SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN
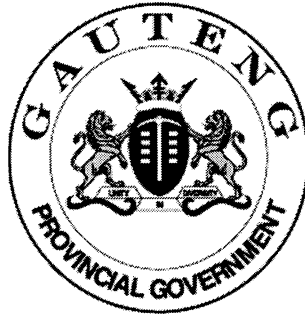
MOTOR MECHANICS

MOTORWERKTUIG-KUNDE

SG   707-2/0

MOTOR MECHANICS SG

10 pages
10 bladsye
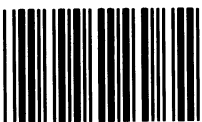
707 2 0   SG

X05

GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIORSERTIFIKAAT-EKSAMEN

MOTORWERKTUIGKUNDE SG

TYD: 3 uur

PUNTE: 200

BENODIGDHEDE:

Sakrekenaar en tekeninstrumente

INSTRUKSIES:

- Beantwoord ALLE vrae.
- Sketse moet netjies en in verhouding wees.
- Alle sketse moet op die regterbladsy van die antwoordboek geteken word.
- Nommer alle vrae korrek.
- 'n Inligtingsblad wat formules bevat, is ingesluit.
- Benoem alle sketse.

VRAAG 1
MEERVOUDIGE KEUSEVRAE

Die volgende vrae is van meer as een antwoord voorsien, waarvan slegs een moontlikheid korrek is. Gebruik die **antwoordblad** aan die **binnekant van die omslag** van jou **antwoordboek** en trek 'n kruis (**X**) oor die letter wat na jou mening die korrekte antwoord is.

1.1   'n Verstopte lugfilter benadeel die enjin se _____.

    A.   volumetriese doeltreffendheid
    B.   termiese doeltreffendheid
    C.   kompressieverhouding   (2)

1.2   Die funksie van die diodes in die alternator-laaikring is om _____.

    A.   die stroomvloei in die kring te beheer
    B.   oorvonking tussen die sleepringe en borsels te voorkom
    C.   die wisselstroom in gelykstroom te omskep   (2)

GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

MOTOR MECHANICS SG

TIME: 3 hours

MARKS: 200

REQUIREMENTS:

Calculator and drawing instruments

INSTRUCTIONS:

- Answer ALL the questions.
- Sketches must be neat and in correct proportion.
- All sketches to be done on the right-hand page of the answer book.
- Number all questions correctly.
- An information sheet containing formulae is included.
- Label all sketches.

QUESTION 1
MULTIPLE-CHOICE QUESTIONS

Each of the following questions is supplied with a number of possible answers of which only one possibility is correct. Make use of the **answer sheet** on the **inside cover** of your **answer book** and draw a cross (**X**) over the letter which, in your opinion, is the correct answer.

1.1   A clogged air filter will have a detrimental effect on the engine's _____.

     A.   volumetric efficiency
     B.   thermal efficiency
     C.   compression ratio   (2)

1.2   The function of the diodes in the alternator charging circuit is to _____.

     A.   control the current in the circuit
     B.   prevent arcing between the slip rings and brushes
   C.   change alternating current to direct current   (2)

1.3   Die komponent in die koppelomsitter wat verantwoordelik is vir die verhoogde draaimoment is die _____.

     A.   pomp
     B.   stator
     C.   turbine   (2)

1.4   Die twee basiese elemente van petrol is koolstof en _____.

     A.   suurstof
     B.   waterstof
     C.   koolsuurgas   (2)

1.5   Wat is die chemies korrekte (optimum) lug/brandstof-verhouding?

     A.   12:1
     B.   18:1
     C.   15:1   (2)

1.6   Watter een van die volgende verwys na die kalibrering van die inspuitpomp?

     A.   Hoeveelheid brandstof wat ingespuit word
     B.   Inspuitdruk
     C.   Beëindiging van inspuiting   (2)

1.7   Die transistor in die ontstekingstelsel dien as 'n _____.

     A.   hoogspanning-geleier
     B.   kapasitor
     C.   elektriese skakelaar   (2)

1.8   Waar sal die skuimtipe brandblusser oor die algemeen gebruik word?

     A.   Vaste stowwe
     B.   Elektriese brande
     C.   Ontvlambare vloeistowwe   (2)

1.9   By die kompressie-ontsteking-inspuitpomp word die lewering van brandstof gestaak, sodra die heliks van die plunjer die _____.

