Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Fuels and Combustion (MEAD 3007) **Semester: V**
Programme: B.Tech._ADE
Time: 03 hrs. **Max. Marks: 100**

Instructions: Answer all the questions in Section A. Section B and C have internal choice.
Answer strictly to the point with reference to the marks allotted to the question.
Assume an appropriate value for any missing data in problems.

SECTION A

S. No.		Marks	CO
Q 1	Compare the solid, liquid and gaseous fuels in terms of energy density, heating value, and applications.	4	CO1
Q 2	Describe thermal cracking, hydrocracking, catalytic cracking and coking briefly.	4	CO2
Q 3	Explain the advantages and disadvantages of the use of gaseous fuels in IC engines.	4	CO3
Q 4	Discuss the stoichiometric combustion of diesel and gasoline fuels. Mention the air fuel ratios required for these fuels.	4	CO4
Q 5	Describe briefly any four physio-chemical properties of lubricants.	4	CO5
	SECTION B		
Q 6	Analyze the utilization of "biodiesel blended diesel" and "ethanol blended petrol" in CI and SI engines respectively, with reference to performance, combustion and emission characteristics of the engine.	10	CO2
Q 7	Illustrate the production methodology of biogas with a neat diagram.	10	CO3
Q 8	A carbohydrate is a compound composed solely of carbon, hydrogen and oxygen. When 10.7695 g of an unknown carbohydrate (MW = 128.2080 g/mol) was subjected to combustion analysis with excess oxygen, it produced 29.5747 g CO_2 and 12.1068 g H_2O. Determine molecular formula of the compound.	10	CO4
Q 9	(i) Explain the concept of boundary layer lubrication with a neat diagram. (ii) Discuss the liquid lubrication, semi solid lubrication and solid lubrication. **(OR)**	10	CO5

<table>
<tr><td></td><td>(i) Explain combustion efficiency of IC engines with formulas.
(ii) Classify the lubricants and additives used for IC engine applications.</td><td></td><td></td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10</td><td>Analyze the combustion characteristics of CI and SI engines in terms of pressure-crank angle degrees, heat release rate, cumulative heat release rate, ignition delay, start of combustion, end of combustion, Advanced combustion, and late combustion.</td><td>20</td><td>CO2, CO3</td></tr>
<tr><td>Q 11</td><td>Determine the constant pressure adiabatic flame temperature for the combustion of Methane with a stoichiometric air at 1 atmospheric pressure. The reactant temperature at initial condition, T_i=298 K. The reaction is $CH_4 + 2O_2 + 7.52\ N_2 = CO_2 + 2H_2O + 7.524\ N_2$ .Also, determine the constant volume adiabatic flame temperature using the following Table. The specific heats of reactants are taken at an average temperature between initial and final temperature, which is (298+1850)/2 = 1074 K ≈1100 K.
<table>
<tr><th>Species</th><th>Standard Enthalpy of Formation at 298 K (kJ/kmol)</th><th>Average specific heat at 1100 K (kJ/kmol-K)</th></tr>
<tr><td>CH_4</td><td>-72.1</td><td>-75.328</td></tr>
<tr><td>CO_2</td><td>-394.0</td><td>55.396</td></tr>
<tr><td>H_2O</td><td>244.5</td><td>-42.44</td></tr>
<tr><td>N_2</td><td>0</td><td>--</td></tr>
<tr><td>O_2</td><td>0</td><td>--</td></tr>
</table>
(OR)
A fuel has the following gravimetric composition;
hexane (C_6H_{14}) : 40 per cent
octane (C_8H_{18}) : 30 per cent
cyclohexane (C_6H_{12}) : 25 per cent
benzene (C_6H_6) : 5 per cent
If the gravimetric air/fuel ratio is 17:1, determine the equivalence ratio.</td><td>20</td><td>CO4</td></tr>
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