Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

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

(20 x 1) (20)

QUESTION 2: APPLIED MECHANICS

(Learning Outcome 3: Assessment Standards 6 and 8)

2.1 2.1.1 Safety factor (SF) $= \frac{max.stress}{safe\ stress}$

$= \frac{85\ \sqrt{}}{17}$

$= 5\sqrt{}$ (2)

2.1.2 STRESS $= \frac{17\times10^3\ \sqrt{}}{\left(\frac{\pi\times0,02^2}{4}\right)}$

$=$ 54 112 726,36 Pa

$=$ 54,11 MPa $\sqrt{}$ (2)

2.2 2.2.1 Gear ratio $= \frac{product\ of\ no.\ of\ teeth\ on\ driven\ gear}{product\ of\ no.\ of\ teeth\ on\ drive\ gear}$

$= \frac{94\times62}{31\times47}$ √

$= 4 : 1$ √ (2)

2.2.2 Output speed $= in\ speed \times \frac{product\ of\ drive\ gear}{product\ of\ driven\ gear}$

$= 1\,500 \times \frac{1}{4}$ √

$= 375$ r/min √ (2)

2.2.3

Power (P) $= \frac{2\pi NT}{60}$ $T = \frac{(5\times10^3)\times60}{2\times\pi\times375}$ √ $= 127{,}32$ N.m. √	$T_{in} = \frac{(5\times10^3)\times60}{2\times\pi\times1500}$ $= 31{,}83$ N.m T_{out} = gear ratio. x T_{in} $= 4 \times 31{,}83$ $= 127{,}32$ N.m.

(3)

2.3 2.3.1 Real module $m_r = \frac{m_n}{\cos\theta}$

$= \frac{5}{cos28^0}$ √

$= 5{,}6628$ mm √

The P.C.D of gear = T x m_r

$= 48 \times 5{,}66$ mm √

$= 271{,}81$ mm √ (4)

2.3.2 Addendum = m_n √

$= 5$ mm √ (2)

2.3.3 Dedendum = 1,157 x m_n √

$= 1{,}157 \times 5$

$= 5{,}785$ mm √ (2)

2.3.4 Full depth $= 2{,}157 \times m_n$ **OR** Full depth = add + ded

$= 2{,}157 \times 5$ √ $= 5 + 5{,}785$

$= 10{,}785$ mm √ $= 10{,}785$ mm (2)

2.3.5 Clearance = 0,157 x m **OR** Clearance = ded – add

$= 0{,}157 \times 5$ √ $= 5{,}785 - 5$

$= 0{,}785$mm √ $= 0{,}785$mm (2)

2.4 2.4.1 $\frac{100N}{150^2} = \frac{force}{750^2}$ √

$\therefore force\ piston\ B = \frac{100 \times 750^2}{150^2}$ √

= 2 500 N √ (3)

2.4.2 Area x distance = Area x distance

150^2 x distance = 750^2 x 10 √

$\therefore$ distance = $\frac{750^2 \times 10\ \surd}{150^2}$

= 250 mm √ (3)

2.4.3 No effect √ (1)

2.5 PITCH = $\frac{12}{3}$

= 4 mm √

EFFECTIVE DIA (D_E) = BD – (0,5 x PITCH)

= 50 – (0,5 x 4)

= 48 mm √

Helix angle TAN θ = $\frac{lead}{\pi \times D_e}$

= $\frac{12}{\pi \times 48}$ √

Θ = 4,55° √

LEADING ANGLE = 90° – (heliks angle + clearance angle)

= 90° – (4,55° + 3°) √

= 82,45° √

TRAILING ANGLE = 90° + (heliks angle – clearance angle)

= 90° + (4,55° – 3°) √

= 91,55° √ (8)

2.6 2.6.1 Effort applied = $\frac{1350}{4}$ √

= 337,5 N √ (2)