     A.   stortpoort ontbloot
     B.   stortpoort sluit
     C.   inlaatpoort sluit   (2)

1.3   The component in the torque converter responsible for the increase in torque is called the _____.

    A.   pump
    B.   stator
    C.   turbine   (2)

1.4   The two basic elements of petrol are carbon and _____.

    A.   oxygen
    B.   hydrogen
    C.   carbon dioxide   (2)

1.5   What is the chemically correct (optimum) air-fuel ratio?

    A.   12:1
    B.   18:1
    C.   15:1   (2)

1.6   Which one of the following refers to the calibration of the injector pump?

    A.   Quantity of fuel injected
    B.   Injection pressure
    C.   End of the injection   (2)

1.7   The transistor in the ignition system serves as a/an _____.

    A.   high-voltage conductor
    B.   capacitor
    C.   electrical switch   (2)

1.8   Where would a foam-type fire extinguisher be generally used?

    A.   Solid matter
    B.   Electrical fires
    C.   Flammable liquids   (2)

1.9   In the compression-ignition-injection pump, injection of fuel ceases when the helix of the plunger _____.

    A.   uncovers the spill port
    B.   closes the spill port
    C.   closes the inlet port   (2)

1.10 Die **effektiewe pompslag** van die plunjer in 'n inspuitpomp verwys na _____.

A.   daardie gedeelte van die slag waartydens geen brandstof in die
         ontbrandingskamer ingeforseer word nie
B.   daardie gedeelte van die slag waartydens brandstof in die
         ontbrandingskamer ingeforseer word
C.   die slag wanneer die plunjer konstant van onder na bo in die silinder
         beweeg   (2)

1.11 'n Oktaangetal van 80 beteken dat die brandstof _____.

A.   'n vlampunt van 80°C het
B.   uit 80 persent iso-oktaan en 20 persent heptaan bestaan
C.   'n klopweereienskap het soortgelyk aan 'n verwysingsbrandstof wat uit 80
         persent iso-oktaan per volume bestaan   (2)

1.12 'n Materiaal wat min weerstand teen die vloei van elektrisiteit bied, word 'n _____
      genoem.

A.   resistor
B.   geleier
C.   isolator
D.   kapasitor   (2)

1.13 Die simbool _/\/\/\/‾ stel 'n _____ voor.

A.   skakelaar
B.   spoel
C.   resistor
D.   kapasitor   (2)

1.10   The **effective pump stroke** of the plunger in an injector pump refers to _____.

A.   that portion of the stroke during which no fuel is forced into the combustion chamber

B.   that portion of the stroke during which fuel is forced into the combustion chamber

C.   the stroke when the plunger moves constantly from the bottom to the top in the barrel   (2)

1.11   An octane rating of 80 means that the fuel _____.

A.   has a flash point of 80°C
B.   is made up of 80 percent iso-octane and 20 percent heptane
C.   has an anti-knock property similar to a reference fuel containing 80 percent iso-octane by volume   (2)

1.12   A material which offers little resistance to the flow of electricity is called _____.

A.   a resistor
B.   a conductor
C.   an isolator
D.   a capacitor   (2)

1.13   The symbol _/\/\/_ represents _____.

A.   a switch
B.   a coil
C.   a resistor
D.   a capasitor   (2)

Vrae 1.14 en 1.15 verwys na die onderstaande skets.
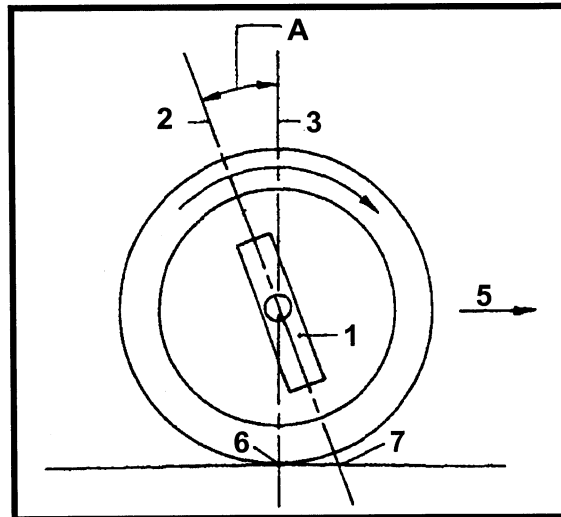
1.14   **A** word die _____ genoem.

