



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2011

**MECHANICAL TECHNOLOGY
MEMORANDUM**

MARKS: 200

This memorandum of 10 pages.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS**(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 1 – 9)**

1.1	A			
1.2				D
1.3	A			
1.4			C	
1.5			C	
1.6		B		
1.7		B		
1.8			C	
1.9	A			
1.10				D
1.11		B		
1.12				D
1.13	A			
1.14				D
1.15		B		
1.16				D
1.17				D
1.18		B		
1.19			C	
1.20		B		

(20 x 1) [20]

QUESTION 2: APPLIED MECHANICS**(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 6 AND 8)**2.1 *clockwise = anti – clockwise* ✓

$$? \times 2 = 25 \times 4 \quad \checkmark$$

$$? = \frac{100}{2} \quad \checkmark$$

$$? = 50 \text{ N} \quad \checkmark$$

The value of the unknown force is 50 N.

(4)

2.1.2 The pinion ✓

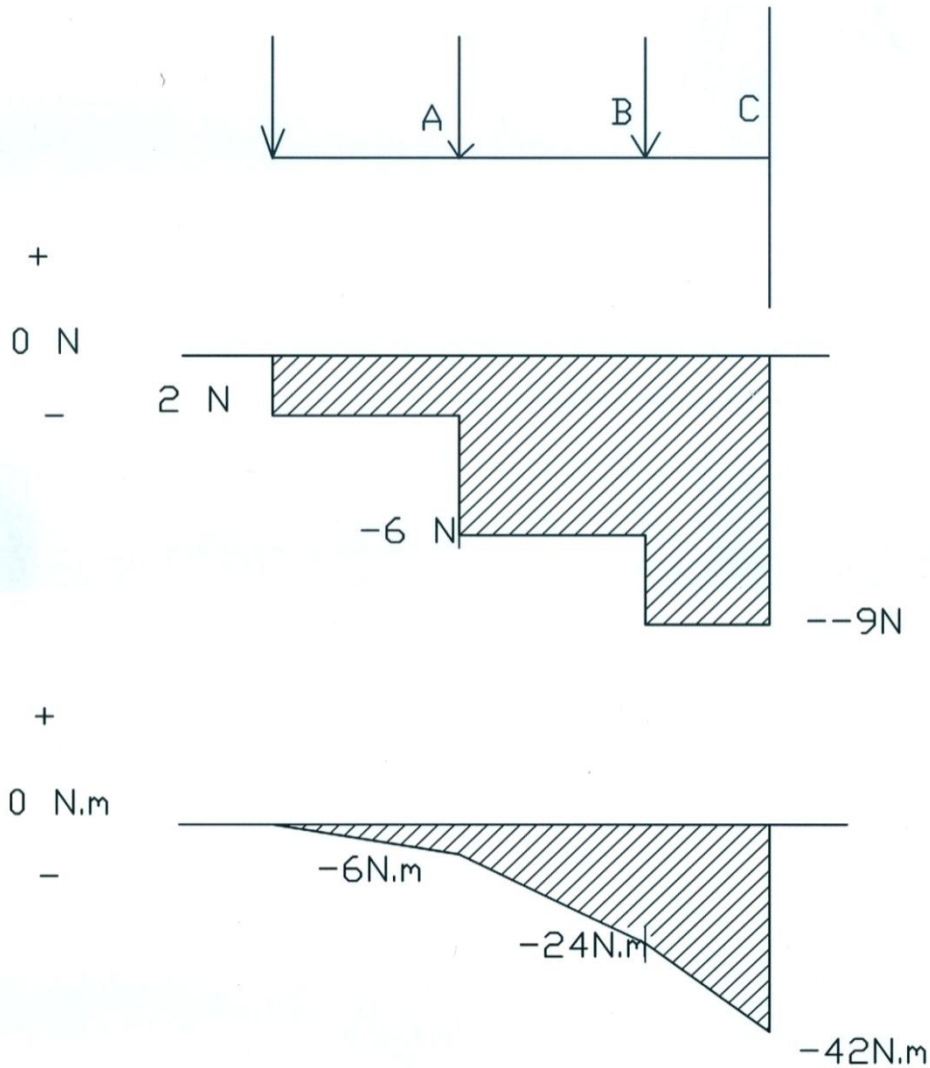
(1)

- 2.1.2
- The design of the gear prevents concentrated loads on the tips of the teeth during initial meshing. ✓
 - The contact between the meshing teeth takes place very gradually. ✓
 - Helical gears are much quieter than spur gears. ✓
 - Helical gear is much stronger than spur gear of same size ✓
 - Helical gear can carry heavier loads. ✓
 - Helical gear transmits more power.
 - Helical gear drives are smooth and silent.