2.6.2 V.R. = $\frac{2\ x\ 210}{160-130}$ √

= $\frac{14}{1}$

= 14 : 1 √ (2)

2.6.3 ή$_{mech}$ = $\frac{MA}{VR} \times 100\%$

= $\frac{337,5}{14}$ x 100% √

= 24,12% √ (2)

2.7 2.7.1 Torque $= 0{,}36 \times (4 \times 10^3)\ \surd \times 2 \times \frac{0{,}28}{2}\ \surd$

= 403,2 N.m. √ (3)

2.7.2 Power $= \frac{2 \times \pi \times 3700 \times 403{,}2\ \surd}{60\ \surd}$

= 156,23 kW √ (3)

[50]

QUESTION 3: TOOLS AND EQUIPMENT

(Learning Outcome 3: Assessment Standard 2)

3.1
1. Test piece √
2. Load √
3. Hardened steel ball √
4. Diameter of impression √ (4)

3.2 Gas analyser / CO-gas analyser
Carbon monoxide gas analyser √ (Any 1 x 1) (1)

3.3
- Too rich mixture √
- Wrong idling speed √
- Clocked air filter element √
- Faulty choke (locked in closed position) √ (4)

3.4
1. To determine the yield stress of a piece of material. √
2. To determine the ultimate stress of a piece of material. √
3. To determine the percentage elongation of a piece of material. √ (3)

3.5 **M**etal **I**nert **G**as **S**hielding √√ **OR**
Metal **A**rc **G**as **S**hielding (2)

3.6 Argon √
Argon + carbon dioxide (CO_2) √
Argon + oxygen
Argon + helium
Argon + helium+ carbon dioxide (Any 2 x 1) (2)

3.7
- Inlet valve that is leaking √
- Outlet valve that is leaking √
- Worn piston rings √
- Blown head gasket √
- Cracked cylinder block (4)

[20]

QUESTION 4: MATERIALS

(Learning Outcome 3: Assessment Standard 3)

4.1 4.1.1 It provides hardness to an alloy. √ (1)

4.1.2
- Producing a stronger metal √
- Increasing resistance to corrosion and rust √
- Changing the colour of the metal √
- Increase the electrical resistance √
- Improve the ductility and elasticity
- Improving casting properties
- Strengthen the metal against wear and tear
- Lowering the cost of the metal
- Lowering the melting point (Any 4 x 1) (6)

4.2
- The most abundant metal √
- Lightweight √
- Ductile √
- Malleable
- Soft
- Resistance to corrosion
- Conduct heat
- Conduct electricity
- Non-magnetic
- Bluish-white – silvery-white colour (Any 3 x 1) (3)

4.3

ADVANTAGES	**DISADVANTAGES**
Rapid moulding and extrusion √	Lack of durability √
No wastage √	Creep √
Scrap and rejects can be used again √	Degradation √
	Loss of shape
(3 x 1)	Brittleness (Any 3 x 1)

(6)

4.4 Tin √ + lead √ (2)

4.5 The material is much tougher and stronger. √
The bicycle is much lighter than other bicycles. √ (2)

4.6 It is when two or more non-ferrous metals are melted together to form one metal. √ Examples:
Brass √
Bronze three types
White metal (babbit)
Duralumin
Solder – silwer
Pewter (Any 1 example + 1) (2)

[20]

QUESTION 5: MANUFACTURING PROCESS, CONSTRUCTION AND SAFETY

(Learning Outcome 3: Assessment Standards 1, 4 and 5)

5.1
- Use safety goggles √
- Make sure the workpiece is properly secured. √
- Be careful for metal particles coming off after the metal fractures. √
- Do not hold the test piece with your hands, it may be hot. Use pliers. (3)