    A.   positiewe wielvlughoek
    B.   positiewe naspoorhoek
    C.   negatiewe wielvlughoek
    D.   negatiewe naspoorhoek   (2)

1.15   Die funksie van hoek **A** is om _____.

    A.   die wiele terug te bring na die reguitvorentoe-posisie nadat daar om 'n draai beweeg is
    B.   middelpuntstuur te verkry
    C.   selfsentrerende aksie te voorsien
    D.   ware rollende beweging aan die voorwiele te gee wanneer daar om 'n draai beweeg word.   (2)

[30]

VRAAG 2
BEREKENINGE

2.1   'n Motorenjin ontwikkel 'n draaimoment van 250 N.m. teen 2 800 omwentelinge per minuut. Bereken die remdrywing in kW.   (4)
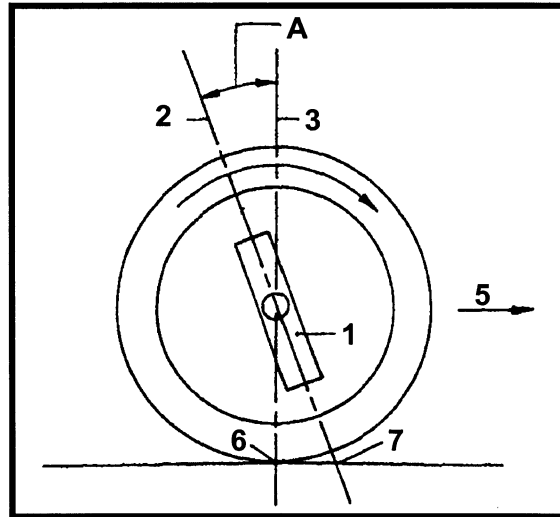
2.2   Die remdrywing wat deur 'n motorenjin ontwikkel word, is 50 kW en die aangeduide drywing is 60 kW. Bereken die meganiese doeltreffendheid.   (2)

2.3   Bereken die kompressieverhouding van 'n motorenjin met 'n boor van 70 mm en 'n slaglengte van 80 mm. Die verbrandingskamer se volume is 40 cm^3.   (8)

Questions 1.14 and 1.15 refer to the sketch below.

1.14   **A** is called the _____.

    A.   positive camber angle
    B.   positive castor angle
    C.   negative camber angle
    D.   negative castor angle   (2)

1.15   The function of angle **A** is to _____.

    A.   bring the wheels back to the straight-ahead position after rounding a corner
    B.   obtain centre-point steering
    C.   provide self-centering action
    D.   give the true rolling motion to the front wheels when negotiating a corner.   (2)

      [30]

QUESTION 2
CALCULATIONS

2.1   A car engine develops a torque of 250 N.m. at 2 800 revolutions per minute. Calculate the brake power in kW.   (4)

2.2   The brake power developed by an engine is 50 kW and the indicator power is 60 kW. Calculate the mechanical efficiency.   (2)

2.3   Calculate the compression ratio of an engine with a bore of 70 mm and a stroke of 80 mm. The combustion chamber volume is 40 cm^3.   (8)

2.4   Definieer die volgende terme:

2.4.1   Aangeduide drywing   (4)

2.4.2   Remdrywing   (2)
                                                                               [20]

VRAAG 3
AANDRYWING

3.1   Wat is die funksie van die tweegang-eindaandrywing?   (2)

3.2   Verduidelik die term **dubbelreduksie-eindaandrywing**.   (2)

3.3   Waarom vereis swaar voertuie en trekkers 'n laer ratverhouding as motorvoertuie
        in die eindaandrywing?   (2)