(Any 5) (5)

- 2.3 2.3.1 To increase the arc of contact of the driver pulley ✓
To act as a belt take-up adjustment. ✓ (2)
- 2.3.2 Idler pulleys run on the slack side of the belt. ✓ (1)
- 2.4 clockwise ✓
Gear B turn in a anti-clock wise direction which in turn will allow Gear C to turn in a clock-wise direction. ✓ (2)
- 2.5 2.5.1 Torque = force x distance
27,5 = force x $(\frac{350}{1000})$ ✓
Force = $\frac{27,5}{0,350}$ ✓✓
= 78,57 N ✓ (4)
- 2.5.2 It is a force ✓ applied to an object ✓ that tends to make the object turn about its axis of rotation. ✓ (3)
- 2.5.3 It is a beam supported at its ends ✓ and it carries a load ✓ which is spread out over a certain distance ✓
A brick resting on a beam ✓ OR
A bag of cement resting on a beam. (4)
- 2.6 2.6.1 Taking moments about RL:
RR x 10 = (550 x 9) + (400 x 5) + (350 x 2) ✓
= 4 950 + 2 000 + 700
= 7 650/10 ✓
RR = 765 N ✓
- Taking moments about RR:
RL x 10 = (550 x 1) + (400 x 5) + (350 x 8) ✓
= 550 + 2 000 + 2 800
= 5 350/10 ✓
RL = 535 N ✓
- TEST UP = DOWN
765 + 535 = 350 + 400 + 550
1 300 N = 1 300 N
Total load = (765 + 535) / 10
= 130 kg ✓
The bridge is safe to be used as the maximum load that can be carry is 250 kg. ✓ (8)

- 2.7 Bending moment at: A = $-(2 \times 3) - (4 \times 0)$ = -6 Nm ✓✓
 Bending moment at: B = $-(2 \times 6) - (4 \times 3) - (3 \times 0)$ = -24 Nm ✓✓
 Bending moment at: C = $-(2 \times 8) - (4 \times 5) - (3 \times 2)$ = -42 Nm ✓✓



(12)

(See appendix at back of memorandum.)

- 2.8 The cam ✓
 The follower ✓
 The frame ✓ (3)
- 2.9 Is a device in which two shafts or rotating members may be connected. ✓ (1)
[50]

QUESTION 3: TOOLS AND EQUIPMENT**(LEARNING OUTCOME 3: ASSESSMENT STANDARD 2)**

- 3.1 3.1.1 Vernier slide calliper ✓ (1)
- 3.1.2
1. Jaws for inside measurements ✓
 2. locknut ✓
 3. Beam ✓
 4. Depth gauge ✓
 5. Vernier scale ✓
 6. Jaws for outside measurements ✓
 7. Main scale ✓
 8. 8. Fixed jaw ✓ (8)
- 3.2 3.2.1
1. The two plugs or rollers should have equal diameters. ✓
 2. Centre line of plugs should be dead parallel to both top and bottom edges of bar. ✓
 3. Centre distances of plugs are to be absolutely correct. ✓ (3)
- 3.3
1. It prevents bolts or studs from breaking. ✓
 2. It prevents bolts and nuts from loosening. ✓
 3. It prevents castings from warping. ✓ (3)
- 3.4
1. Unskilled person is able to carry out the checking of parts once the comparator has been set. ✓
 2. It saves time during the mass production of articles. ✓ (2)
- 3.5 3.5.1 Screw pitch gauge ✓ (1)
- 3.5.2 To determine the unknown pitch on a bolt/shaft ✓
To determine a screw cutting tool's included angle ✓ that is either 60° or 55°. (2)
- [20]**

