Question 1

What factors influenced the collapse of the MG-Rover car company, and how are these factors influenced by global politics? How far do multinational companies control the economic climate and to what extent are they controlled by government social-economic policy? How do global marketing strategies influence design of automobiles and manufacturing policy, especially make or buy policy from component suppliers? Illustrate your answer with examples from present day automotive industry practice.

[25 Marks]

Question 2

The Formula one (F1) industry has an annual spend of about £1.5 billion. The richest companies spend about £250 million per year and the smallest about £25 million per year. How can this be justified? Give examples of technical advances or concepts, which have been developed for the F1 sport and have been adopted in volume production cars. What, in terms of technical innovation, volume of manufacture and variety of design, are the differences between engineering for the F1 market and the global car market.

[25 Marks]

Question 3

(a) What is fuzzy logic? Distinguish between Crisp and Fuzzy values.

[5 Marks]

(b) Explain why fuzzy logic is used in a microprocessor based engine management system, and compare with any other possible technical solutions.

[15 Marks]

(c) What are the advantages and disadvantages of a microprocessor based engine management system, as compared with a simple mechanical throttle and carburettor?

[5 Marks]

Question 4

(a) How does Ergonomics in general and the man-machine interface specifically help in the design of a motorcar interior?

[7 Marks]

(b) What is ENCAP and how does it influence the design of automobile body shells.

[8 Marks]

(c) Explain how vehicle crash dynamics is used together with a CAD system, such as CATIA, to design vehicles, which meet or exceed ENCAP.

[10 Marks]
Question 5

Give an account of some recent near-to-market technical developments in automobile technology. Explain how the ideas have advanced the state-of-art of vehicle technology. Give references and examples of production vehicles where appropriate.  

[25 Marks]

Question 6

(a) Describe three workbenches, which you may find in an industry standard CAD system such as CATIA. With reference to the data sheet explain the mathematics used to program each workbench.  

[6 Marks]

(b) What is Constructive solid geometry? How does the Euler-Poincare formula help in solid body modelling?  

[4 Marks]

(c) Describe in detail how to use CATIA to model a monocoque automobile body shell.  

[15 Marks]

Question 7

(a) When deriving the governing differential equations of motion of a dynamical system, both Newton’s second law and Lagrange’s equation can be used. Explain briefly the main differences between the two approaches.  

[5 Marks]

(b) Draw a simple diagram of a piston, connecting rod, crankshaft and cylinder. Try to apply Lagrange’s equation to the system and explain the problems. Consider an alternative method for calculating the forces on the piston and explain how to combine this with Lagrange’s equation to estimate the forces in the connecting rod.  

[20 Marks]

Internal Examiner: Dr. R.C.Edney  
External Examiner: Prof M. Imregun