3.4   Noem die aandrywing wat twee agterasse gebruik.   (2)

3.5   Die onderstaande skets toon die komponente van 'n outomatiese ratkas wat in
        laagste of eerste gang geskakel is. Teken hierdie skets in jou antwoordboek wat
        die veranderinge toon wanneer dit in die tweede gang geskakel is.
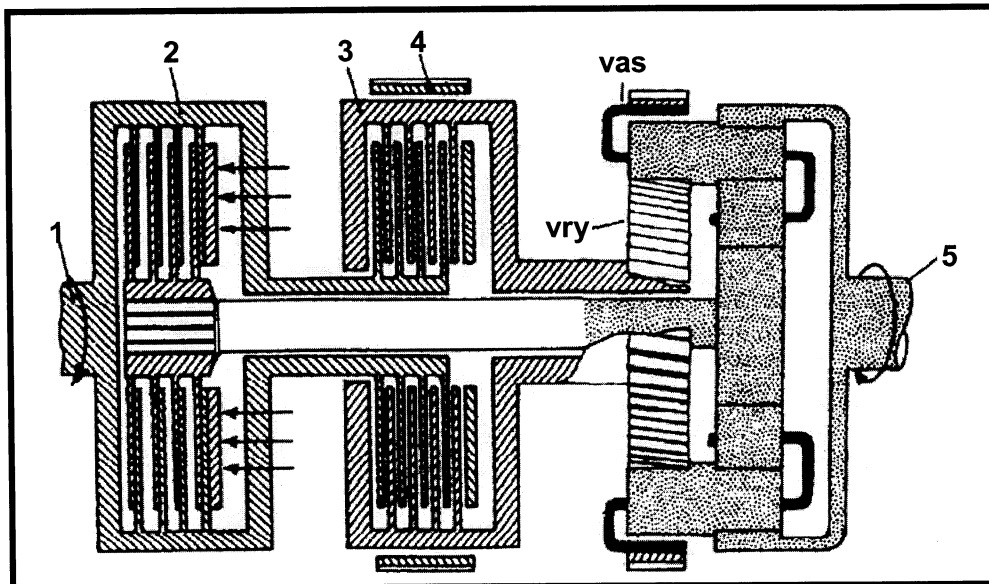
                                                                               (13)

3.6   Teken 'n netjiese skets van 'n vloeistofkoppeling.   (5)

3.7   Noem TWEE voordele van 'n vloeistofkoppeling.   (2)

3.8   Noem TWEE nadele van 'n vloeistofkoppeling.   (2)

3.9   In watter rigting draai die stator ten opsigte van die pomp wanneer die pomp en
        die turbine van die koppelomsitter teen dieselfde spoed draai?   (2)
                                                                               [32]

                                                                               b.o.

2.4   Define the following terms:

2.4.1   Indicated power   (4)

2.4.2   Brake power   (2)

[20]

QUESTION 3
DRIVES

3.1   What is the function of the two-speed final drive?   (2)

3.2   Explain the term **double-reduction final drive**.   (2)

3.3   Why do heavy vehicles and tractors require a lower gear ratio than motor vehicles
        in the final drive?   (2)

