GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

MOTOR MECHANICS SG

OCTOBER / NOVEMBER 2005
OKTOBER / NOVEMBER 2005

TIME: 3 hours

MARKS: 200

REQUIREMENTS:

Calculator and drawing instruments

INSTRUCTIONS:

• Answer ALL questions.
• Sketches must be neat and in good proportion.
• All sketches should be drawn on the right hand page in the answer book.
• Ensure that all your answers are numbered correctly according to the question paper.
• A formula sheet is included on page 9.

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 The TWO opposing forces which are used in the vacuum speed governor to control engine speed are atmospheric pressure and _____.

   A. intake manifold vacuum
   B. centrifugal force
   C. spring tension (2)

1.2 The TWO basic elements of petrol are hydrogen and _____.

   A. oxygen
   B. carbon
   C. nitrogen (2)

1.3 Tandem drive refers to _____.

   A. double reduction drive
   B. two-speed drive
   C. two rear axles with drive on both (2)

1.4   Which imbalance is governed by the flywheel?

A.   Mechanical imbalance
B.   Static imbalance
C.   Power imbalance   (2)

1.5   The S.U. unit for force is _____.

A.   Joule
B.   Newton
C.   Watt   (2)

1.6   When the air-fuel mixture ignites inside the combustion chamber due to glowing carbon, it is known as _____.

A.   ignition knock
B.   detonation
C.   pre-ignition   (2)

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

A.   The beginning of the injection
B.   The end of the injection
C.   The quantity of fuel injected   (2)

1.8   When a thinner cylinder head gasket is used on an engine, the compression pressure will _____.

A.   decrease
B.   increase
C.   stay the same   (2)

1.9   The connection of the voltmeter in an electrical circuit is always in _____.

A.   parallel
B.   series
C.   parallel and series   (2)

1.10   Positive castor on the front wheels occurs when the top of the kingpin is tilted to the _____.

A.   back
B.   front
C.   left   (2)

1.11   The concept **kilo** refers to _____.

A.   kilometer
B.   weight
C.   thousand   (2)

1.12 The purpose of the diodes in the alternator charging circuit is to _____.

    A.   prevent short circuits
    B.   convert alternating current into direct current
    C.   convert direct current into alternating current   (2)

1.13 When the tyre of a vehicle wears in the centre of the running surface it is because of _____.

    A.   tyre pressure being too low
    B.   tyre pressure being too high
    C.   incorrect camber setting   (2)

1.14 The concept **indicated power** refers to the _____.

    A.   amount of watt generated by the vehicle
    B.   theoretical power
    C.   actual power   (2)

1.15 The heat value of a fuel refers to _____.

    A.   the way the coolant is heated
    B.   the heat generated by the engine
    C.   None of the above.   (2)

1.16 If the driver gear in a gear train has more teeth than the driven gear, the torque _____.

    A.   increases
    B.   remains constant
    C.   decreases   (2)

1.17 The primary sun gear is connected to the _____.

    A.   front set of clutches
    B.   rear set of clutches   (2)

1.18 The vacuum over the jet of a constant vacuum carburettor decreases when the throttle valve _____.

    A.   suddenly closes
    B.   suddenly opens
    C.   remains open in a fixed position   (2)

1.19 The purpose of the stator in the torque converter is to _____.

    A.   increase torque
    B.   transfer power
    C.   increase power   (2)

1.20 A clogged air filter will have a detrimental effect on the _____ of the engine.

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

[40]

QUESTION 2
AUTOMATIC GEARBOX

2.1 Explain the purpose of the one-way clutch in the torque converter. (2)

2.2 Draw a neat sketch of the double epicyclic gear train in low gear and name the various components. (12)

2.3 Which component in the epicyclic gear train is locked when the following gear ratios are being selected?

    2.3.1   First gear   (2)

    2.3.2   Second gear   (2)

    2.3.3   Reverse gear   (2)

2.4 Can the torque of the vehicle be increased by the fluid coupling? (2)

2.5 How many brake bands are used in the automatic gearbox? (1)

2.6 To which set of clutches is the secondary sun gear connected? (2)

[25]

QUESTION 3
FUELS

3.1 What is the purpose of the fractionating tower? (2)

3.2 Name the THREE sources from which a liquid fuel can be manufactured. (6)

3.3 Name FOUR advantages of the catalytic cracking process. (8)

3.4 Define the following terms:

    3.4.1   Detonation   (3)

    3.4.2   Pre-ignition   (2)

3.5   Give the air / fuel ratio for the following conditions:

   3.5.1   Maximum power   (1)

   3.5.2   Idling speed   (1)

   3.5.3   Economy   (1)

   3.5.4   Cold starting   (1)
                                                                                          [25]

