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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2013 SESSION

SUBJECT CODE	:	**FVB40403**
SUBJECT TITLE	:	**ENGINE PERFORMANCE ENHANCEMENT**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2.5 Hours**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **Answer all questions in English.**

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: There are SIX (6) questions. Answer FOUR (4) questions only.

(Total: 100 marks)

Please use the answer booklet provided.

Question 1 (25 marks)

Evaluate how the engine performance can be increased by modifying the engine component as listed below:

(a) Cylinder Head

(10 marks)

(b) Camshaft and Valve train

(5 marks)

(c) Exhaust System Modifying

(5 marks)

(d) Engine Management System – tuning

(5 marks)

Question 2 (25 marks)

All spark ignition engines require a method of reducing engine torque output during operation. This allows engine power output to match requirements throughout the engine speed and load range.

(a) Explain how to reduce the torque as shown in the **Figure 1** below:

(10 marks)

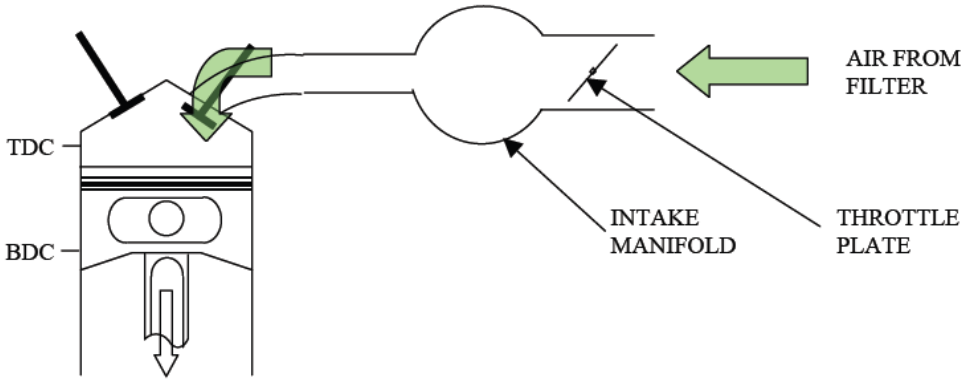

Figure 1

(b) Describe how the Intake pumping losses resulted.

(5 marks)

(c) Describe how the Exhaust Gas Recirculation (EGR) produces a reduction in pumping losses.

(5 marks)

(d) Describe how the pumping losses can be reduced by reducing valve lift to throttle the cylinder or by changing the intake valve closing timing.

(5 marks)

Question 3 (25 marks)

The following combustion chamber design changes increase the mass burning rate in a spark-ignition engine at fixed compression ratio, bore, speed, and inlet mixture conditions. Explain how each change affects the burning rate.

(a) Using two spark plugs per cylinder instead of one.

(7 marks)

(b) Using a combustion chamber with higher clearance height near the spark plug and a more central plug location**.**

(8 marks)

(c) Explain what the "best" spark timing is.

(5 marks)

(d) Describe how the spark timing varies with engine speed and load.

(5 marks)

Question 4 (25 marks)

Supercharging is a term used for a process which helps to increase the suction pressure of an IC engines above the atmospheric pressure.

(a) Explain the requirement of supercharger to be fulfilled.

(5 marks)

(b) Describe how the supercharger raises the engine power output.

(10 marks)

(c) Explain the comparison of actual naturally aspirated and supercharged engine as shown in the **Figure 2** below.

(10 marks)

