Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2019

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.

SECTION A

S. No.		Marks	CO
Q 1	Classify the fuels based on the availability and applications.	**4**	**CO1**
Q 2	Explain the advantages and disadvantages of the use of solid fuels in heating applications.	**4**	**CO2**
Q 3	Discuss proximate and ultimate analysis of liquid fuels briefly.	**4**	**CO3**
Q 4	Explain adiabatic flame temperature with equations.	**4**	**CO4**
Q 5	Illustrate the four physiochemical properties of lubricants.	**4**	**CO5**

SECTION B

Q 6	Analyze the volatility of liquid fuels and its effect on performance of IC engines.	**10**	**CO2**
Q 7	Derive the equation for flame quenching and analyze the conditions leads to flame quenching in IC engines.	**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. What is its molecular formula?	**10**	**CO4**
Q 9	Interpret the different kinds of lubrication system with neat diagrams. **(OR)** (i) Explain combustion efficiency of IC engines with formulas. (ii) Classify the lubricants and additives used for IC engine applications.	**10**	**CO5**

SECTION-C

<table>
<tr>
<td>Q 10</td>
<td>(a) Explain any five combustion characteristics of SI and CI engines.
(b) Interpret the effect of flame quenching on emissions of IC engines.</td>
<td>20</td>
<td>CO2, CO3</td>
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<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><td>Species</td><td>Standard Enthalpy of Formation at 298 K (kJ/kmol)</td><td>Average specific heat at 1100 K (kJ/kmol-K)</td></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>
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(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, CO5</td>
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