5.2
- See that all guards are in place. √
- Ensure that no oil or grease is on the floor. √
- Select the correct blade for the material to be cut. √
- When changing blades ensure that machine is switched off at the mains. √
- When replacing the blade, do it carefully.
- Do not adjust guides whilst machine is running.
- Clamp material properly.
- Support long pieces of material at the end.
- Always stop machine if you leave it unattended. (Any 4 x 1) (4)

5.3 5.3.1

Ind $= \frac{40}{N}$

$= \frac{40}{19}\sqrt{}$

$= 2\frac{2\times2}{19\times2}\sqrt{}$

= 2 full turns and 4 holes on the 38 hole circle √ (3)

5.3.2

Angle ind $= \frac{N}{540}$

$\frac{(11\times60)+40}{540}$ √

$=\frac{700}{540}\sqrt{}$

$=1\frac{8\times2}{27\times2}\sqrt{}$

= 1 full turn and 16 holes on the 54 hole circle √ (4)

5.4 5.4.1

Ind $= \frac{40}{N}$

$= \frac{40}{60}$ √

$\frac{2\times8}{3\times8}$ √

= no turn but 16 holes on the 24 hole circle. √ (3)

5.4.2 Change gears needed:

$\frac{DR}{DN} = \frac{(A-N)}{A}\times\frac{40}{1}$

$\frac{(60-61)}{60}\times\frac{40\ \sqrt{}}{1\ \sqrt{}}$

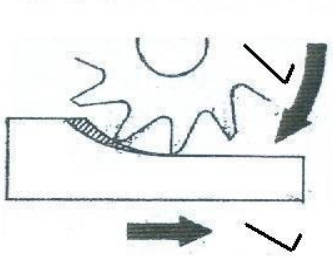
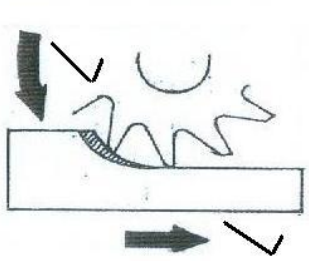
$= -\frac{2\times16}{3\times16}\sqrt{}$

= simple drive

DR = 32T √ and the DN = 48T √ (5)

5.4.3 Direction of rotation is to the left (negative) (anti-clock) √ (1)

5.5

	
upcut	downcut

(4)

5.6
1. 40 tooth worm wheel √
2. Sector arm √
3. Index plate √
4. Index crank √
5. Single start worm √ (5)

5.7 5.7.1
- Atmospheric contamination √
- Surface contamination √
- Dirty or wet electrodes
- Rusted MIG-wire (2)

5.7.2
- Check for leakage on gas supply from the MIG-welding machine √
- Clean surface
- Change electrode
- Change MIG-wire (1)

5.7.3
- Poor welding technique √
- To a wide weld joint √
- Excessive iron oxide
- Welding speed too slow
- Welding current too low (2)

5.7.4
- Clean the surface to be tested √
- Spray the liquid dye penetrant onto surface √
- Allow dye to dry √
- Use cloth and cleaning detergent to remove excess dye √
- Spray developer on weld allow to dry √
- Use cloth and cleaning detergent to remove excess developer √
- Defects will start to show. (ultraviolet light is sometimes used) √ (7)

5.8 $V = \pi \times D \times N$ √

Cutter r/min = N

$N = \frac{85}{\pi \times 0,12}$ √

= 225,47 r/min √

Feed (f) = $f_1 \times T \times N$ √

f = $0,01 \times 40 \times 225,47$ √

= 90,19 mm/min √ (6)

[50]

QUESTION 6: TURBINE AND MAINTENANCE

(Learning Outcome 3: Assessment Standards 7 and 9)

6.1
- Make sure tractor's diff oil is warm. √
- Place container under diff and clean the drain plug. √
- Remove oil filler plug and then drain plug and drain oil into container. √
- Allow enough time for oil to drain. √
- Clean the filler and drain plug and place new copper washer on each. √
- Screw drain plug back with new copper washer. √
- Fill the diff until the oil starts to trickle out of the filler hole. √
- Note! Do not over fill; screw filler plug back and clean excessive oil. √ (8)