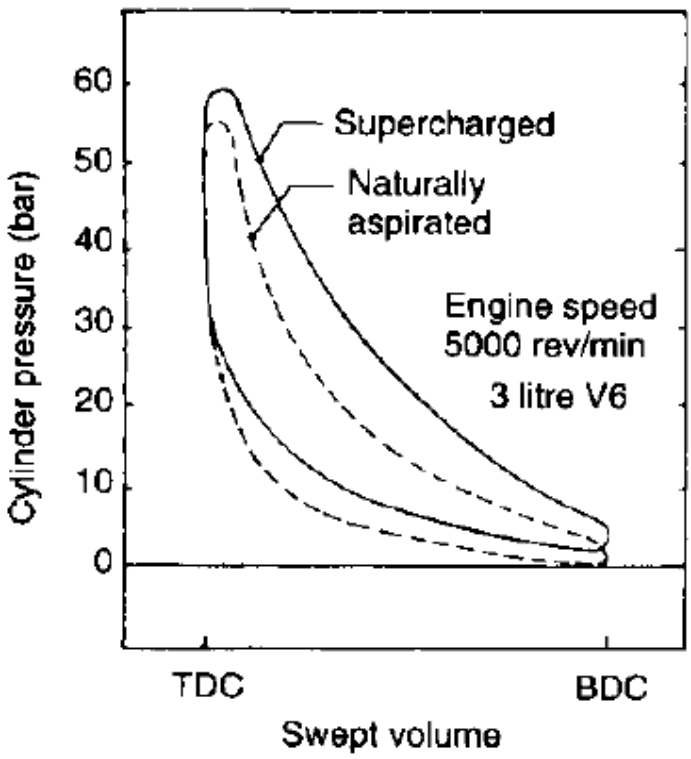

Figure 2

Question 5 (25 marks)

A turbocharger utilizes a portion of the energy contained in the exhaust gas, when it is released by the opening of the exhaust valve towards the end of the power stroke.

(a) Describe the mechanism of turbocharger.

(5 marks)

(b) The **Figure 3** shows the comparative A/R ratios for vaneless turbine housings.

Explain the effect of:

(i) A large A/R ratio

(5 marks)

(ii) A small A/R ratio

(5 marks)

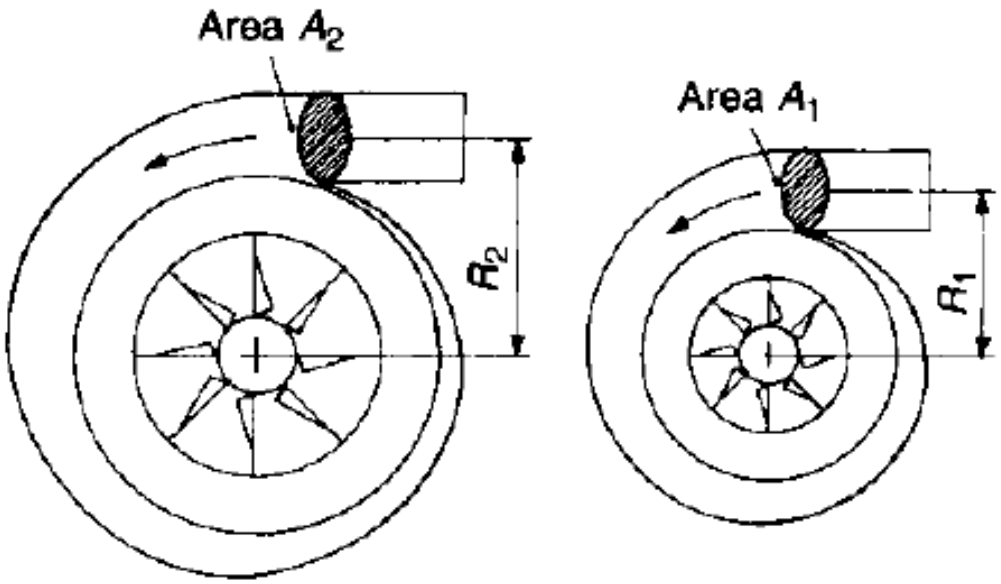

Figure 3

(c) Air at atmospheric pressure (1 bar) and temperature of 25 ^{0}C is drawn into the compressor where it is compressed to a boost pressure and temperature of 0.6 bar and 120 ^{0}C respectively. Determine the output density ratio of the compressed and compare this with the ideal value if there was no temperature increase.

Hint:

The charge density: $\rho = \frac{p}{RT}$

(10 marks)

Question 6 (25 marks)

An auto engine has a bore of 90 mm, stroke of 85 mm and compression ratio 0f 8.5. The engine is rebored to 2 mm oversize.

Calculate:

(a) Original capacity of the engine.

(5 marks)

(b) Percentage increase in capacity due to reboring.

(5 marks)

(c) Compression ratio after reboring.

(5 marks)

(d) Air standard efficiency (before and after reboring).

(5 marks)

(e) Discuss the result.

(5 marks)

END OF QUESTION