MARKS: 200

This memorandum consists of 12 pages.
**SECTION A**

**QUESTION 1**

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**TOTAL SECTION A: (20 x 2)  40**
SECTION B

QUESTION 2: MATERIALS AND STRUCTURES

2.1 2.1.1 • Isolate all sources of ignition. ✓
• Extinguishers (full) in hazardous areas. ✓
• No smoking signs in hazardous areas. ✓
• Exits clearly marked in hazardous areas. ✓
• Proper electrical installation. ✓
• Flammable materials stored safely. ✓
• Fire emergency numbers listed near telephone. ✓
• Emergency fire plan posted. ✓
• Make of firebreaks.
• Any acceptable correct answer ✓

(Any 8) (8)

2.1.2 • Only tackle a fire after the alarm has been raised and it is safe to do so. ✓
• Ensure you are accompanied when you fight a fire or go to investigate, never do it alone. ✓
• Only tackle a fire in its very early stage. ✓
• Put your safety and that of others first, no heroics! ✓
• Only use an extinguisher if you are sure of how to use it properly. ✓
• Do not hold the horn on a CO₂ extinguisher – it will be very cold.
• Any acceptable correct answer regarding the safety measures ✓

(Any 5)

2.2 • stop the PTO before dismounting. ✓
• ensure that safety shields are in place before work starts. ✓
• replace cracked or defective safety shields immediately. ✓
• keep clothing, hair and all body parts away from a rotating PTO. ✓
• never step over a rotating PTO shaft.
• keep universal joints in phase.
• always use the driveline or PTO shaft recommended for your machine.
• position the tractor's drawbar properly. ✓

(Any 4) (4)

2.3 2.3.1 Chromium
• Increases resistance against corrosion. ✓
• Promotes the hardening of steel. ✓
• Improves strength. ✓
• Improves resistance to the formation of scale.
• Improves tensile strength.
• Decreases magnetism.
• Most chromium steels can be welded well. ✓

(Any 3) (3)
2.3.2 Manganese

- It combats corrosion.
- Gives steel a coarser structure.
- Changes the band structure, at the same time causing a reduction in striking strength.
- Increases tensile strength.
- Reduces the critical cooling tempo and by doing so improves hardening.
- Increases resistance against wear.
- Reduces magnetism.

(Any 3) (3)

2.3.3 Nickel

- It improves the amount of toughness and the hardening ability.
- It gives steel a fair amount of toughness at low temperatures.
- Used with chromium, nickel helps to increase the hardening ability of steel much more than when only one of the elements is used on its own.
- Steel which is alloyed with chromium and nickel is resistant to air, water and many chemical acids and alkali.

(Any 3) (3)

2.4

- Type of material to be joined.
- Conditions under which this joint will be used.

(2)

2.5 Strengthening with reinforcement:

Reinforcement beams must be placed in a crisscross pattern in the foundation to prevent the shifting and cracking of the foundation.

Thickness of the foundation:

The thickness of the foundation must correlate with the weight of the structure.

(4)

2.6 Answer is B

(1)

2.7

2.7.1 Light penetration.

(1)

2.7.2 The wire will shrink on a cold day and break.

(1)
QUESTION 3: ENERGY

3.1 3.1.1 Solar(Sun)/Wind ✓
Solar/Sun energy is a freely available energy source ✓
that is used to produce electricity ✓
with the aid of a small photovoltaic cell/sun panel/solar cell. ✓
The solar cell is light weight ✓
and easily transportable to the new construction site of the portable fence. ✓

OR

Wind is freely available ✓
and is used to drive a small turbine ✓ that produces electricity. ✓
The small wind turbine is light weight ✓
and easily transportable ✓
to the new construction site of the portable fence. ✓

3.1.2 Keeping wild animals and vermin away from domesticated farm animals and crops. ✓
Separate different groups of animals. ✓
Allowing rotational grazing.
Fencing animals off from eroded areas, trees, rivers and roads.
(Any 2) (2)

3.1.3 Affordable ✓
Easily constructed ✓
Durable
Light weight
Easily modified
Less animal hide and pelt damage
Deterrent to trespassers and predators
(Any 2) (2)

