Mansoura University
Faculty of Engineering
Mech. Power Eng. Dept.
Fourth Year

Final Semester Exam
Engines Performance-MPE4415
January 15, 2013, Time: 3 hr
Full Mark:90

Answer the following questions. Assume any necessary assumptions.

Question (1) [30 marks]

[4 marks]

1.1 Explain briefly with aid of a neat sketch the basic principle of a dynamometer.

1.2 Describe with neat sketches the operation of: [12 marks]

a- Electronic stroboscope.
b- Electrical dynamometer.
c- Burette tube with electronic timing.
d- Air intake measurement by a tank and orifice plate.

[14 marks]

1.3 A 4-cylinder, four-stroke engine gasoline engine gave the following results on the test bed: Cylinder diameter = 90 mm, Piston stroke = 85 mm, shaft speed 1500 rpm, torque arm 0.6m, net brake load 260 N, time for 50 ml of fuel 25 sec, mass flow rate of cooling water 0.06 kg/sec, pressure drop across orifice 20 mm H_2O(m_{air}[kg/hr]=18.65 $\sqrt{\Delta H \times \rho_{air}}$, where ΔH in mm, ρ_{air} inlet air density kg/m^3), the area of indicator diagram 530 mm^2, pressure scale 100 kPa/mm and base length of diagram 50 mm, exhaust gases temperature 450 °C, water outlet temperature 73 °C, water inlet temperature 15 °C, air inlet temperature 18 °C, ambient pressure 1.01 bar, specific gravity of fuel 0.85, heating value of fuel 43000 kJ/kg, and specific heat of exhaust gases 1.19 kJ/kg. °C. Calculate the brake power, brake mean effective pressure, brake specific fuel consumption, λ, brake thermal efficiency, mechanical efficiency, volumetric efficiency and draw up heat balance sheet on kW.

Question (2)[30 marks]

[6 marks]

2.1 State two methods of water supply measurements and discuss their theory of operation.

2.2 Explain the following test: [8 marks]

a- Motoring test.
b- Morse test.

2.3 Deceleration method test on a single cylinder gas engine. The test data are shown in table. The brake power is 30 kW and the polar moment of inertia of the moving parts 120 kg.m^2.

[6 marks]

Engine speed [rpm]	Time [sec]
1000	0
805	35
660	66
510	110
395	152
290	200
0	350

Calculate the initial deceleration of the engine, the friction power, and the mechanical efficiency at the initial speed.

2.4 Willan's line test for single cylinder 1400 cc, 4 stroke compression ignition engine running 1400 rpm. The test data are shown in table. Torque arm=0.25m. [10 marks]

Brake load [N]	Time for 50 ml of fuel s.g=0.85, [sec]
50	190
76	150
120	110
165	95
240	70
350	50
375	20

Calculate the friction power, bmep and mechanical efficiency.

Question (3)[30 marks]

3.1 Draw and discuss the effect of an engine speed on the volumetric efficiency, bsfc, bmep and mechanical efficiency of a spark ignition engine. [6 marks]

3.2 Explain the effect of compression ratio on the volumetric efficiency and exhaust temperature. [4 marks]

3.3 During a test on a four stroke cycle petrol engine the following reading were obtained: [20 marks]

Spark ignition timing, BTDC	Brake load [kg]	Time for 300 ml of fuel s.g=0.84, [sec]
15	68	86
20	73	83
25	77	81
30	82	78

Torque arm=0.3m, heating value of fuel 43000 kJ/kg, compression ratio 8 and engine speed 1750rpm. Draw performance curves (bp, bsfc and η_{th}) of engine against spark ignition timing and discuss the results.

Good luck, **Dr. Ahmed Abd Elsalam**