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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April, 2017

Program Name: B. Tech – Automotive Design Engineering | **Semester : VIII**
Course Name : Alternative Fuel for Automobiles | **Max. Marks : 100**
Course Code : ADEG 451 | **Duration : 3 Hr.**
No. of page/s : Six

- **Assume suitable data if missing**
- Draw neat diagrams wherever required
- Give suitable examples in support of your answer
- Be precise in your answer
- Write the Roll No. on the Question Paper also.
- Other than the Roll No. don't write anything on the Question Paper

Section A

All Questions are compulsory 10 x 2 marks = 20 marks

1. Which of the following statements is not correct with respect to alcohols as alternative fuels in IC Engines
   a. Anti-knock characteristics of alcohol is poor
   b. Alcohols contains about half the heat energy of gasoline /litre
   c. Alcohol does not vaporize as easily as gasoline
   d. Alcohols are corrosive in nature
2. Stoichiometric air-fuel ratio of alcohol when compared to gasoline is
   a. Higher
   b. Lower
   c. Equal
   d. None of the above
3. Small amount of gasoline is often added to alcohol to
   a. Reduce the emission
   b. To increase the power output
   c. To increase the efficiency
   d. To improve cold weather starting
4. Methanol by itself is not a good CI engine fuel because
   a. Its octane number is high
   b. Its cetane number is low
   c. Both (a) and (b)
   d. None of the above
5. Anti-knock characteristics of alcohol when compared to gasoline is
   a. Higher

b. Lower
c. Equal
d. None of the above

6. Alcohols alone cannot be used in CI engines as
   a. Their self-ignition temperature is high
   b. Latent heat of vaporization is low
   c. Both (a) and (b)
   d. None of the above
7. Advantage of hydrogen as an IC engine fuel
   a. High volumetric efficiency
   b. Low fuel cost
   c. No HC and CO emissions
   d. Relative safe
8. Disadvantage of hydrogen as a fuel in IC Engine
   a. Storage is easy
   b. Low NOx emissions
   c. Detonating tendency
   d. Easy handling
9. Compared to diesel, biomass fuels have the advantage of
   a. Lower emissions
   b. Easy availability
   c. Both (a) and (b)
   d. Higher energy content
10. Biomass fuels suffers from the disadvantage of
    a. Low energy content
    b. High Sulphur
    c. High specific fuel consumption
    d. Both (a) and (c)

Section B

All Questions are Compulsory. All Questions carries equal marks 4 x10 marks = 40 marks

13. Evaluate Power and Specific Energy Consumption Vs. Engine speed for the Methanol, Gasoline and diesel

14. Explain the importance of Physico & Chemical Properties of fuels and discuss the physico and chemical properties of gaseous hydrogen

15. In detail discuss the constructional and working principle of Hybrid vehicle

16. The air flow to a four cylinder four stroke gas engine is measured by means of a 7.5 cm diameter sharp-edged orifice, Cd – 0.6. During test on the engine following data were recorded:

Bore	=	11 cm
Stroke	=	13 cm
Engine speed	=	2250 rpm
Brake power	=	36 kW
Fuel consumption	=	10.5 kg/hr
Calorific value	=	42000 kJ/kg
Pressure drop across the orifice	=	4.1 cm of water

Atmospheric temperature and pressure are 15^0 C and 1.013 bar

Calculate:

a) Thermal efficiency on B.P basis
b) Brake mean effective pressure

[Or]

16. A four stroke cycle gas engine has a bore of 20 cm and stroke of 40 cm. The compression ratio is 6. In a test on the engine the indicated mean effective pressure is 5 bar, the air to gas ratio is 6:1 and the calorific value of the gas is 12MJ/m^3 at NTP. At the beginning of the compression stroke the temperature is 77^0 C and the pressure 0.98 bar. Neglecting the residual gases, determine the indicated power, the thermal efficiency and relative efficiency of the engine at 250 rpm.

