



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022**

COURSE NAME : ENGINE MAINTENANCE AND SERVICE

COURSE CODE : BNG 31903

PROGRAMME CODE : BNG

EXAMINATION DATE : JULY 2022

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) Wrench is a tool that usually operated by hand, for tightening bolts and nuts. Basically, a wrench consists of a stout lever with a notch at one or both ends for gripping the bolt or nut in such a way that it can be twisted by a pull on the wrench at right angles to the axes of the lever and the bolt or nut. Wrenches also made in various shapes and sizes.
- (i) Name **TWO (2)** types of wrench based on **Figure Q1(a)**.
(2 marks)
 - (ii) Based on **Q1(a)(i)**, classify **ONE (1)** difference of this wrench types based on their usage.
(2 marks)
 - (iii) Outline **TWO (2)** types of torque wrench.
(2 marks)
 - (iv) Justify **ONE (1)** important of torque wrench during engine maintenance and service session.
(2 marks)
- (b) When raising the car, it is important that the jack is fitted in the intended points on the car's underbody. **Figure Q1(b)** shows the location of the lifting points of vehicle (Volvo S60).
- (i) Identify **TWO (2)** appropriate location of the lifting point at the vehicle based on **Figure Q1(b)**. Justify your answer.
(3 marks)
 - (ii) Name **ONE (1)** tool require during tire changing session and located at lifting point based on the answer **Q1(b)(i)**.
(1 marks)
- (c) Identify **FOUR (4)** significant pieces of information that are included in the vehicle identification number (VIN).
(2 marks)
- (d) 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) Explain the working principle of the Positive Crankcase Ventilation (PCV) in modern vehicles.
(4 marks)
 - (ii) Explain **ONE (1)** possible effect when Positive Crankcase Ventilation (PCV) valve fail to operate other than increase exhaust emission.
(2 marks)

- Q2** (a) Compression ratio is one of the fundamental specifications of an internal combustion engine that determines engine efficiency.
- (i) Define compression ratio with the aid of a sketch. (2 marks)
 - (ii) Distinguish **FOUR (4)** effects of lower compression ratio versus higher compression ratio in terms of engine performance. (4 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 42 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) Generalize **FOUR (4)** critical functions of the lubrication oil in every engine. (4 marks)
 - (ii) Differentiate between mineral oil and synthetic oil. (4 marks)
 - (iii) Outline the differences between SAE rating and API rating for engine oil. (2 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 **THREE (3)** major reasons of excessive oil consumption in the car's engine. (6 marks)
 - (iii) Justify why fully synthetic engine oil (0W20) is not recommended for an older engines. (2 marks)
- Q4** (a) The purpose of finding the top dead centre (TDC) in degreing the camshaft is to determine whether the camshaft is installed in the correct relationship or phasing with the crankshaft.
- (i) Outline the step to determine the top dead centre (TDC) from start until step "setting the dial and the pointer on the timing disk to zero". (6 marks)
 - (ii) Complete the procedure of finding the TDC in **Q4(a)(i)** until complete. (6 marks)
- (b) An engine with camshaft setup of intake valve opening at 46 degree BTDC, intake valve closing at 64 degree ABDC, exhaust valve opening at 57 degree BBDC and closing at 43 degree ATDC.
- (i) Illustrate the valve timing diagram based on the above setup. (4 marks)
 - (ii) Calculate the valve overlap period. (2 marks)
- (c) 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. (2 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 **THREE (3)** items that need to be installed as part of the short block assembly. (3 marks)

- (ii) Explain the importance of maintaining the correct piston ring gap. (2 marks)
- (iii) The torque exerted on the bolts is used to control the clamping force that is applied to the gasket. With the aid of a sketch, illustrate the typical cylinder head bolt torque sequence. Assume the total bolts are 10 pieces. (5 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) An engine knocking noise is often difficult to diagnose. List **TWO (2)** possible reasons that could cause engine knocking. (2 marks)
- (iii) The engine should be tested in a perfect day with low relative humidity and high atmospheric pressure for the best results. These factors have a significant effect on the engine's power. As an engineer, suggest the best solution to overcome this issue. (4 marks)

-END OF QUESTIONS -

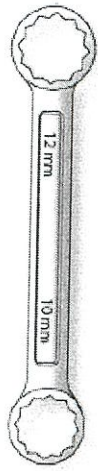
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(i)



(ii)

Figure Q1(a)

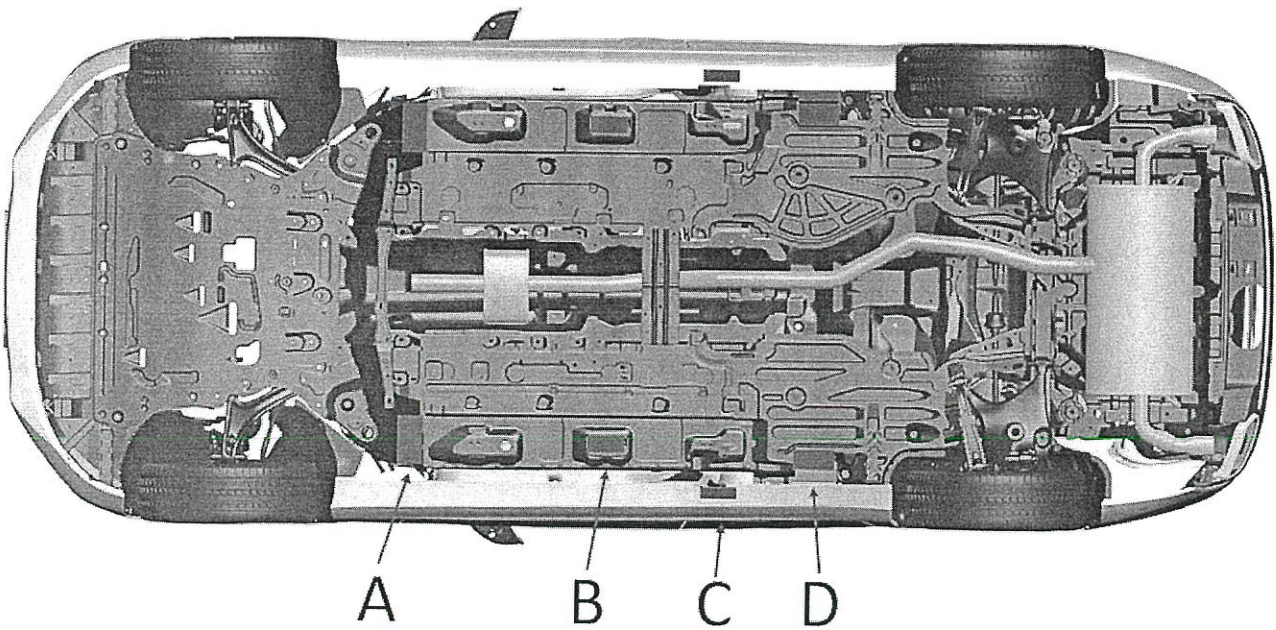


Figure Q1(b)

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