6.2 Refers to the resistance √of oil to flow. √ (2)

6.3
- Must be water resistant (must not mix) √
- Rust/corrosion resistant √
- Good for load pressure √
- High melting point
- Low freezing point (Any 3 x 1) (3)

6.4 6.4.1 C √ (1)

6.4.2 B √ (1)

6.4.3 A √ (1)

6.5
1. Timing chain √
2. Camshaft pulley √
3. Chain guide √
4. Crankshaft pulley √ (4)

6.6 6.6.1
1. Inlet √
2. Outlet √
3. Rotor √
4. Casing/housing √ (4)

6.6.2
- More power is obtained compared to a similar vehicle without a turbocharger. √
- More economical per given kilowatt output to similar engine size. √
- Less fuel is used compared to engine mass.
- Power loss at altitude is eliminated
- Supercharger do not suffer lag
- Superchargers do not need special exhaust systems
- Superchargers do not need special shutdown procedure

(Any 2 x 1) (2)

6.6.3
- Small amount of power loss because it uses engine power √
- Higher fuel consumption if power generated not fully used √
- The lifespan of engine is decreased because of higher cylinder pressure, which increases the load on the engine parts.
- Owing to compression of air this results in an increase in temperature causing a decrease in the density of the inlet charge (2)

6.7

STEAM	GAS
• It is compact √	• Easy starting √
• No lubrication required √	• High power from given weight of engine √
• Turbine can be accurately regulated	• No rubbing internal parts so that internal friction and wear are almost eliminate
• Variety of fuels can be used to obtain steam	• No water cooling system needed
• More economical	• Requires little routine maintenance

(4)

6.8
- Remove all balance pieces √
- Remove mud and dirt from the rim. √
- Remove small stones and mud from the wheel surface. √
- Inspect the wheel surface for wear.
- Check the side walls.
- Inspect the rims.
- Check if the wheel sizes are the same.
- Check the working of the shock absorbers.
- Check the steering column for wear. (Any 3 x 1) (3)

6.9
- Kinetic energy is the steam which is converted to mechanical energy to cause rotation. √
- Steam at very high temperature and pressure is directed to the turbine. √
- Nozzles are used to direct the pressure onto the blades. √
- The blades are attached to the turbine and shaft causing it to rotate. √
- This is mechanical energy created by the impulse and the reaction effort of the steam jet. √ (5)

[40]

TOTAL: 200

6.6.2
- Meer krag teenoor teen 'n voerturug met dieselfde enjingrootte sonder 'n turbo-aanjaer. √
- Meer ekonomies per gegewe kilowatt uitset as enjin met dieselfde uitset √
- Minder brandstof verbruik teenoor vergelykbare enjingrootte
- Kragverlies a.g.v. hoogte bo seevlak word geëlimineer.
- Geen vertraging/sloering nie
- Aanjaers het nie spesiale uitlaatstelsels nodig nie
- Aanjaers het nie spesiale afsluitprosedure nodig nie.

(Enige 2 x 1) (2)

6.6.3
- Klein hoeveelheid krag verlore a.g.v. enjin wat die blaser moet aandryf. √
- Hoër brandstofverbruik indien al die drywing nie gebruik word nie √
- Lewensduur van enjin verkort a.g.v. hoër silinderdruk, wat weer groter druk op onderdele plaas.
- Die kompressie van die lug verhoog die temperatuur wat op sy beurt die digtheid van die brandstofmengsel verlaag.