3.4   Name the drive which makes use of two rear axles.   (2)

3.5   The sketch below shows components of the automatic gearbox engaged in low or
        first gear. Draw this sketch in your answer book to show the changes when
        second gear is selected.
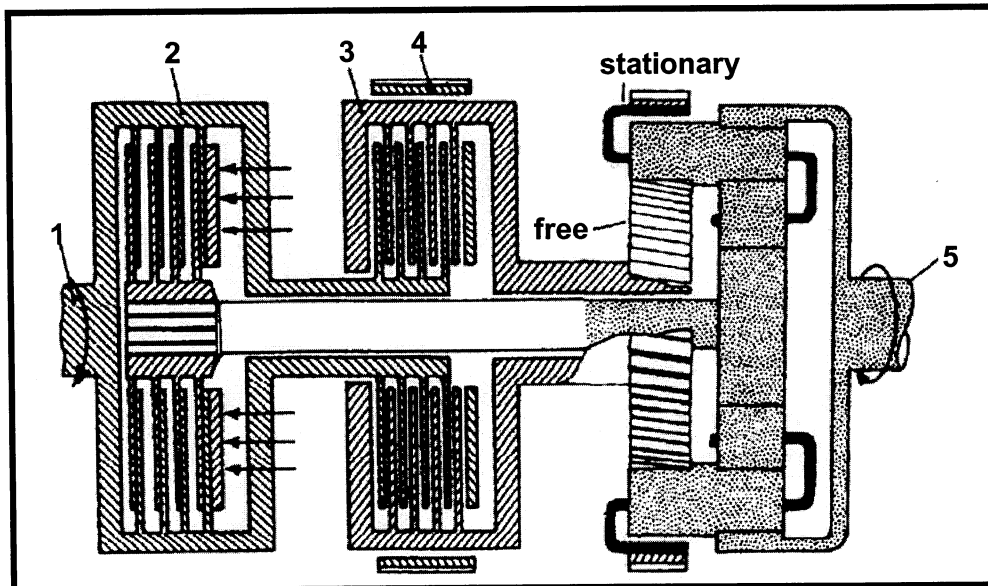
(13)

3.6   Draw a neat sketch of a fluid coupling.   (5)

3.7   Name TWO advantages of a fluid coupling.   (2)

3.8   Name TWO disadvantages of a fluid coupling.   (2)

3.9   In which direction does the stator rotate in relation to the pump when the pump
        and turbine of the torque converter rotate at the same speed?   (2)

[32]

P.T.O.

VRAAG 4
STUURWERK EN WIELSPORING

4.1 Beskryf die doel van die stuurkas. (2)

4.2 Die onderstaande skets toon 'n onvoltooide wurm-en-sektor-stuurkas. Teken hierdie stuurkas in jou antwoordboek en voeg alle ontbrekende onderdele by. Benoem volledig. (10)
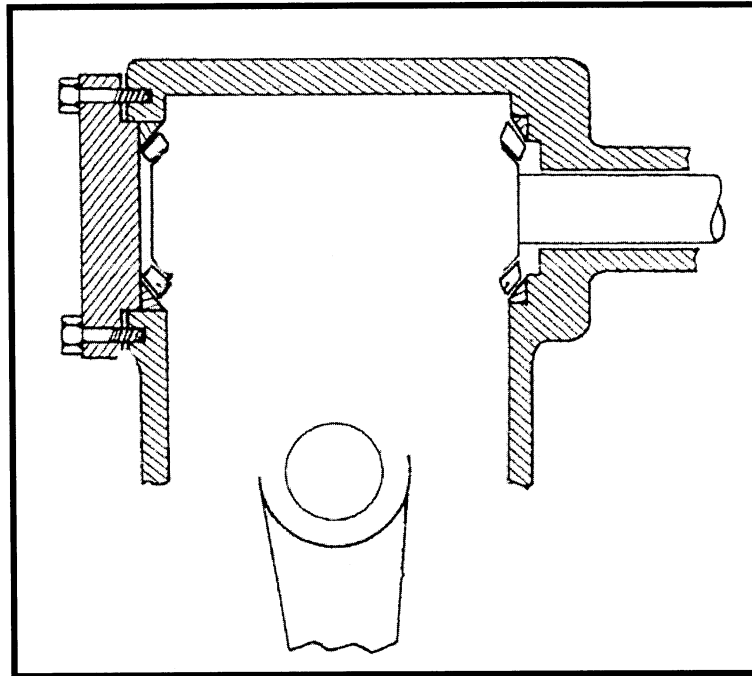