Section C

All Questions are Compulsory. All Questions carries equal marks 2 x 20 marks = 40 marks

17. The following observations were made during a trail of a single cylinder, four-stroke cycle gas engine having cylinder diameter of 18 cm and stroke 24 cm

Duration of trail	=	30 min
Total no. of revolutions	=	9000
Total no, of explosions	=	4450
Mean effective pressure	=	5 bar
Net load on brake wheel	=	40 kg
Effective diameter of brake wheel	=	1m
Total gas used at NTP	=	2.4 m^3
Calorific value of gas at NTP	=	19 MJ/m^3
Total air used	=	36m^3
Pressure of air	=	720 mm Hg
Temperature of air	=	17^0 C
Density of air at NTP	=	1.29 kg/m^3

Temperature of exhaust gas	=	350^0 C
Room temperature	=	17^0 C
Specific heat of exhaust gas	=	1 kJ/kg K
Cooling water circulated	=	80 kg
Rise in temperature of cooling water	=	30^0 C

Draw up a heat balance sheet and estimate the mechanical and indicated thermal efficiencies of the engine. Take R = 287 J/ kg K.

[Or]

An eight cylinder, four stroke engine of 9 cm bore and 8 cm stroke with a compression ratio of 7 is tested at 4500 rpm on a dynamometer which has 54 cm arm. During a 10 minutes test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4 kg of gas having calorific value of 44000 kJ/kg. Air at 27^0 C and 1 bar was supplied to the carburettor at the rate of 6 kg/min.

Find
(i) brake power delivered
(ii) brake mean effective pressure
(iii) brake specific fuel consumption
(iv) brake specific air consumption
(v) brake thermal efficiency
(vi) volumetric efficiency and
(Vii) Air-fuel ratio

18.a. From the given Figures 1 & 2 from the research paper titled, "An Experimental Investigation of the performance and gaseous exhaust emissions of a diesel engine using blends of a vegetable oil", **predict** the following emissions

a. Nitrogen oxides
b. Carbon Monoxide at part load and full load

Give the reasons for your answers.