6.7

STOOM	GAS
• Dit is kompak √ • Geen smering nodig √ • Turbinespoed kan meer akkuraat beheer word • Verskeidenheid van brandstowwe kan gebruik word om stoom te produseer • Meer ekonomies	• Maklike aktivering √ • Hoë werkverrigting per gegewe enjin massa √ • Geen bewegende interne onderdele, dus word interne wrywing beperk • Geen waterverkoelingstelsel nodig • Benodig min roetine-onderhoud

6.8
- Verwyder alle balanseermassastukke. √
- Verwyder alle modder en vuilis van velling. √
- Verwyder klippies en modder uit loopvlak van band. √
- Ondersoek die band se loopvlak vir slytasie.
- Ondersoek die band se wande.
- Ondersoek die wielvelling.
- Ondersoek of bande van dieselfde grootte is.
- Ondersoek of skokbrekers in werkende toestand is.
- Ondersoek stuurstangverbindings vir slytasie. (Enige 3 x 1) (3)

6.9
- Kineties energie is die stoom wat omgeskakel word na meganiese energie wat rotasie veroorsaak. √
- Stoom word teen hoë temperatuur en druk na die turbine gelewer. √
- Spuitstukke lewer die druk op die lemme. √
- Die lemme is aan die turbine gekoppel wat op 'n as is en dit sal draai. √
- Dit is meganiese energie wat deur impuls veroorsaak is en dit is van 'n stoom straal afkomstig. √ (5)

[40]

TOTAAL: 200

5.8 $V = \pi \times D \times N$ √
Snyer r/min = N
N = $\frac{85}{\pi \times 0,12}$ √
= 225,47 r/min √
Toevoer (f) = $f_1 \times T \times N$ √
f = $0,01 \times 40 \times 225,47$ √
= 90,19 mm/min √ (6)
[50]

VRAAG 6: TURBINES EN ONDERHOUD

(Leeruitkoms 3: Assesseringstandaarde 7 en 9)

6.1
- Verseker dat ewenaar se olie warm is. √
- Plaas houer onder ewenaar en maak skoon rondom dreineerprop. √
- Skroef olievulprop en dan dreineer prop uit en dreineer olie. √
- Gee genoegsame tyd vir olie om te dreineer. √
- Maak vulprop en dreineerprop skoon en sit nuwe koperwasters op beide proppe. √
- Skroef dreineerprop terug met nuwe koperwaster √
- Vul die ewenaar met olie totdat olie net net by vulgaat uitloop √
- LW! Moet nie oorvol maak nie, skroef vulprop terug en vee oortollige olie af. √ (8)

6.2 Dit verwys na olie se weerstand √ teen vloei. √ (2)

6.3
- Moet waterbestand wees (moet nie meng nie) √
- Roes- en korrosiebestand √
- Geskik vir lasdruk √
- Hoë smeltpunt
- Lae vriespunt (Enige 3 x 1) (3)

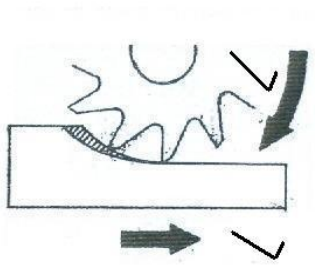
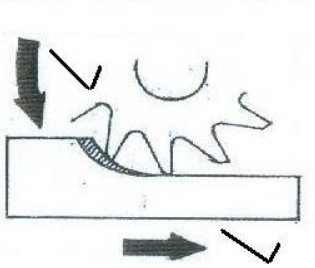
6.4 6.4.1 C √ (1)
6.4.2 B √ (1)
6.4.3 A √ (1)

6.5
1. Tydreëlingketting √
2. Nokaskatrol √
3. Kettinggids √
4. Krukaskatrol √ (4)

6.6 6.6.1
1. Inlaat √
2. Uitlaat √
3. Rotor √
4. Omhulsel √ (4)

5.4.3 Draairigting is linksom (negatief) (antikloksgewys) √ (1)

5.5

	
opfrees werk	klimfrees werk

(4)

5.6
1. 40 tand wurmwiel √
2. Sektorarm √
3. Indeksplaat √
4. Indeks kruk/slinger √
5. Enkel begin wurm √ (5)