4.3 Noem DRIE nadele van kragstuur. (3)

4.4 Definieer **statiese wielbalans**. (2)

4.5 Noem VYF faktore wat in ag geneem moet word, voordat wielsporingverstellings gedoen word. (5)

4.6 Teken netjiese sketse om die volgende wielsporingshoeke aan te dui:

4.6.1 Krinkspilhelling (5)

4.6.2 Negatiewe wielvlug (5)

4.6.3 Ackerman-beginsel (8)
[40]

QUESTION 4
STEERING GEAR AND WHEEL ALIGNMENT

4.1 Describe the purpose of the steering box. (2)

4.2 The sketch below shows an uncompleted hourglass worm and sector steering box. Draw this steering box in your answer book and add all missing components. Label fully. (10)
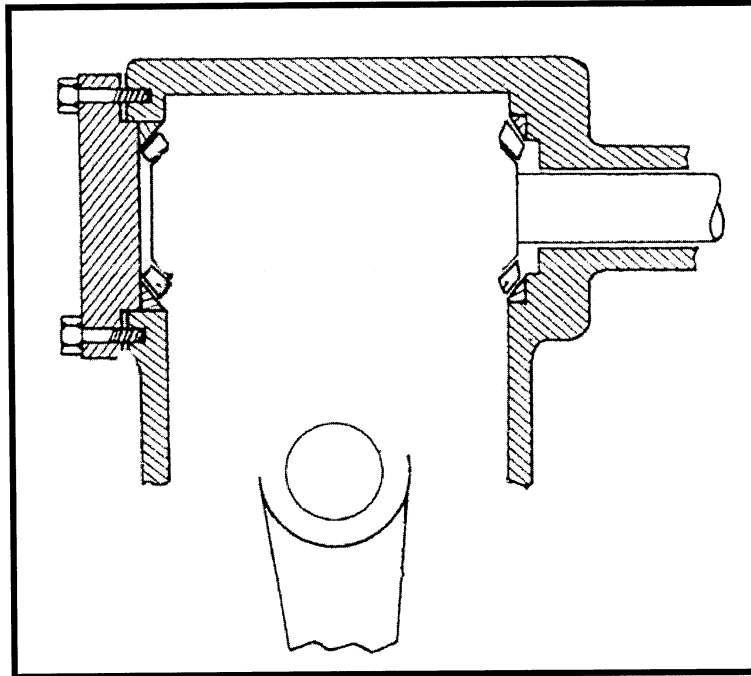
4.3 State THREE disadvantages of power steering. (3)

4.4 Define **static wheel balance**. (2)

4.5 Name FIVE factors to be taken into consideration before attempting wheel alignment adjustment. (5)

4.6 Draw neat sketches to illustrate the following wheel alignment angles:

    4.6.1 Kingpin inclination (5)

    4.6.2 Negative camber (5)

    4.6.3 Ackerman principle (8)

[40]

VRAAG 5
ELEKTRISITEIT

5.1 Teken 'n netjiese, diagrammatiese skets van die transistor-ontstekingstelsel met onderbrekerpunte vir 'n enkelsilinder-enjin. (10)

5.2 Noem VYF tipes elektriese toerusting wat jy normaalweg in 'n motorherstelwinkel nodig sal hê. (5)

5.3 Noem DRIE voordele van 'n spoedbeheer-stelsel. (3)

5.4 Noem DRIE nadele van die transistor-ontstekingstelsel. (3)

5.5 Verduidelik die term **elektromagnetiese induksie**. (2)

5.6 Teken die simbool vir 'n diode en dui die rigting van elektriese stroomvloei aan. (3)

5.7 Noem TWEE tipes magnete. (2)

5.8 Hoeveel diodes word in 'n alternator-laaikring gebruik? (2)

5.9 Die transistor, soos in die transistor-ontstekingstelsel gebruik, bevat drie aansluiters. Aan watter een word die beweegbare gedeelte van die kontakpunte verbind? (2)

5.10 Waarom is 'n kapasitor oorbodig by die transistor-ontstekingstelsel? (4)
[36]

VRAAG 6
VERGASSING / K.O. ENJINS

6.1 Definieer die volgende terme:

    6.1.1 Hittewaarde (4)

    6.1.2 Vlugtigheid (3)

    6.1.3 Voorontsteking (3)

6.2 Noem TWEE verstellings wat aan 'n inspuitpomp gemaak kan word. (2)

6.3 Noem TWEE redes waarom die kompressie-ontsteking-enjin se inspuitpomp met 'n leweringsklep (persklep) toegerus is. (4)

6.4 Teken 'n netjiese skets van die wiektipe aanjaer. (10)

b.o.

