

Name: _____ Entry No. _____

Center for Energy Studies
Alternative Fuels for Transportation (ESL 875)
Major Test

Date: 27 Nov, 2008

Venue:

Total Marks: 40

Note: Write the name and entry number in the question paper and answer sheet
Answer questions 1, 2 and 3 in the space provided in question paper

1. Indicate if the following statements are True (T) or False (F) (15marks)

- a. Propane has a higher Octane rating compared to Gasoline ()
- b. LPG has got a lower octane rating compared to premium petrol ()
- c. Addition of methane to LPG increases its Octane number ()
- d. As compared with Petrol, LPG combustion enhances the deposits of soot on combustion chamber walls ()
- e. Liquefied gases such as DME can be directly blended with LPG()
- f. DME engine can have the same NO_x emission level as the Otto engine with 3-way catalytic converter ().
- g. DME has a lower heating value than diesel. ()
- h. DME has a higher viscosity than diesel and hence does not necessitate a lubricant for engine applications. ()
- i. LNG combustion usually increases methane emission. ()
- j. It is essential to have a cetane improver for using DME in engines. ()
- k. Higher CR, advanced ST and possibly small amount of H₂ addition could make biogas comparable to NG()

2 Fill in the blanks with appropriate words (10 marks)

- A) When vaporized LNG burns only in concentrations of _____% to _____% when mixed with air.
- B) Cetane number of DME is of the order of _____
- C) Stoichiometric A/F ratio of DME is about _____
- D) _____ is the major point of concern in hydrogen operated SI engine which can be controlled/eliminated by use of flame traps or flame arrestors.
- E) Soot emissions from DME operated engines are generally _____ than a similar diesel operated engines.

3. List (5 marks)

Three transportation fuels from Natural Gas which are suitable for Otto Engine and Two transportation fuels from Natural Gas which are suitable for Diesel Engine

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2. Comment on

(3 X 10 = 30)

- a. Why is it possible to achieve ultra-lean hydrogen SI engine operation?.
- b. Explain why relatively higher volume of DME is required to be injected as compared to diesel.
- c. Enumerate three significant features of Hydrogen added LPG combustion in Automotive engine
- d. Explain how Propane in its liquid state reduces the chances of vehicle fire whereas when leaked it is more likely to ignite than gasoline
- e. List out five significant measures adopted in India for control of vehicular emission.
- f. Explain the phenomena of “Auto-refrigeration” and “Rapid Phase Transition” in respect of LNG
- g. Explain why LNG is not flammable if its composition has more than 15 percent natural gas in air
- h. Researchers in Cornell University tried to run a diesel engine to run on net hydrogen. They tried a compression ratio upto 29 to achieve compression ignition of hydrogen, but were not successful. Why?.
- i. One morning, while taking breakfast in the hostel you observed that Delhi’s sky near IIT campus seemed to have been wrapped up with a blanket .Ramesh termed it as “London smog” whereas Saurabh said it “Los Angeles Smog”. As a student of ESL 875 your opinion was sought. How do you explain the phenomena?
- j. Backfire has been the major stumbling block in a practical hydrogen engine development. Direct cylinder injection at the end of compression stroke intrinsically precludes backfire. Why then Direct cylinder injection has not been widely investigated? Mention two major practical operating problems in ensuring direct cylinder injection.