University of Technology-Electromechanical Engineering Dept
Final Examination 2013-2014[form1]

Third year/ power
Subj.Combustion & Air Pollution
Examinar:Assis. Prof. Dr.Hassan

Time: 180 min.
Date: 16 /6/2014

Answer <u>four</u> questions only

Q1/(a)Determine the approximate A/F ratios by mass, and the wet and dry products Combustion,for weak and rich mixture of ethanol C_2H_5OH,which have respectively:
(a) 12% excess air ,assuming no CO or H in products.
(b) 18% in sufficient air ,assuming no oxygen or hydrogen in products.
(b)Define and explain the meaning of the following parameters
1.ignition delay period 2.indicated mean effective pressure
3.equivalance ratio [15mark]

Q2/ The dry products from a combustion test of fuel show a partial volumetric analysis of 18% carbon dioxide , 2.1 % carbon monoxide and 1.2 % hydrogen , with The ash containing 0.01 un burnt carbon per gram of fuel supplied.If the sample of solid fuel of coal have the following volumetric percentage composition carbon 87 ,hydrogen 8 , oxygen 4 and ash 1.0 , determine :
1.The stoichiometric air fuel mass ratio
2.The actual air fuel mass ratio
3.The equivalence ratio
4.Witch types of mixture of fuel
5.The wet percentage products of composition [15mark]

Q3/(a) Show on the diagram the variations in concentrations of products of carbon dioxide carbon monoxide and un burnt hydrocarbons as a function of A/F mass ratio.
(b) Discuss &explain the main factors effecting the rate of burning and pressure rise in a 2-nd stage of combustion in a diesel engine. [15mark]

Q4/ (a)Explain on which factors depend the formation of NO_x ,show that on a diagram
(b)Discuss & explain the Exhaust Gas Recycle (EGR) method for reducing NO_x emission. [15mark]

Q5/(a) Isoocctane C_8H_{18} are used in an engine with excess air 120%. The theoretical maximum combustion temperature are 2419 K at an equivalence ratio 0.83.To reduce formation of NO_x ,it is desired to reduce this maximum temperature to 2200 K.This is done by exhaust gas recycling EGR.The exhaust gas that consists mostly of N_2 ,CO_2 and H_2O will be approximated as all nitrogen at atempearture of 1000 K.If the calculated values of moles of EGR x-moles of N_2 at 1000 K are 16.8 moles calculates:
1.the percentage amount of EGR needed to reduce maximum combustion temperature to 2200 K
2.the total fraction of exhaust in the cylinder during the compression stroke if the residual gas coefficient x_r =0.02
(b)Discuss and explain the undesirable emissions generated in the combustion process of combustion engine,discuss also the major causes of these emissions. [15mark]