QUESTION 5
ELECTRICITY

5.1   Draw a neat, diagrammatic sketch of the transistor-ignition system with breaker points for a single-cylinder engine. (10)

5.2   List FIVE types of electrical equipment you would normally need in a motor vehicle repair shop. (5)

5.3   State THREE advantages of a speed-control system. (3)

5.4   State THREE disadvantages of the transistor-ignition system. (3)

5.5   Explain the term **electromagnetic induction**. (2)

5.6   Draw the symbol for a diode and show the direction of current flow. (3)

5.7   Name TWO types of magnets. (2)

5.8   How many diodes are used in the alternator charging system? (2)

5.9   The transistor used in the transistor-ignition system has three connecting terminals. To which terminal is the moveable part of the contact points connected? (2)

5.10   Why is a capacitor unnecessary in the transistor-ignition system? (4)

[36]

QUESTION 6
CARBURATION / C.I. ENGINES

6.1   Define the following terms:

6.1.1   Heat value (4)

6.1.2   Volatility (3)

6.1.3   Pre-ignition (3)

6.2   State the TWO adjustments that can be conducted on the injection pump. (2)

6.3   State TWO reasons why the injection pump of a compression-ignition engine is equipped with a delivery valve. (4)

6.4   Draw a neat sketch of the vane-type blower. (10)

6.5 Noem VYF voordele van die konstantevakuum-vergasser wanneer dit vergelyk
word met die statiese tipe vergasser. (5)

6.6 Verduidelik waarom die konstantevakuum-vergasser met 'n demperklep toegerus
is. (5)

6.7 Noem DRIE dele waaruit die pompelement van die kompressie-ontsteking-enjin
se inspuitpomp bestaan. (3)

6.8 Noem DRIE funksies van die enjinspoedreëlaar by die kompressie-ontsteking-
enjin. (3)
[42]

TOTAAL: 200

6.5 State FIVE advantages of the constant-vacuum carburettor when it is compared to the static type carburettor. (5)

6.6 Explain why the constant-vacuum carburettor is equipped with a damper piston. (5)

6.7 Name the THREE parts that make up the pump element of the injector pump as used on compression-ignition engines. (3)

6.8 Name the THREE functions of an engine-speed governor in the compression-ignition engine. (3)

[42]

TOTAL: 200

FORMULEBLAD

F = m x a

Arbeid = F x afstand

T = F x R

Drywing = $\dfrac{F \text{ x afstand}}{tyd}$

Drywing = $\dfrac{\text{G.E.D. x } \pi \text{ x } D^2 \text{ x slaglengte x r/s x getal silinders}}{4 \text{ x } 2}$

Drywing = $\dfrac{\text{G.E.D x } \pi \text{ x } D^2 \text{ x slaglengte x r/s x getal silinders}}{4}$

AD = PLANn

Remdrywing = F x 2 π R x N

Remdrywing = 2 π NT

Meganiese doeltreffendheid = $\dfrac{R.D.}{A.D.}$ x $\dfrac{100}{1}$

K.V. = $\dfrac{SV + VV}{VV}$

Oppervlakte = $\dfrac{\pi D^2}{4}$

Slagvolume = $\dfrac{\pi D^2 L}{4}$

EINDE

FORMULAE SHEET

$F = m \times a$

Work = $F \times$ distance

$T = F \times R$

Power = $\dfrac{F \times \text{distance}}{\text{time}}$

Power = $\dfrac{\text{M.E.P.} \times \pi \times D^2 \times \text{strokelength} \times \text{r/s} \times \text{number of cylinders}}{4 \times 2}$

Power = $\dfrac{M.E.P \times \pi \times D^2 \times \text{strokelength} \times \text{r/s} \times \text{number of cylinders}}{4}$

IP = PLANn

Brakepower = $F \times 2 \pi R \times N$

Brakepower = $2 \pi NT$

Mechanical efficiency = $\dfrac{B.P.}{I.P.} \times \dfrac{100}{1}$

C.R. = $\dfrac{SV + CV}{CV}$

Area = $\dfrac{\pi D^2}{4}$

Stroke volume = $\dfrac{\pi D^2 L}{4}$

END