

Menoufia University  
Faculty of Engineering  
Shebin El-Kom  
Department: Mechanical Power Eng.  
Total Marks: 100 marks



Subject: Air Pollution  
Code : MPE628  
Level: Master  
Time Allowed: 3 hours  
Date of Exam: 10/6/2017

This exam measures ILOS no.: (A6, A11, A18), (B5, B9, B10), (C15), (D1, D2)

Answer the following questions:

**Question (1)** (25 marks)

- (a) What is the difference between thermal and catalytic converters? How do they help to reduce emissions from engines? (8 marks)
- (b) S.I.E. works by hydrogen fuel. Explain in details how you can measure the concentration of emissions from that engine. (6 marks)
- (c) How is the  $SO_x$  formed in the exhaust of IC engines? What are the important variables that affect  $SO_x$  emissions? (6 marks)
- (d) What are the problems created by exhaust emissions? (5 marks)

**Question (2)** (25 marks)

- (a) Explain briefly the following terms: (8 marks)
- 1- Blow-by emissions
  - 2- SOF (Soluble Organic Fractions)
  - 3- Non-exhaust emissions
  - 4- Light-off temperature
- (b) Show with equations how air pollution causes the formation of photochemical smog. (6 marks)
- (c) With the help of a schematic diagram explain the working principle and operation of an analyzer used for measuring the concentration of unburned hydrocarbons. How is this analyzer calibrated? (11 marks)

**Question (3)** (20 marks)

- (a) What do we mean by environmental pollution? Mention the different sources of environmental pollution? Explain its harmful effect on elements of environment? (6 marks)
- (b) Describe the working principle of Bosch smoke-meter with the help of a simple line diagram. (6 marks)
- (c) Explain the causes of hydrocarbon emissions from CI engines? (8 marks)

**Question (4)** (30 marks)

- (a) What are the causes of poisoning the catalyst of a converter? How can be reduced? (6 marks)
- (b) What do you understand by the term EGR? Explain how EGR reduces  $NO_x$  emission. (6 marks)
- (c) What are the design and operating variables which may increase the formation of  $NO_x$  and UHC in the exhaust of SI engine? (12 marks)
- (d) With a neat sketch explain the effect of equivalence ratio on HC, CO, and  $NO_x$  emissions for a four stroke direct injection diesel engine. (6 marks)

With my best wishes  
*Dr. Gaber Asar*