Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **17ME3029** | **Duration :** | **3hrs** |
| **Sub. Name :** | **COMBUSTION IN ENGINES** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | A natural gas analyses as: CH4-85%, C2H4-3%, C6H6-3%, H2-5%, N2-4%. It is burnt with 20% excess air. The air is moist containing 1.5% water vapour. Calculate i. Dry theoretical air needed for burning one cubic meter of natural gas ii. Volume of moist air used for burning including excess air and iii. Volume of products of combustion at STP and its analysis. | CO1 | 10 |
| b. | Derive a relation for expressing Kp in terms of Kc. | CO1 | 6 |
| c. | