✓</td>
<td>☐ ✓</td>
</tr>
</tbody>
</table>

(Any 3 x 2) (6)
4.4 **Description of the cutting process that must be followed to ensure a safe and clean cut when cutting a 10 mm steel plate with the oxy-acetylene cutting torch.**

- Set the required gas flow on the cylinders. ✓
- Set the oxy-acetylene torch according to the need. ✓
- Heat the material up to red hot. ✓
- Press the oxygen lever to blow away the melted metal. ✓

(4)

4.5 **Explanation of the influence that water/moisture has on the plasma cutter nozzle.**

Water entering the torch nozzle can cause a short circuit. ✓ The short circuit causes damage to the nozzle because of the internal arcing that takes place. ✓ Unevenness of the flame. ✓

(Any 2) (2)

4.6 **Design of a cattle handling facility for 50 cattle consisting of one big holding kraal, three smaller kraals, a crush pen and functional gates.**

**MARKING INSTRUCTIONS:**

- Effective design (one big kraal ✓, three smaller kraals ✓ and a crush pen ✓) (3)
- Enough gates to facilitate the handling process. ✓ (1)
- Placing/functionality of the gates. ✓ (2)
- Measurements/headings. ✓ (1)
- Entrance gate. ✓ (1)
QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 5.1.1 THREE factors with a short explanation of each that have an influence on the depth control system of a tractor.

- Soil resistance: ✓ On sandy soils the plough will go deeper. In hard soil the plough will not penetrate easily. ✓
- Forward speed of the tractor: ✓ When ploughing at high speed, the plough will not penetrate effectively. ✓
- Ploughing depth: ✓ Soil will have a great influence on the plough when ploughing deep. ✓

5.1.2 THREE items on the tractor that the driver must inspect before starting the tractor.

- Fuel level ✓
- Water level ✓
- Oil level ✓
- Tyre pressure ✓
- Any liquid leaks ✓ (Oil, water or fuel)
- Any repairs needed ✓ (Electrical etc.)
- Loose electrical wires ✓
- Battery water level ✓
- All safety guards in position ✓
- Any parts of a tractor ✓ (Any 3)

5.2 FIVE advantages of modern combine harvesters over manual harvesting methods.

- Very quick way of harvesting the crop. ✓
- Very reliable method of harvesting. ✓
- Economical. ✓
- Labour saving. ✓
- Accurate record keeping. ✓
- Computers do the whole harvesting processes with little input from the driver. ✓
- Single operation. ✓ (Any 5)

5.3 FOUR requirements that safety screens on farm machinery must comply with.

- Safeguard the equipment ✓
- Safeguard the operator ✓
- Removed and replaced easily ✓
- Must appear neat ✓
- Must be properly installed. (not loosened while in motion) ✓
- Weight saving ✓ (light)
- Keep out all undesired material ✓
- Strong ✓
- Not broken ✓
- Safety signs on screens. (Any 4)
5.4 5.4.1 The device (A or B) that will be found in a ripper to protect the teeth from braking when it gets stuck behind a rock or plant root.

A ✓

(1)

5.4.2 THREE functions of the slip clutch found in the drive mechanism of a baler.

- Prevent heavy objects from being taken into the baler. ✓
- Protect the pick-up if it is impeded by anything. ✓
- Protect the auger if it becomes overloaded. ✓
- Moving parts are protected. ✓

(Any 3)

(3)

5.4.3 The device, in diagram B, that enables the driveshaft connected to the slip clutch to work at an angle.

Universal joint ✓
U coupling ✓

(1)

5.5 FIVE factors that must be taken into consideration when planning the purchase of a new tractor.

- Driving power ✓
- Local availability of parts and service ✓
- Rigidity of construction ✓
- Simplicity of control mechanisms ✓
- Driver comfort ✓
- Versatility ✓
- Proven reliability and durability ✓
- Type of drive necessary ✓
- Cost/Price of the tractor ✓

(Any 5)

(5)

5.6 Comparison between the V-belt and flat belt’s under the headings that are given.

<table>
<thead>
<tr>
<th>Headings</th>
<th>V-Belt</th>
<th>Flat belt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to of install</td>
<td>Difficult to install ✓</td>
<td>Easy to install ✓</td>
</tr>
<tr>
<td>Used over long distance</td>
<td>Not manufactured to run over long distance ✓</td>
<td>Can run over long distance ✓</td>
</tr>
<tr>
<td>Lengthened or shortened</td>
<td>Length cannot be changed ✓</td>
<td>Easily lengthened and shortened ✓</td>
</tr>
<tr>
<td>Slip under tension</td>
<td>Do not easily slip ✓</td>
<td>Pulleys do slip ✓</td>
</tr>
</tbody>
</table>

(8)
5.7 The effect that the presence of air has on the working of a hydraulic system.