QUESTION 4: MATERIALS**(LEARNING OUTCOME 3: ASSESSMENT STANDARD 3)**

- 4.1 4.1.1 C ✓
- 4.1.2 D ✓
- 4.1.3 A ✓
- 4.1.4 B ✓ (4)
- 4.2
- Work piece size ✓
 - Quenching rate ✓
 - Carbon content ✓ (3)

- 4.3
- Water and salt (brine or sodium chloride) ✓
 - Tap water ✓
 - Fused or liquid salts ✓
 - Molten lead ✓
 - Soluble oil and water ✓
 - Oil
 - Air
- (Any 5) (5)
- 4.4
- 4.4.1 C ✓
- 4.4.2 D ✓
- 4.4.3 A ✓
- 4.4.4 B ✓
- (4)
- 4.5
- Brine cools twice as rapid as water. ✓
 - It tends to remove scale from the steel. ✓
 - It causes steel to cool more uniformly. ✓
- (3)
- 4.6 The vapour that forms around the part acts as an insulator and slows down the cooling rate ✓
- (1)

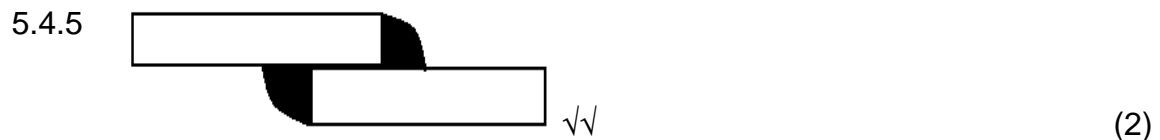
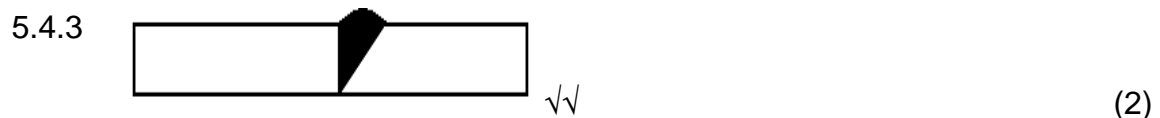
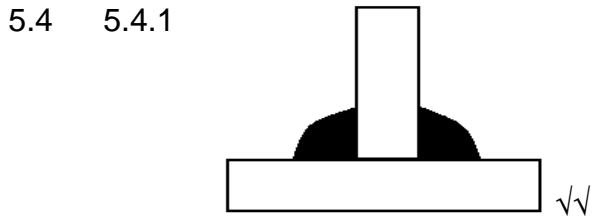
[20]

QUESTION 5: MANUFACTURING PROCESS, CONSTRUCTION AND SAFETY

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 1, 4 AND 5)

- 5.1
- Make sure that all guards are in place. ✓
 - Do not wear loose clothing ✓
 - Keep any waste or rags away from rotating parts ✓
 - Check that there is no oil or grease on the floor ✓
 - Do not leave spanners or keys on rotary parts ✓
 - Never apply a spanner to revolving work
 - Always clamp work piece safely and firmly
 - Do not use your hands to remove cuttings while machine is in motion
 - Never adjust the cutting tool while a machine is running
 - Resist the habit of leaning on machinery
 - Do not attempt to stop a machine by placing your hand on the chuck.
 - Give attention to cutting-fluid control before switching on a machine.
- (Any 5) (5)
- 5.2
- 1 Arc welded ✓
 - 2 Size of the weld ✓
 - 3 Convex weld face ✓
 - 4 Flame finish ✓
 - 5 2 mm – root gap ✓
 - 6 50 mm long weld ✓
 - 7 100 mm pitch ✓
 - 8 welded all round ✓
 - 9 welded on site ✓
 - 10 “V” butt weld ✓
- (10)

- 5.3 5.3.1 Blue ✓
 5.3.2 Black ✓
 5.3.3 Revolutions per minute ✓
 5.3.4 Pitch circle diameter ✓
 5.3.5 Mass ✓ (5)



- 5.5
- The safety guard must be in place before starting ✓
 - Protective shields must be placed around the object being grinded to protect people passing by. ✓
 - Use correct grinding disc for the job ✓
 - Do not force the grinding disc on the work. ✓
 - Make sure that there are no cracks on the disc before you start
 - Protective clothing and eye protection are essential. (Any 4) (4)

