Menoufiya University

Faculty of Engineering Shebin El-Kom

Mechanical Power Eng. Department

Second Semester Examination 2013-2014



Subject: Design of ICE Code: MPE 414C

Level: 4th year

Time Allowed: 3 hours Total Marks: 90 marks Date of Exam: 3/6/2014

Solve the Following Questions and assume any required data (Question Number-1):(22 Marks)

- (a) Draw the details of Solex carburetor and explain its performance at part load condition (6 marks)
- (b) Choose the suitable EFI system to replace zenith carburetor for SIE with minimal mechanical modifications. Show the advantage of the new system compared to carburetor system (6 marks)
- (c) SIE consumes 240 g/kW.h when running at WOT, where engine speed and power are 5500 rpm and 70 kW respectively. If the engine capacity is 2 liter, evaluate the mixture quality at this operating condition and compare it with the optimum mixture quality at this condition. (5 marks)
- (d) In the previous problem if the mixture deviates the optimum value at full load condition, estimate the engine power when running at the optimum mixture quality. Consider the other parameters remain the same (5 marks)

(Question Number-2) :(23 Marks)

- (a) What is meant by "economical mixture" in SIE. Explain why at part load, the engine operates at the echonomical mixture rather than the mixture of maximum power (5 marks)
- (b) Identify briefly the following terminology: EFI - ECU - TBI - WOT - GDI (5 marks)
- (c) Classify the fuel injection system used in SIE and show the advantage and disadvantage of each one. (5 marks)
- (d) Draw flow chart to represent program used to control the speed-density injection system (8 marks)

(Question Number-3) :(22 Marks)

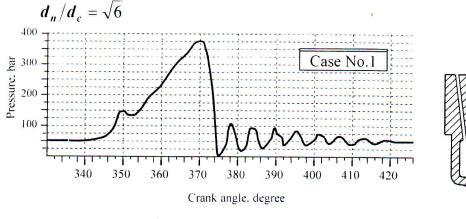
- (a) Develop mathematical model to represent the change of manifold pressure with respect to design parameters. (5 marks)
- (b) Draw sketch for EFI system of SIE employs direct air measurement technique. Discuss briefly how the system controls the mixture quality at different operating conditions and the role of each sensor in the system (5 marks)
- (c) 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. (5 marks)
- (d) Compare between single shot injection and split injection technique in EFI of Diesel engines in terms of engine performance and emission. (7 marks)

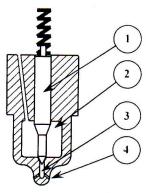
(Question Number-4): (23 Marks)

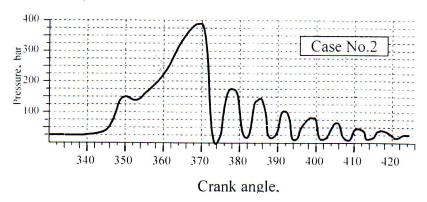
- (a) Diesel engine uses electronic fuel injection system. The injection starts at 20° after TDC. The engine runs at the following condition: output power=50 kW @ 2800 rpm, sfc=220 g/kW.h. The injector contains 4 holes with 0,15 mm diameter each, and opening pressure is 1100 bar. Calculate:
 - Injection duration in terms of crank angle degree.
 - Engine cylinder dimensions if the engine runs at A/F=18

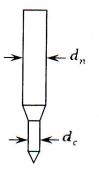
If split injection technology is employed at which 3 successive injections are performed instead of one with dwell period equal half of each split injection, assign the total injection period in this case in terms of crank angle degree (13 marks)

(b) Diesel engine runs at 2750 rpm and exposed to certain load. The instantaneous fuel pressure at the needle chamber is recorded during the injection cycle as shown in case No. 1. When the external load increases, the instantaneous fuel pressure at the needle chamber changed as shown in case No.2. The injector needle dimensions are represented as follows:









- Identify each part number shown in the figure above.
- Assign the opening pressure and closing pressure in each case
- Start of injection and end of injection in each case
- Residual pressure inside the pressure line in each case.
- Assign the after injection period if exist in each case
- Estimate the length of injection pipe in case No. 1 (12 marks)

(2/2)

With our best wishe

				<u>, </u>	viin o	ur desi	wisnes	3					
This exam co	ntribut	es" by	measu	ring in	achievi	ing Prog	ramme	Academ	ic Stan	dards	accordin	g to NAR	S
Question Number	Q2-d	Q2.c	Q2.b	Q1.a	Q4.a	Q3.b	Qle	Q2a	Q1.c	Q1.d	Q4.b Q4.b	Q3.b	Q3-a