The air is compressible that will lead to higher pressure in the hydraulic system and can cause pipes to burst. The piston on the receiving side will not react as required because there is no direct pressure. The system will shudder.

(4)

QUESTION 6: WATER MANAGEMENT

6.1 THREE advantages of system A over system B.

- This system is less expensive to install.
- It consists of sections that can be easily disconnected.
- They are used for small or square shaped fields.
- Less crop damage.
- No electricity needed.
- Can easily been moved to another land. (Any 3)

(3)

6.2 THREE sources that a 'Smart Controller' uses to determine local weather conditions.

- Soil sensor
- Rain sensors
- Satellite feed
- weather station
- Internet/Wi-Fi
- Evaporation pan
- Radar
- Moist sensors (Any 3)

(3)

6.3 Recommendation to a farmer on to consider before choosing a type of irrigation system for a piece of land.

- The size of the area to be irrigated.
- The shape of the land.
- Obstructions, such as trees or rocks.
- How deep the soil needs to be watered.
- How much time and effort is available to use the system.
- Type of crop under cultivation.
- Cost
- Amount of water available (Any 3)

(3)
6.4 **THREE instances where flood irrigation would be preferred over sprinkler irrigation.**

- When water supply is of abundance.
- Surface gradient cannot lead to erosion.
- Infiltration tempo is constant.
- Where soil has good water absorption.
- Landscape has a suitable slope.
- Initial setup cost is low.
- Finance available.
- When land is next to a non-consistent river.

(Any 3) (3)

6.5 6.5.1 **The mistakes in the design drawing of a septic tank.**

- Inlet must be higher than the wall.
- Outlet must be lower than the wall. Make the wall higher.

(2)

6.5.2 **THREE items that must NOT be flushed down a septic tank drainage system.**

- Plastics or non-degradable materials.
- Cigarette buds, rags etc. should get into the tank.
- Disinfectants should be used.
- Paper or sanitary towels that does not dissolve easily.
- Bleaches.
- Oils or fatty substances.
- Drain openers.

(Any 3) (3)

6.5.3 **What will happen in a septic tank drainage system if the bacteria are destroyed?**

- The system will simply act as a holding tank for waste.
- It will fill up with waste.
- Natural decomposition will not occur.

(Any 2) (2)

6.6 **TWO factors that will determine the cleaning of a septic tank.**

- The amount of waste water that goes through the system each day.
- The amount of excess fats, rinds and other similar garbage in the drain.
- Working of the bacteria.
- Seize of the tank.
6.7 Calculation of the flow rate of a tank (litre per minute) by using the data below:
(Show all calculations)
The capacity of the tank is 20 k ℓ
It took 40 minutes to fill the tank to the top.
Use the formula:  Flow rate = \frac{\text{capacity}}{\text{time}}

Flow rate = \frac{20 \times 1000}{40} = \frac{20000}{40} = 500 ℓ/minute

(4)

6.8 Function of GPS, GIS and VRT.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>Pinpoints exact position up to one meter ✓</td>
</tr>
<tr>
<td>GIS</td>
<td>Shows areas of under growth/over watering/under watering ✓</td>
</tr>
<tr>
<td>VRT</td>
<td>Consists of farm field equipment with the ability to precisely control or measure the rate of application ✓</td>
</tr>
</tbody>
</table>

(3)

6.9 Components on the whole house filtering system that must be checked and replaced on a regular basis.

- Filter elements/cartridges ✓
- O-rings ✓
- Salt in the water softener ✓
- Pipes ✓
- Sieve ✓
- Pumps ✓
- Tanks ✓
- Taps ✓
- Valves ✓

(Any 2) (2)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200