



**UNIVERSITI KUALA LUMPUR  
Malaysia France Institute**

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**FINAL EXAMINATION  
JANUARY 2014 SESSION**

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**SUBJECT CODE** : FVB 40903  
**SUBJECT TITLE** : AUTOMOTIVE MATERIALS  
**LEVEL** : BACHELOR  
**TIME / DURATION** : 2.5 Hours  
**DATE** :

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**INSTRUCTIONS TO CANDIDATES**

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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.
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**THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.**

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

**(Total: 100 marks)**

**Please use the answer booklet provided.**

**Question 1 (25 marks)**

- (a) In order for cylinder block to meet these functional requirements the engineering materials used to manufacture, the product must possess high strength, modulus of elasticity; wear resistance, scuffing resistance, and corrosion resistance.

Explain:

- (i) Wear phenomena.

(5 marks)

- (ii) Scuffing phenomena.

(5 marks)

- (iii) The reason for the wear and scuffing should be occurred on the cylinder bore surface.

(5 marks)

- (b) In the past, automakers have moved from cast iron to aluminum cylinder blocks for weight shedding purposes. Describe the reason for replacing cast iron to aluminum.

(10 marks)

**Question 2 (25 marks)**

- (a) Piston is considered to be one of the most important parts in a reciprocating engine in which it helps to convert the chemical energy obtained by the combustion of fuel into useful (work) mechanical power. Piston materials include aluminum-silicon alloy, eutectoid alloys and hypereutectoid alloys.

Explain:

- (i) Eutectoid alloys.

(8 marks)

- (ii) Hypereutectoid alloys

(8 marks)

- (b) The pistons must be ensured to have high wear resistance and good running properties.  
Describe the various ways that should be conducted to finish the surface treatment.  
(9 marks)

**Question 3 (25 marks)**

- (a) The first and most important step in selecting rings is to identify your application and its intended usage. Explain the requirement if :
- (i) Your application is to be used for common automotive passenger car and light truck usage.  
(5 marks)
  - (ii) Your application is to be used for high performance.  
(5 marks)
- (b) Describe the surface treatments to employ with piston rings as listed below:
- (i) Plasma spatter layers.  
(5 marks)
  - (ii) PVD layers (Physical Vapor Deposition).  
(5 marks)
  - (iii) HVOF layers (High Velocity Oxy-Fuel).  
(5 marks)

**Question 4 (25 marks)**

- (a) Combustion gases in four-stroke engines are controlled by the valve mechanism, a complex structure, often referred to as a valve train, of which the camshaft is an integral part.  
Explain the processing and characteristics of the various camshafts type as listed below:
- (i) Quench tempered camshaft.  
(6 marks)
  - (ii) Carburized camshaft.  
(6 marks)
  - (iii) Bonded camshaft  
(6 marks)

- (b) Similar to the situation for the vehicle of the engine's mass is minimized as a whole, the camshaft as an individual component is subject to the necessity to reduce masses.

Explain the possible option that should be considered.

(7 marks)

**Question 5 (25 marks)**

- (a) The seat for the exhaust valve is heavily impacted by heat and corrosion, which is why, as a rule, it is hardfaced with special alloys. In isolated cases, this is also done for the intake valve even though martensitic hardening is normally used because of the material selected. Hardfacing can be used to reduce wear and enhance the sealing effect.

Explain the process that can be applied to valve hard facing.

(10 marks)

- (b) The demands made on a valve include endurance strength at elevated temperatures, wear resistance, resistance to high-temperature corrosion, and oxidation and corrosion resistance.

Explain the standard valve materials as the following:

- (i) Ferritic-martensitic valve steels

(5 marks)

- (ii) Austenitic valve steels.

(5 marks)

- (iii) Valve materials with high nickel content.

(5 marks)

**Question 6 (25 marks)**

- (a) The connecting rod is generally abbreviated to con-rod. The crankshaft con-rod mechanism transforms reciprocative motion to rotational motion. Select the materials that should be used for:

- (i) Lightweight vehicle.

(8 marks)

- (ii) Racing engines

(8 marks)

(b) Great care must be observed in the crankshafts since it is the most important part of the engine. Explain the possible effect that can influence the crankshaft's service life.

(9 marks)

**END OF QUESTION**