- 5.6
1. Make sure about correct personal safety equipment ✓
 2. Open the gas main ✓
 3. Set the regulators ✓
 4. Purge the system ✓
 5. Ignite the acetylene gas (flint-spark lighter) ✓
 6. Adjust the welding flame ✓ (6)

- 5.7
1. See that all guards are in place. ✓
 2. See that no oil, grease or obstacles are around the machine. ✓
 3. Select the correct blade for the material. ✓
 4. When changing blades ensure that machine is switched off at main switch. ✓
 5. When removing or replacing the blade do it gently. ✓
 6. Do not adjust guides whilst the machine is running
 7. All material must be clamped properly before cutting commences
 8. Long pieces of material must be supported at the end
 9. Always stop the machine if you leave it unattended. (Any 5) (5)
- 5.8
- 5.8.1 Outside screw cutting ✓ (1)
 - 5.8.2 Boring operation ✓ (1)
 - 5.8.3 Internal screw cutting ✓ (1)
 - 5.8.4 Parting off operation ✓ (1)
 - 5.8.5 Facing operation ✓ (1)
- [50]**

QUESTION 6: PUMPS AND MAINTENANCE

(LEARNING OUTCOME 3: ASSESSMENT STANDARDS 7 AND 9)

- 6.1 It is a force that resists the movement of one object against another. ✓✓ (2)
- 6.2
- 6.2.1
 - Services not done at routine intervals. ✓
 - No attention paid to temperature gauge or any warning lights. ✓ (2)
 - 6.2.2
 - The oil level in the sump will drop. ✓
 - When the oil level becomes too low, there may not be sufficient oil pressure to transport the oil to all the places. ✓ (2)
 - 6.2.3 (Leak in the cooling system)
 - *Radiator leaking ✓
 - *Hoses leaking ✓
 - *Damaged cylinder head gasket (mechanical failure)
 - *Faulty water pump
 - *Broken v-belt (Electronic failure)
 - *Faulty temp. sender unit (Any 2) (2)
- 6.3
1. Sliding friction ✓
 2. Static friction ✓
 3. Rolling friction ✓
 4. Fluid friction (Any 3) (3)

- 6.4 1. A proper wheel alignment always starts and ends with a test drive. ✓
 2. The front end and steering linkage should be checked for wear. ✓
 3. The tyres should be in good shape with even-wear patterns. ✓
 4. Pulling problems are not always related to wheel alignment. ✓
 5. Check the air pressure if unsure. (Any 4) (4)
- 6.5 6.5.1 Steering wheel ✓ (1)
- 6.5.2 A – Balancing ✓
 B – Lead weights ✓ (2)
- 6.6 6.6.1
- | PISTON | PLUNGER |
|--|---|
| Length of piston is shorter than stroke length ✓ OR
Piston has rings | Length of plunger longer than stroke length ✓ OR
The cylinder has a stuffing box with soft packing at the end of the cylinder |
- (2)
- 6.6.2 It is the difference between the theoretical flow rate and the real flow rate. ✓✓ (2)
- 6.7 6.7.1 1. Inlet ✓
 2. Eye ✓
 3. Outlet ✓
 4. Pump casing ✓
 5. Impellor / rotating wheel ✓
 6. Fluid ✓ (6)
- 6.8
- Centrifugal pumps are more compact. ✓
 - The initial cost is relatively low. ✓
 - Maintenance cost is low due to rotation motion of parts. ✓
 - Centrifugal pumps are adaptable ✓
 - The construction is simple and reliable ✓
 - It works at high speed therefore connect directly to motor ✓
 - No water hammer and shocks
 - Delivery can be adjusted from no flow to full flow without switching the pump off.
 - Centrifugal pumps do not have moving valves or sensitive parts. (Any 6) (6)
- 6.9 6.9.1
- It is very efficient and can develop a high pressure ✓
 - There are no reciprocating parts which can cause vibrations ✓
 - The drive is always positive ✓
 - It has no valves or springs ✓ (4)
- 6.9.2
- Wear between the gears and the housing reduces the pump pressure. ✓
 - When the gears wear, the pump tends to be noisy. ✓ (2)

[40]

TOTAL: 200

ADDENDUM

