Menoufia University		Subject: Design of ICE
Faculty of Engineering Shebin El-Kom		Code: MPE 414C
Mechanical Power Eng. Department	جامعة المنوفية	Level: 4th year
First Semester Examination 2015-2016		Time Allowed: 3 hours
		Total Marks : 60 marks
		Date of Exam : 17/1/2016

Solve the Following Questions

(Question Number-1) :(15 Marks)

(a) Prove mathematically and graphically that, the left offset crank slider mechanism offers low side thrust compared to central crank slider mechanism and assign the ratio between them at each crank angle(consider C.W crank rotation)   (5 marks)

(b) Explain why in offset crank slider mechanism (left or right), the instantaneous piston acceleration is not symmetrical along the entire cycle as in central crank slider mechanism.   (5 marks)

(c) Compare between left offset and right offset crank slider mechanisms in terms of maximum acceleration and side thrust.   (5 marks)

(Question Number-2) :(15 Marks)

(a) Discuss different methods used to derive cam shaft and show the advantages and disadvantages of overhead cam shaft configuration.

(5 marks)

(b) Define valve clearance and compare between clearance required for both inlet valve and exhaust valve.   (5 marks)

(c) SIE consumes 2.8 g/s of fuel at stoichiometric mixture when runs at 3000 rpm. Its compression ratio is 6.5 . Considering the thermal cycle as air standard cycle, calculate the basic dimensions of this engine as well as the mean effective pressure (assume any required data). If the engine use offset crank slider mechanism with $k = 0.1$ find the side thrust when the crank rotates $90°$ C.W.   (5 marks)

(Question Number-3) :(15 Marks)

(a) List different stresses applied on connecting rod shank and show why its cross section must be I section. **(5 marks)**

(b) Design piston for diesel engine produces 45 kW @ 2800 rpm and the mean effective pressure is 10 bar. The maximum pressure is 7 times the mean effective pressure. Check the stresses on piston crown, pressure ring grooves and oil ring section. Calculate also the dimensions of pressure rings. Draw a sketch of piston showing the main dimension. **(10 marks)**

(Question Number-4) :(15 Marks)

(a) SIE, 4 stroke has 6 cylinders inline. Calculate the following:

- Firing angle between cylinders
- No. of crank journals considering single span configuration
- Angle between each two successive cranks

  Finally assign the firing order of such engine and draw sketch of crank shaft. **(5 marks)**

(b) Assign the basic dimensions of crank shaft for single cylinder, 4 stroke, SIE. Technical data of this engine are summarized as follows:

Power (WOT)	: 8.6 kW	Speed (WOT)	: 4500 rpm
Pmean	: 11.2 bar	Connecting rod mass	: 480 g.
Crank pin mass	: 85 g.	Counter weight/crank web	:165 g.

Center of gravity of the counter weight lies at 25% of stroke from the crank shaft center

Check also the mean and maximum pressure applied on both crank pin and main journals. The instantaneous pressure inside the engine cylinder during the thermal cycle is given as follows.

θ, degree	0	90	180	270	360	450	540	630	720
P_g bar	0.98	0.88	0.92	7.1	38	12.8	2.1	1.6	0.98

Assume any required data.

Draw sketch for crank shaft design. The basic dimensions must be written in separate table. The basic dimensions must be written in separate table. **(10 marks)**

With our best wishes