3.2 3.2.1 • No fuel costs ✓
• Low maintenance costs. ✓
• No clean-up costs ✓
• No carbon tax costs ✓
• Reduced oil imports
• No air pollution. Environmentally friendly
• Renewable energy source
• As a result, large numbers of wind turbines/solar cells could reduce dependence on other energy sources, providing a more dependable source of energy in the long term.
• Less expensive energy source.
• Great resource to generate energy in remote locations.
• Solar/Wind power technology is limitless
• Solar/Wind is also extremely portable.
• Solar/Wind power can create more energy than is necessary for a single family needs
• Extra power from solar panels and wind turbines can be fed back into the power grid, providing clean, free energy to people throughout an entire community.
• A renewable source. (Any 4) (4)
3.2.2 Solar cells are unable to produce electricity during the night time and during cloudy days.

The wind turbine can produce electricity during the night and during cloudy days when wind is available. There might be sun during the day but no wind.

3.3
- Vegetable oils
- Animal fats
- Recycled cooking oils (Any 2)
QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 4.1.1 • Inverter welding machine mainly related to more electronic components that can cause malfunctions/breakages. ✓
• Complex structure. ✓
• Inverter welding machine is more expensive
• Arc-welder can be driven by the PTO of a tractor whereby the inverter needs an energy source
• Parameter setting difficult/ Welding current settings difficult. (Any 2)

4.1.2 • Gravity can cause metal to drip or run down. ✓
• Keep puddle small. ✓
• Prevent over penetration, burning through. ✓
• Electrode size plays a role in penetration.
• Current plays a dominant role in the welding process.
• Surface area must be cleaned thoroughly. (Any 3)

4.2 • Set up a cleaned work piece. ✓
• Work pieces of 5mm or less in thickness. ✓
• Put on the welding goggles. ✓
• Light up the torch to give a neutral flame. ✓
• Take a 3mm copper coated welding rod. ✓
• Starting at the beginning of the joint, hold the welding torch so that its tip forms an angle of approximately 45°-60° with the work piece. ✓
• Hold the flame steady over the work piece with the inner flame approximately 3 mm above the surface to be welded.
• When the work piece has heated up sufficiently it melts and forms a pool.
• To prevent a hole being burnt through the metal, lift the torch tip slightly to keep the pool small.
• When you have established the pool, place the end of the filler rod at a 45°-60° angle in the centre of the pool.
• As the weld progresses the filler rod melts and has to be continually fed into the weld.
• The longer you hold the filler rod in the pool, the larger the build up of the weld.
• The filler rod must be removed from the pool when there is enough build up.
• When the filler rod is not in the pool, the end is kept just inside the flame
• Continue with the weld until a bead is formed. (Any 6)

4.3 4.3.1 MIG/MAG/CO₂ welder ✓

4.3.2 It is an arc welding process in which individual consumable electrodes (standard welding rods) are replaced by continuously fed wire, ✓ and an insert gas shield replaces electrode flux. ✓
4.3.3 Commercially available mixture with oxygen
- Argon
- Helium
- Carbon dioxide (CO₂).

(Any 3) (3)

4.4

4.5
- Leftward welding technique.
  - Used to weld mild steel sheet up to 5mm
- Rightward welding technique.
  - Used to weld mild steel sheet thicker than 5mm.
- Vertical welding.
  - Welding starts at the lower end of the weld, and then moves upwards to the end of the work piece.

(3 x 2) (6)

4.6 When metal is heated, it expands and when it cools down it shrinks.
The shrinking of welded metal, as well as weld runs, causes distortion of sheets when they cool down.
Shrinking takes place in all directions simultaneously and therefore causes various types of distortion.

(4)

4.7
- Pre-setting.
- Welding of patch work.
- Clamping.
- Spot/Tag-welding.

