


Faculty of Engineering - Mataria.	 HELWAN UNIVERSTY	1 st Semester
Mechanical Power Department.		Academic Year 2015/2016
Course Name:		Final Exam
Internal Combustion Engines (2).		Date of Exam: Jan. 2016
Course Code:		Time Allowed: 3 hrs.
Level: Fourth Year		Maximum Mark: 90

1. Attempt all questions.
2. Illustrate your answer by neat sketches and diagrams whenever possible.
3. Assume reasonable values for any missing data.
4. Exam is (1) paper (2) page.

Q1	Mark (21)
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a. Reason the following:

- i. Crank-case scavenging is used only for low power engines.
- ii. Loop or uniflow scavenging is commonly used for high power engines.
- iii. "If the breathing losses of two-stroke engines are not to be excessive, the mean piston speed has to be limited". (9 Points)

b. A single cylinder, two-stroke spark-ignition engine with petrol injection has a bore of 114 mm, stroke of 152 mm and a compression ratio of 8. The bmep is 7 bars at 30r.p.s while the indicated thermal efficiency is 0.34, the mechanical efficiency is 0.8 and the air supplied is 0.0756 Kg/s. If the fuel is injected after ports closure resulting in a cylinder fuel to air ratio of 0.07, calculate:

- i. Scavenging ratio and scavenging efficiency.
- ii. Brake and indicated power in KW.
- iii. The indicated thermal efficiency of the engine if a 0.07 fuel-air ratio carbureted mixture was used. Consider the exhaust pressure to be 1.05 bar, inlet air temperature to cylinder 40C⁰ and the calorific value of fuel 43.71Mj/Kg. (12 Points)

Q2	Mark (19)
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a. Suppose an engine was constructed for variable valve timing, thus ensuring optimum timing at all speed. Explain, with the aid of a graph, how the volumetric efficiency would vary with speed at wide open throttle operation with short inlet pipe and $Z < 0.5$. (7 Points)

b. A diesel engine used for a tractor produces 52Kw at 1650rpm with a brake specific fuel consumption of 0.25 Kg/KW.hr. at sea level with barometer 760mm Hg and temperature of 25C. The tractor was taken to a hill top at an altitude of 3000 meters (barometer 540mm Hg and temperature 270K) with the fuel pump delivery lever at the fixed position. Estimate the power output and specific fuel consumption at hill top. Mechanical efficiency is 0.8. The air coefficient at sea level is 1.6. For this particular engine, 5 percent decrease in air coefficient produces 1 percent decrease in indicated thermal efficiency at the particular fuel setting. Assume the engine speed to remain constant. (12 Points)

Q3	Mark (25)
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a. Put forward a detailed account of the thermal load patterns of the cylinder head, piston and liner of induction swirl, compression swirl and combustion swirl CIE. Then discuss the reasons for cracking in the critical areas of the combustion chamber under