5.7 5.7.1
- Atmosferiese besmetting√
- Oppervlakbesmetting√
- Vuil of nat elektrodes
- Geroeste MIG-draad (2)

5.7.2
- Kyk vir lekasie op gastoevoer van MIG sweismasjien √
- Maak oppervlak skoon
- Vervang elektrode
- Vervang MIG-draad (1)

5.7.3
- Swak tegniek √
- Vir ’n te breë sweislas. √
- Oormatige ysteroksied.
- Sweisspoed te stadig.
- Sweisspanning te laag (2)

5.7.4
- Maak oppervlakte wat getoets moet word skoon. √
- Wend die kleurstof aan. √
- Laat drogingstyd toe. √
- Gebruik ’n lap en skoonmaakmiddel om die ekstra kleurstof te verwyder √
- Spuit ontwikkelingstof op sweislas en laat droog word. √
- Gebruik lap en skoonmaakmiddel om ekstra ontwikkelingstof te verwyder √
- Foute word nou sigbaar. (ultraviolet lig word soms gebruik) √ (7)

VRAAG 5: VEILIGHEID, TERMINOLOGIE EN HEGTINGMETODES

(Leeruitkoms 3: Assesseringstandaarde 1, 4 en 5)

5.1
- Gebruik 'n veiligheidsbril. √
- Maak seker toetsstuk is stewig vas. √
- Wees versigtig vir metaaldeeltjies wat afsplinter wanneer die toetsstuk breek. √
- Moet nie die toetsstuk met kaal hande hanteer nie, dit kan warm wees. Gebruik 'n tang. (5)

5.2
- Sorg dat alle skerms in posisie is. √
- Sorg dat daar geen olie/ghries om vloer lê nie. √
- Kies regte lem vir tipe materiaal wat gesny moet word. √
- Skakel hoofskakelaar af voordat lem vervang moet word √
- Wees versigtig tydens lem afhaal en op sit.
- Moet nie die leiers verstel tydens saagproses nie.
- Klem werkstuk stewig vas.
- Ondersteun lang werkstukke by die punt.
- Sit masjien af as klaar gewerk het. (Enige 4 x 1) (4)

5.3 5.3.1

$$\text{Ind} = \frac{40}{N}$$
$$= \frac{40}{19} \surd$$
$$= 2\frac{2\times2}{19\times2} \surd$$
= 2 volle draai en 4 gate op die 38 gatsirkel. √ (3)

5.3.2

$$\text{Hoek ind} = \frac{N}{540}$$
$$= \frac{(11\times60)+40}{540} \surd$$
$$= \frac{700}{540} \surd$$
$$= 1\frac{8\times2}{27\times2} \surd$$
= 1 volle draai en 16 gate op die 54 gatsirkel. √ (4)

5.4 5.4.1

$$\text{Ind} = \frac{40}{N}$$
$$= \frac{40}{60} \surd$$
$$= \frac{2\times8}{3\times8} \surd$$
= geen draai maar 16 gate op die 24 gatsirkel √ (3)

5.4.2 Wisselratte benodig:

$$\frac{DR}{DN} = \frac{(A-N)}{A}\times\frac{40}{1}$$
$$= \frac{(60-61)}{60} \times \frac{40\ \surd}{1\ \surd}$$
$$= -\frac{2\times16}{3\times16} \surd$$
= Enkelvoudige aandrywing
DR = 32T √ en die DN = 48T √ (5)

VRAAG 4: MATERIALE

(Leeruitkoms 3: Assesseringstandaard 3)

4.1 4.1.1 Dit verleen hardheid aan 'n allooi. √ (1)

4.1.2
- 'n Sterker metaal te vorm √
- Korrosie- en roesweerstand te verhoog √
- Die kleur van metaal te verander √
- Elektriese weerstand te /verhoog √
- Rekbaarheid en elastisiteit te verbeter
- Giet-eienskap te verbeter
- Metaal teen slytasie te versterk
- Koste van metaal te verlaag
- Die smeltpunt te verlaag (Enige 4 x 1) (4)