(Any 2) (2) [35]
QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 5.1.1 It is the exact moment when the needles lift the binding rope so that the compressed hay can be bound. ✓

5.1.2

- Lubrication. ✓
- Check all bearings, chains and gears. ✓
- Check all safety clutches. ✓
- Sharpen all blades.
- Check tyre pressure.
- Check bolt tension.
- Inspect chassis and tyres for damage. (Any 3) (3)

5.1.3

- Slip clutch. ✓
- Screens. ✓
- Shear bolts ✓
- Ram stop safety mechanism ✓ (4)

5.2 5.2.1 Three-point mechanism ✓ consisting of two lifting arms ✓ and a top link. ✓ (3)

5.2.2 Universal joint ✓ (1)

5.2.3

- Strong ✓
- Easily to remove/install ✓
- Not become loose ✓
- Weight saving ✓ (3)
- Must provide adequate/efficient protection. (Any 3)

5.3

Fixed capital ✓
Moveable capital ✓
Working or floating capital ✓ (3)

5.4

- Loss of maize kernels due to blowers that is set incorrectly. ✓
- Thresher that breaks the kernels. ✓
- Too much foreign particles. ✓
- Mechanical problems. ✓
- Electrical problems ✓
- Cannot use harvester when the crop is wet due to rain or irrigation. (Any 4)

5.5 5.5.1 Straight-cut gear/Spur gear ✓ (1)

5.5.2 Last very long. ✓ (1)
5.5.3 • Sliding gearbox/Manual✓
• Constant mesh gearbox✓
• Synchronised gearbox✓
• Automatic
• Trip-tronic
• Pre-select         (Any 3) (3)

5.6   5.6.1 • Sturdy construction. ✓
• Replaceable wearing parts. ✓
• Rotor housing should close tightly. ✓
• Strength of power source available✓
• Size of the hopper feed aperture.  (Any 4)
• Amount and type of feed that must be grounded. (Any 4)

5.6.2 • The mass of the moving parts is spread equally over bearings. ✓
• Cyclone hangs level on the blower pipe. ✓
• Looks neat. ✓               (3)

5.6.3 • Do not work on the machine while it is still in motion. ✓
• Ensure that there are no loose objects lying inside the machine when starting it. ✓
• Wear safety gear. ✓
• Do not use the machine when the rotor is out of balance. ✓
• Driving mechanism must be screened off. ✓
• Use in a well ventilated area.
• Small pieces of scrap metal must be kept away from fodder.
• It can cause a spark, which can start an explosion. (Any 5) (5)

[40]
QUESTION 6: WATER MANAGEMENT

6.1 6.1.1 • Quantity of water ✓
• Topography ✓
• Frequency of irrigation ✓
• Duration of application ✓
• Needs of the plant.
• Plant density.
• Soil moisture.
• Prevailing rainfall. (Any 3)

6.1.2 It is to apply enough water to fully wet the plant's root zone ✓ while minimizing overwatering ✓ and then allow the soil to dry out in between watering, ✓ to allow air to enter the soil, but not so that the plant is stressed beyond what is allowable. ✓ (4)

6.2 6.2.1 E ✓
6.2.2 A ✓
6.2.3 B ✓
6.2.4 C ✓
6.2.5 D ✓ (5)

6.3 6.3.1 Natural system ✓
Regular system ✓ (2)

6.3.2 Pyramids of three or six poles ✓ are laid lengthwise along the bottom of an open trench and covered with grass ✓ before filling it with soil. ✓ (3)

6.3.3 • Installation costs are high. ✓
• Blockages occur from time to time and are expensive to correct. ✓
• The installation requires technical skills and knowledge. ✓ (3)

6.4 6.4.1 Only water without solid particles ✓ must flow out through the top pipe and then seeps away into the soil. ✓ (2)

6.4.2 • Any household component connected to the sewage system ✓
• Septic tank ✓
• Distribution box ✓
• Absorption field ✓
• Cesspools ✓
• Vent
• PVC/ceramic pipes. (Any 5) (5)
6.4.3 • Detergents. ✓
• Laundry waste. ✓
• Bleach. ✓
• Household chemicals.
• Caustic drain openers.
• Garbage disposal unit which substantially increase the accumulation of solids.
• Disposal of items not biodegradable in the system (plastics etc.)
• Disposal of excessive amounts of grease and fats, which are biodegradable but need particular types of bacteria to digest.
• Disposal of cigarette butts and sanitary napkins which are also biodegradable but are not readily decomposable.
• Too many people using a smaller/inadequate or failing system.

(Any 3) (3)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200