Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ENGINE MAINTENANCE AND SERVICES
COURSE CODE	:	BNG 31903
PROGRAMME CODE	:	BNG
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSE BOOK.** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) A torque wrench is a special tool used to tighten bolts, nuts, and other fasteners to a specific level of torque, or rotational force.

(i) Name **TWO (2)** different kinds of torque wrenches that can be bought in stores.

(2 marks)

(ii) Justify why tighten nuts and bolts with specific torque is important.

(4 marks)

(iii) List **FOUR (4)** important engine bolts that need to be tightened with a certain amount of torque.

(4 marks)

(b) Identify **TWO (2)** significant pieces of information that are included in the vehicle identification number (VIN).

(2 marks)

(c) Positive Crankcase Ventilation (PCV) valve is a part in the engine that plays a large role in engine efficiency, improving emissions and the overall operation of your vehicle.

(i) Illustrate the working principle of the Positive Crankcase Ventilation (PCV) in modern vehicles with the aid of diagram.

(4 marks)

(ii) In addition to Positive Crankcase Ventilation (PCV), the catalytic converter is also part of the vehicle's emission control system. Briefly explain how it works.

(4 marks)

Q2 (a) Compression ratio is one of the fundamental specifications of an internal combustion engine that determines engine efficiency.

(i) Show compression ratio using a diagram with labels.

(4 marks)

(ii) Give **TWO (2)** different ways to change the compression ratio.

(2 marks)

(b) A 4-cylinder 4-stroke gasoline direct injection engine with a 76 mm bore running at a rated power of 80 kW at 6000 rpm. Determine the following;

(i) If the stroke length is 88 mm, calculate the engine displacement in cc.

(2 marks)

(ii) Calculate the compression ratio of the engines if the clearance volume of the cylinder is 43 cc.

(2 marks)

(c) Gasoline and diesel engine are the most common engine type in modern vehicles. Differentiate these two in terms of engine design architecture.

(4 marks)

(d) The engine cooling system enables the engine to run at its optimum temperature. The system works by sending a liquid coolant through the passage in the engine block and cylinder head.

(i) Identify **FOUR (4)** main parts in the cooling system.

(4 marks)

(ii) Explain the primary function of the thermostat.

(2 marks)

Q3 (a) Engine oil is a lubricant used in internal combustion engines, such as power cars, motorcycles, lawnmowers, engine-generators, and others.

(i) Distinguish **FOUR (4)** essential tasks of the engine's lubrication fluid.

(4 marks)

(ii) Discuss the importance of maintaining the proper engine oil level in a vehicle, and what are the potential consequences of driving with insufficient or excessive oil.

(4 marks)

(iii) Explain the significance of the numbers 5W-30 in multigrade engine oil, and investigate how does it affect the performance of an engine

(4 marks)

(b) Most vehicle manufacturers recommend changing the engine oil every six months or 10,000 km accumulated mileage, whichever comes first.

(i) In your own word, briefly explain why it is necessary.

(2 marks)

(ii) Describes the **TWO (2)** major reasons of excessive oil consumption in the car's engine.

(2 marks)

(iii) Justify why fully synthetic engine oil (0W20) is not recommended for an older engines.

(4 marks)

Q4 (a) Engine overhaul, also known as engine rebuilding, is a process of disassembling, inspecting, cleaning, and repairing or replacing the components of an internal combustion engine to restore it to its original factory specifications or improve its performance.

(i) Explains the differences between a minor overhaul and a major overhaul.

(4 marks)

(ii) **Figure Q4 (a)** shows how to measure one of the most important parts of an engine overhaul. Justify why it's important.

(4 marks)

(iii) List the **THREE (3)** measurement tools that must be used during the engine rebuilding procedure.

(3 marks)

(b) Tappet clearance, also known as valve clearance, is the small gap between the rocker arm and the top of the valve stem. Discuss why tappet clearance is significant in engine measurement activity.

(4 marks)

(c) **Figure Q4 (c)** depicts the placement of the cylinder head bolts (10-bolts) on a 4-cylinder engine. Illustrate the tightening sequence throughout engine construction.

(5 marks)

Q5 (a) Successful engine assembly depends on getting all of the details right. All the process should be based on the instructions stated in the service manual provided by the car manufacturers.

(i) List **FOUR (4)** items that need to be installed as part of the short block assembly.

(4 marks)

(ii) Identify the importance of engine prelube before the engine is started

(2 marks)

(b) The purpose of using an engine dynamometer after an engine is assembled permits checking for possible problems or leaks before the engine is installed in the vehicle besides determining the engine's output performance.

(i) Compare the differences between measured values and calculated values resulting from testing an engine on a dynamometer.

(4 marks)

(ii) List **TWO (2)** types of dynamometers.

(2 marks)

(iii) An engine knocking noise is often difficult to diagnose. Identify **TWO (2)** possible reasons that could cause engine knocking.

(4 marks)

(iv) For the best results, the engine should be tested on days with low relative humidity and high air pressure. These variables have a considerable impact on engine power. However, as a human, it is impossible for you to control the weather. As an engineer, recommend the best ways to ensure that the data obtained from the dynamometer testing is relevant and unaffected by weather conditions.

(4 marks)

-END OF QUESTIONS –

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Figure Q4 (a)

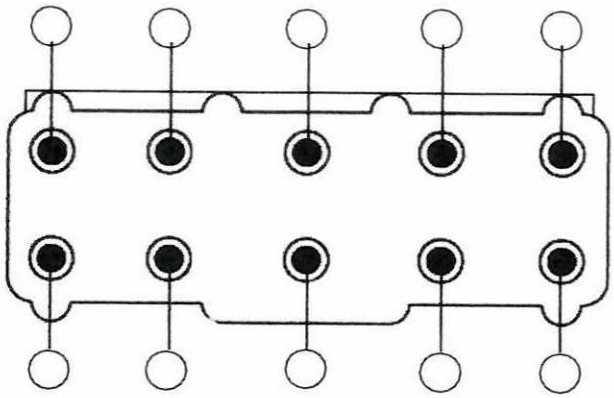

Figure Q4 (c)