4.2
- Oorvloedigste metaal beskikbaar √
- Baie lig √
- Rekbaar √
- Smeebaar
- Sag
- Korrosie bestand
- Gelei hitte
- Gelei elektrisiteit
- Nie-magneties
- Blouwit – silwerwit kleur (Enige 3 x 1) (3)

4.3

VOORDELE	NADELE
Snelle vorming (ekstrusie) proses √	Kort gebruiksduur √
Geen vermorsing √	Kruiping √
Afvalstukke kan weer gebruik word √	Afbreking √
	Vormverlies
(3 x 1)	Brosheid (Enige 3 x 1)

(6)

4.4 Tin √ + lood √ (2)

4.5 Die materiaal is veel taaier en sterker. √
Die fiets is veel ligter as ander fietse. √ (2)

4.6 Dit is wanneer twee of meer nie-ferro (-ysterhoudende) metale saamgesmelt word om een metaal te vorm. √ Voorbeelde:
Geelkoper √
Brons – drie tipes
Witmetaal (babbit)
Duralumin
Soldeersel – silwer
Piouter (Enige 1 voorbeeld + 1) (2)

[20]

2.7 2.7.1 Wringkrag = $0{,}36 \times (4 \times 10^3) \sqrt{} \times 2 \times \frac{0{,}28}{2}$ √
= 403,2 N.m √ (3)

2.7.2 Drywing = $\frac{2 \times \pi \times 3700 \times 403{,}2 \ \sqrt{}}{60 \ \sqrt{}}$
= 156,23 kW √ (3)
[50]

VRAAG 3: GEREEDSKAP EN TOERUSTING

(Leeruitkoms 3: Assesseringstandaard 2)

3.1
1. Toetsstuk √
2. Krag toegepas √
3. Verharde staalbal √
4. Diameter van induiking √ (4)

3.2 Gasanalisator / CO-gasanalisator
Koolstofmonoksied-gasanalisator √ (Enige 1 x 1) (1)

3.3
- Ryk mengsel verstelling √
- Verkeerde luierspoed √
- Verstopte lugfilter √
- Foutiewe smoorklep (sit in toe-posisie vas) √ (4)

3.4
1. Om die trekspanning van 'n stuk materiaal te bepaal. √
2. Om die maksimum trekspanning van 'n stuk materiaal te bepaal. √
3. Om die persentasie verlening van 'n stuk materiaal te bepaal. √ (3)

3.5 **M**etaal **T**rae **G**as **A**fskerming (**M**etal **I**nert **G**as **S**hielding) √ √ OF
Metaal **B**oog **G**as **A**fskerming (**M**etal **A**rc **G**as **S**hielding) (2)

3.6 Argon √
Argon + koolstofdioksied (CO_2) √
Argon + suurstof
Argon + helium
Argon + helium + koolstofdioksied (Enige 2 x 1) (2)

3.7
- Inlaatklep wat lek √
- Uitlaatklep wat lek √
- Geslete suierringe √
- Deurgeblaaste silinderkoppakstuk √
- Gekraakte silinderblok (4)

[20]

2.4 2.4.1 $\frac{100N}{150^2} = \frac{krag}{750^2}$ √

$\therefore kragsuier\ B = \frac{100 \times 750^2}{150^2}$ √

= 2 500 N √ (3)

2.4.2 Oppervlakte x afstand = Oppervlakte x afstand

150^2 x afstand = 750^2 x 10 √

∴ afstand = $\frac{750^2 \times 10\ √}{150^2}$

= 250 mm √ (3)

2.4.3 Geen invloed √ (1)

2.5 STEEK = $\frac{12}{3}$

= 4 mm √

EFFEKTIEWE DIA (D_E) = BD – (0,5 x STEEK)

