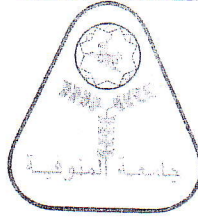


Menoufiya University
Faculty of Engineering Shebin El-Kom
Mechanical Power Eng. Department
Post graduate Examination 2014-2015



Subject: Performance of ICE
Level: 600. Code: MPE618
Time Allowed: 3 hours
Total Marks :100 marks
Date of Exam : 13 /6/2015

Solve the Following Questions and assume any required data
(Question Number-1) :(25 Marks)

- (a) What is meant by "economical mixture" in SIE. Explain why at part load, the engine operates at the economical mixture rather than the mixture of maximum power. Show also how to identify the quality of economical mixture at part load condition. (6 marks)
- (b) Identify briefly the following terminology:
EFI – ECU – TBI – WOT – GDI (6 marks)
- (c) Classify the fuel injection system used in SIE and show the advantage and disadvantage of each one. (6 marks)
- (d) Compare between speed-density EFI system and direct measurement EFI system in terms of
- Fuel metering technique
 - Injection timing
 - Injection location
- Elucidate why direct air measurement system is more accurate in term of fuel metering process. (7 marks)

(Question Number-2) :(25 Marks)

- (a) Explain why in Diesel engines, the mixture required at no load condition is extremely lean while in spark ignition engine and at the same operating condition, the mixture must be rich enough to ensure stable operation. (6 marks)
- (b) Discuss the mixture requirements for cold starting condition in SIE and show how EFI system satisfies this requirement. Draw a sketch to represent this process. (6 marks)
- (c) Drive mathematical expression to simulate the change of inlet manifold pressure during the thermal cycle. Discuss the role of the design factor on diminishing the effect of pressure waves travelled in the inlet manifold. Draw also modified design for inlet manifold to ensure symmetrical path of mixture to different engine cylinders (7 marks)
- (d) Compare between carburetor as a fuel system in SIE and throttle body injection system in terms of mixture quality and timing. Show also the advantages and disadvantages of each system (6 marks)

(Question Number-3) : (25 Marks)

- (a) Discuss the role of the following elements in direct air measurements EFI system.
- Water temperature sensor
 - Thermo-time switch
 - Air metering system
 - Engine speed sensor
- (4 marks)
- (b) Explain why, using stoichiometric mixture in Diesel engine leads to smoked exhaust and loss of power, while in SIE this mixture quality leads to generate maximum power.
- (6 marks)
- (c) What is the importance of oxygen sensor in spark ignition EFI system? Discuss briefly its theory of operation.
- (6 marks)
- (d) Speed-density EFI mounted on SIE and runs at 3000 rpm when the mean effective pressure is 8.74 bar. The torque applied at crank shaft is 120 N.m and A/F is 16.5. Calculate the pulse width of the injector signal generated by ECU. At this operating condition, ECU records the following data :
- Inlet manifold air pressure 0.95 bar
 - Inlet manifold air temperature 24 °C
 - Volumetric efficiency 0.68
 - Water temperature 90 °C
- Draw also the injection timing diagram for the engine.
- (9 marks)

(Question Number-4) : (25 Marks)

- (a) What is the effect of the following factors on volumetric efficiency
- Air humidity
 - Vaporization of fuel in inlet manifold
- Show also the weight of each factor mathematically
- (6 marks)
- (b) Discuss briefly the technical tests performed frequently on fuel injection system of diesel engine to maintain optimum performance.
- (6 marks)
- (c) Explain why a mixture requirement for diesel engine at part load is completely different than that of SIE at the same operating condition.
- (6 marks)
- (d) Draw a sketch for common rail EFI system in Diesel engine and show how it can meter the correct amount of fuel at different loads. Compare between the conventional hydraulic injection system and the electronic common rail system.
- (7 marks)