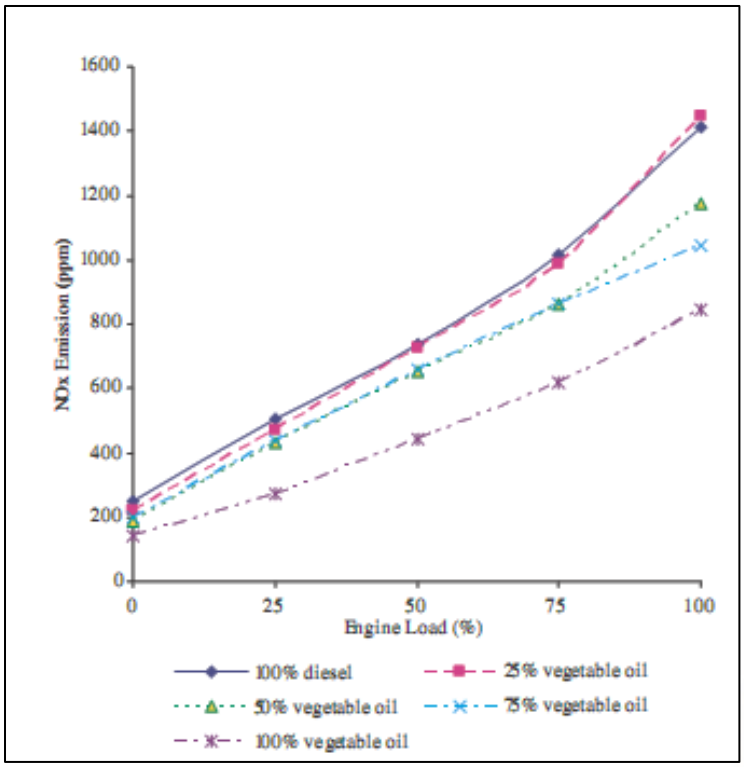

Figure 1 Comparison of NOx emissions of different fuels

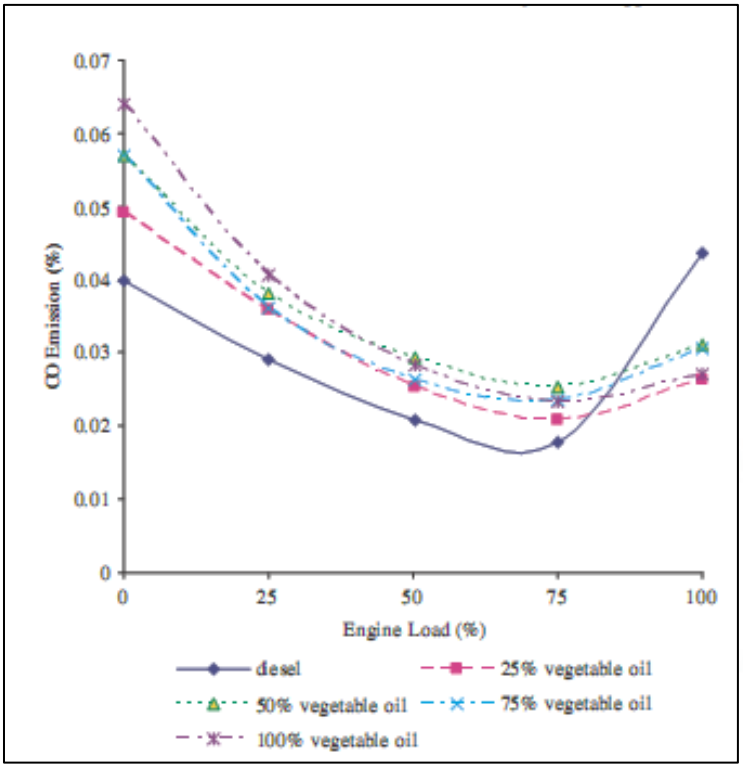

Figure 2 Comparison of CO emissions for different fuels

18.b. From the given Figures 3 & 4 from the research paper titled, "Studies on dual fuel operation of rubber seed oil and its bio diesel with hydrogen as the inducted fuel", **predict** the following combustion parameters.

a. Effect of Ignition delay for all fuels with hydrogen induction
b. Combustion duration for all fuels with hydrogen induction

Give the reasons for your answers

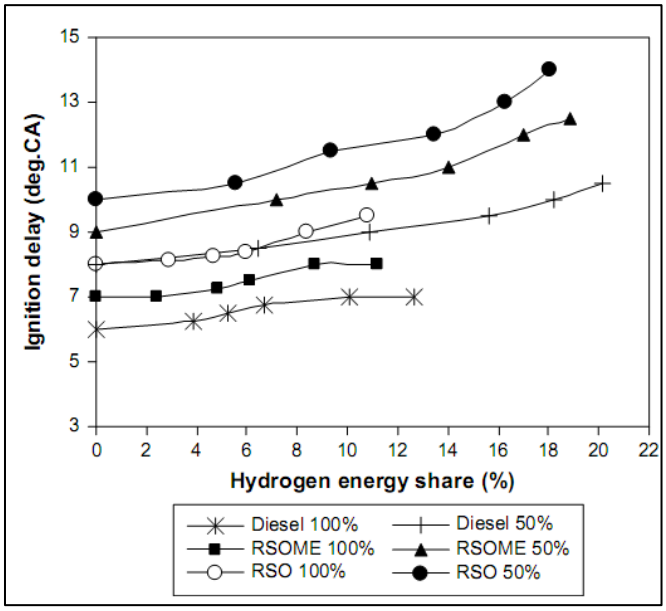

Figure 3 Variation of Ignition Delay at 50% and Full Load with Hydrogen induction

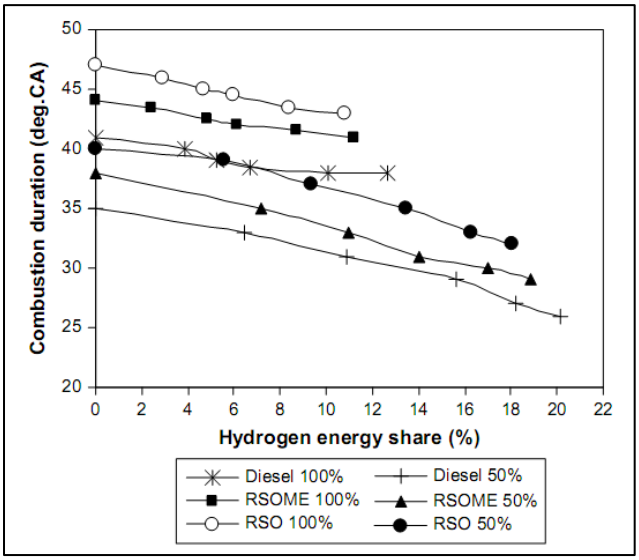

Figure 4 Variation of Combustion duration with 50% load and full load with hydrogen induction.

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