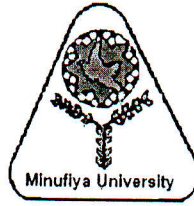


Menofiya University
Faculty of Engineering
Shebin El-Kom
First Semester Examination
Academic Year: 2012-2013



Year: Ph.D exam
Department: MPE706
Subject: unconventional ICE
Time Allowed: 3 hours
Date: 6 / 1 / 2018

Allowed Tables and Charts: None

Answer all the following Questions

Question (1) (30 marks)

- (a) Discuss the philosophy of variable compression ratio engines showing its effect on engine performance at different operating conditions. (10 marks)
- (b) Discuss how to perform Alvar cycle in SIE. Discuss the role of the phase shifter to perform variable compression ratio during operation. Derive mathematical expression to simulate the instantaneous cylinder volume with respect to crank rotation. Illustrate your answer graphically. Discuss the availability of using supercharged process in this type of engine. (10 marks)
- (c) Prove that, controlling valve timing for inlet valve can used to perform variable compression ratio engines. Discuss also the limitations of such technique. (10 marks)

Question (2) (40 marks)

- (a) Differentiate between different types of Stirling engines. Explain why this type of thermal engines considered as real multi fuel engines. Show also how to use unconventional heat sources to derive such engines. Draw also a sketch for each type. (20 marks)
- (b) Derive a complete mathematical model to simulate the thermal processes occurs during the thermal cycle of Stirling engine from any type at transient conditions. Simulation must consider the kinematics of the moving parts. (20 marks)

Question (3) (30 marks)

- (a) Illustrate combustion process occurs in HCCI engines and discuss the limits required to avoid sever knock inside engines. Is stratified charge technique suitable for use in HCCI engines? Discuss your answer briefly. (10 marks)
- (b) Identify HCCI free piston engine performance compared to the traditional ICE. Draw a sketch to this type of engine and show the type of electric generator mounted to its power piston. (10 marks)
- (c) Propose different methods to control ignition timing in HCCI engines with respect to external load and speed. Show the advantages and disadvantages of each one. (10 marks)