QUESTION 4
ENGINE BALANCE

4.1   Draw simple sketches to illustrate and explain static balance.   (4)

4.2   Define the following:

   4.2.1   Power balance   (4)

   4.2.2   Dynamic balance   (4)

4.3   State the following firing orders:

   4.3.1   Horizontal-opposed 4-cylinder engine   (2)

   4.3.2   Six-cylinder in-line engine   (2)

4.4   Draw a sketch of a V-4 engine crankshaft layout and show the following:

   4.4.1   Enclose angle   (4)

   4.4.2   Firing periods   (4)

4.5   What is the purpose of the crankshaft vibration damper?   (2)

4.6   When referring to the secondary flywheel, to which component is reference made
        and where is this component mounted?   (4)
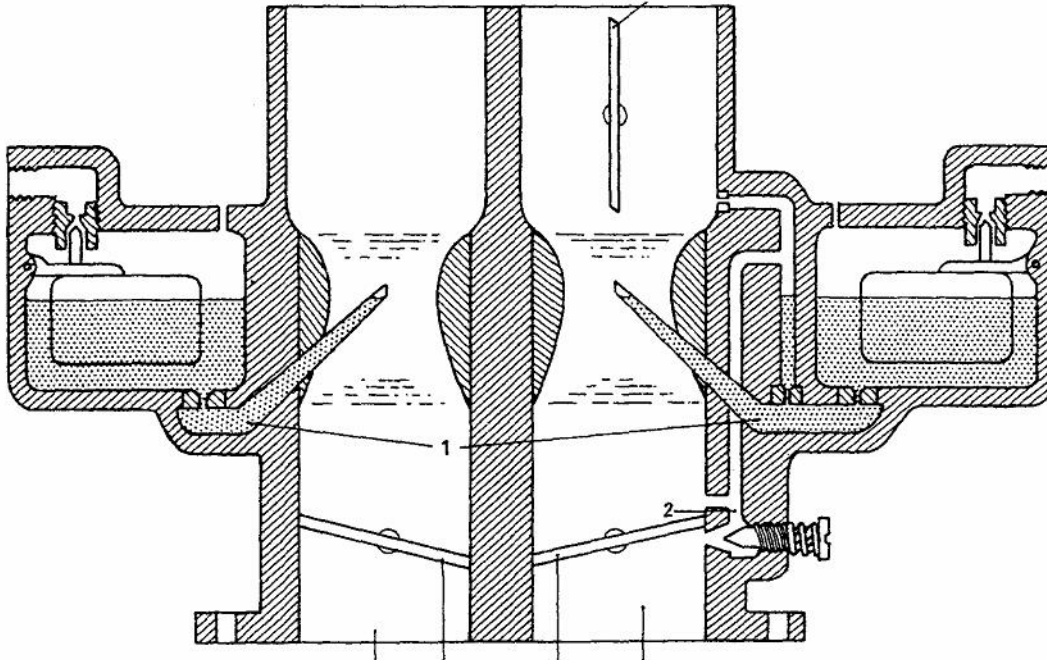   **[30]**

QUESTION 5
CARBURETTORS

Figure 1

5.1 **Figure 1** shows a two-phase multi-barrel carburettor. Redraw this sketch and show the single-phase multi-barrel carburettor. Indicate the construction differences. (12)

5.2 Describe FOUR advantages of the **constant vacuum carburettor** in comparison to **static carburettors**. (8)

5.3 Name TWO types of constant vacuum carburettors in use. (2)

5.4 What is the purpose of the following components of the constant vacuum carburettor?

    5.4.1 Damper piston (2)

    5.4.2 Tapered needle (2)

5.5 Name TWO disadvantages of the constant vacuum carburettor. (4)
[30]

QUESTION 6
ELECTRICITY

6.1 Draw a fully labelled, diagrammatic layout of a transistor ignition system without contact points. (13)

6.2 Why is a capacitor unnecessary in a transistor ignition system? (4)

6.3 State FOUR advantages of the alternator in comparison to the generator. (4)

6.4 Draw an electrical circuit to show how an ammeter is connected. (4)
[25]

QUESTION 7
CALCULATIONS / WHEEL ALIGNMENT

7.1 Define the following in terms of a motor car engine:

7.1.1 Indicated power (3)

7.1.2 Brake power (3)

7.2 The following information was obtained from an engine:

Cylinder diameter : 90 mm
Length of stroke : 110 mm

Calculate

7.2.1 the swept volume. (4)

7.2.2 the compression ratio if the clearance volume is 40 cm^3. (2)

7.3 Which principle is used to determine toe-out on turns? (2)

7.4 Name TWO types of steering boxes in use. (2)

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

7.5.1 Positive castor (5)

7.5.2 Toe-in (4)
[25]

TOTAL: 200

FORMULAE SHEET

$F = m \times a$

$Work = F \times distance$

$T = F \times R$

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

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

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

$IP = PLANn$

$Brake\ power = F \times 2\pi R \times N$

$Brake\ power = 2\pi NT$

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

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

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

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

END