= 50 – (0,5 x 4)

= 48 mm √

Helikshoek TAN θ = $\frac{STYGING}{\pi XD_E}$

= $\frac{12}{\pi \times 48}$ √

Θ = 4,55° √

INGRYPHOEK = 90° – (helikshoek + vryloop)

= 90° – (4,55° + 3°) √

= 82,45° √

SLEEPHOEK = 90° + (helikshoek – vryloop)

= 90° + (4,55° – 3°) √

= 91,55° √ (8)

2.6 2.6.1 Mag toegepas = $\frac{1350}{4}$ √

= 337,5 N √ (2)

2.6.2 S.V. = $\frac{2\ x\ 210}{160-130}$ √

= $\frac{14}{1}$

= 14 : 1 √ (2)

2.6.3 ή$_{meg}$ = $\frac{MA}{S.V} \times 100\%$

= $\frac{337,5}{14}$ x 100% √

= 24,12% √ (2)

2.2 2.2.1 Ratverhouding $= \frac{produk\ van\ die\ aantal\ tande\ op\ gedrewe\ ratte}{produk\ van\ die\ aantal\ \ tande\ op\ dryfratte}$

$= \frac{94\times62\ \surd}{31\times47}$

$= 4 : 1\ \surd$ (2)

2.2.2 Uitsit spoed $= in\ spoed\ \times \frac{produk\ van\ dryfratte}{produk\ van\ gedrewe\ ratte}$

$= 1500\ \times \frac{1}{4}\ \surd$

$= 375$ r/min $\surd$ (2)

2.2.3

Drywing (P) $= \frac{2\pi NT}{60}$ $T = \frac{(5\times10^3)\times60\ \surd}{2\times\pi\times375\ \surd}$ $= 127{,}32$ N.m $\surd$	$T_{in} = \frac{(5\times10^3)\times60}{2\times\pi\times1500}$ $= 31{,}83$ N.m T_{uit} = rat verh. x T_{in} = 4 x 31,83 = 127,32 N.m

2.3 2.3.1 Werklike module $m_w = \frac{m_n}{\cos\theta}$

$= \frac{5}{cos28^0}\ \surd$

$= 5{,}6628$ mm $\surd$

Die S.S.D van die rat = T x m_w

= 48 x 5,66 mm $\surd$

= 271,81 mm $\surd$ (4)

2.3.2 Addendum = $m_n\ \surd$

= 5 mm $\surd$ (2)

2.3.3 Dedendum = 1,157 x $m_n\ \surd$

= 1,157 x 5

= 5,785 mm $\surd$ (2)

2.3.4 Vol diepte = 2,157 x m_n **OF** Vol diepte = add + ded

= 2,157 x 5 $\surd$ = 5 + 5,785

= 10,785 mm $\surd$ = 10,785 mm (2)

2.3.5 Vry ruimte = 0,157 x m **OF** Vry ruimte = ded – add

= 0,157 x 5 $\surd$ = 5,785 – 5

= 0,785mm $\surd$ = 0,785mm (2)

VRAAG 1: MEERVOUDIGEKEUSE-VRAE

(Leeruitkoms 3: Assesseringstandaarde 1 – 9)

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

(20 x 1) (20)

VRAAG 2: KRAGTE, STELSELS EN BEHEER.

(Leeruitkoms 3: Assesseringstandaarde 6 en 9)

2.1 2.1.1 Veiligheidsfaktor (VF) $= \frac{maks.span}{veilig\ span}$

$= \frac{85\ \surd}{17}$

$= 5\surd$ (2)

2.1.2 SPANNING $= \frac{17\times10^{3}\ \surd}{\left(\frac{\pi\times0,02^{2}}{4}\right)}$

$= 54\ 112\ 726,36$ Pa

$= 54,11$ MPa $\surd$ (2)

Province of the
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