GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

MOTOR MECHANICS SG

FEB / MAR 2006

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 formulae sheet is included on page 8.

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 air-fuel mixture of 15:1 is a / an _____.

     A.   rich fuel mixture
     B.   chemically correct air / fuel mixture
     C.   economical mixture   (2)

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

     A.   determine the direction of rotation of the pump
     B.   increase the torque
     C.   secure a smooth gear selection   (2)

1.3   Volumetric efficiency refers to the _____.

     A.   amount of fuel versus the amount of air taken in
     B.   volume of engine capacity
     C.   volume of air / fuel-mixture entering the engine cylinder during the inlet stroke   (2)

1.4   The TWO basic elements that petrol consists of are _____.

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

1.5   The function of the diodes in the alternator charging system is to _____.

    A.   control the current flow in the system
    B.   prevent arcing across slip rings and brushes
    C.   convert alternating current to direct current   (2)

1.6   When the spill port is opened by the plunger in the pump element it indicates the _____.

    A.   beginning of the effective pump stroke
    B.   beginning of injection
    C.   end of injection   (2)

1.7   When electrical fires are to be extinguished, use should be made of _____.

    A.   water
    B.   a foam-type fire extinguisher
    C.   a powder-type fire extinguisher   (2)

1.8   A resistor is used in an electrical circuit to _____.

    A.   interrupt the current flow
    B.   allow the flow of current in one direction only
    C.   lower current flow   (2)

1.9   Detonation occurs in a spark ignition engine when _____.

    A.   trapped fuel ignites in the combustion chamber
    B.   glowing carbon ignites the fuel
    C.   None of the above.   (2)

1.10   Vacuum over the jet of the constant vacuum carburettor decreases when the throttle valve _____.

    A.   suddenly opens
    B.   suddenly closes
    C.   None of the above.   (2)

1.11   The firing order for a horizontally opposed four-cylinder engine is _____.

    A.   1, 3, 4, 2
    B.   1, 4, 3, 2
    C.   1, 2, 3, 4   (2)

1.12 Parallel connection is applicable to the _____.

A. voltmeter
B. ammeter (2)

1.13 If the driver gear in a gear train has fewer teeth than the driven gear, the torque _____.

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

1.14 Negative castor on the front wheels occurs when the top of the kingpin is tilted to the _____.

A. back
B. front (2)

1.15 The compression pressure of an engine will decrease when a _____.

A. thicker cylinder-head gasket is used
B. thinner cylinder-head gasket is used
C. None of the above. (2)

[30]

QUESTION 2
CALCULATIONS

2.1
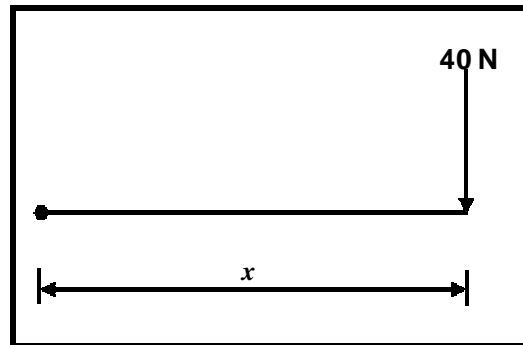
Calculate the distance of x if the torque is 240 Nm. (4)

2.2 Calculate the swept volume of an engine with a stroke length of 95 mm and a cylinder diameter of 80 mm. (Answer in cm^3). (4)

2.3 Calculate the cylinder diameter of an engine (in millimeter) with a stroke volume of 308 cm^3 and a stroke length of 80 mm. (6)

2.4 The following data refers to a four-stroke engine:

Mean effective pressure	=	900 000 Pa
Length of stroke	=	86 mm
Cylinder diameter	=	84 mm
Revolutions per minute	=	3 600
Number of cylinders	=	4

Calculate the indicated power in kW. (6)

[20]

QUESTION 3
WHEEL ALIGNMENT

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

3.2 Name FIVE factors to be taken into account before wheel alignment is adjusted. (5)

3.3 With the aid of simple sketches, illustrate the following wheel alignment angles:

3.3.1 Positive camber (4)

3.3.2 Negative castor (4)

3.4 Name TWO factors which will affect toe-out in turns. (4)

3.5 Name TWO advantages of negative castor angles. (4)

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

[25]

QUESTION 4
AUTOMATIC GEARBOX

4.1 Name TWO advantages and ONE disadvantage of the fluid coupling. (3)

4.2 In which component of the torque converter is the one-way clutch mounted? (2)

4.3 Draw a neat sketch of the double epicyclic gear train when engaged in reverse gear. (Show direction of rotation on all gears and shafts.) (10)

4.4 Which brake band in the automatic gearbox holds the primary sun gear when second gear is engaged? (2)

4.5 How many sets of clutches are used in the three-speed automatic gearbox? (2)

4.6 Draw a neat sketch of the fluid coupling and name all the components. (6)

[25]

QUESTION 5
IGNITION SYSTEMS

5.1 Name the THREE connecting terminals of the transistor. (3)

5.2 The transistor does the function of a _____. (2)

5.3 When the transistor is switched on there will be current flowing through to the _____ coil. (2)

5.4 Name THREE disadvantages of the transistor ignition system. (6)

5.5 Why will the breaker points in the transistor ignition system not deteriorate as in the case of the conventional system? (2)

5.6 Draw a neat sketch of the transistor ignition system with breaker points. (10)
[25]

QUESTION 6
FUELS / CARBURETTORS

6.1 Name THREE sources from which liquid fuels can be produced. (6)

6.2 Name TWO cracking processes which are used in the manufacturing of liquid fuels. (2)

6.3 Define the following:

6.3.1 Volatility (3)

6.3.2 Heat value (4)

6.4 Which circuit in the constant vacuum carburettor is controlled by the damper valve (Piston)? (2)

6.5 Draw a neat, labelled sketch of the mechanical activating mechanism for the two-phase multi-barrel carburettor during full throttle. (8)
[25]

QUESTION 7
ENGINE BALANCE / CI-ENGINES

7.1 Define the **effective pump stroke**. (4)

7.2 Name TWO settings which can be done on the injector pump. (2)

7.3 Draw a neat sketch of the Roots-blower. (5)

7.4 Which component is known as the **secondary flywheel** and **where** on the engine is it mounted? (4)

7.5 Draw a neat, labelled sketch of the delivery valve. (8)

7.6 State TWO functions of the delivery valve. (2)
[25]

QUESTION 8
ELECTRICITY

8.1 Out of how many separate coils does the stator in the alternator consist? (2)

8.2 Name TWO types of stator-coil connections that can be used on an alternator. (2)

8.3 Draw a neat sketch of the bi-metal temperature gauge when the coolant mixture is close to boiling point. (10)

8.4 Draw the following electrical symbols:

    8.4.1 Resistor (2)

    8.4.2 Diode (2)

    8.4.3 Switch (2)

8.5 Which electrical component of the motor vehicle makes use of a parallel electrical motor? (2)

8.6 Define **electromagnetic induction**. (3)
[25]

TOTAL: 200

FORMULAE SHEET

F = m x a

Work = F x distance

T = F x R

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

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

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

IP = PLANn

Brake power = F x 2 π R x N

Brake power = 2 π NT

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

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

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

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

END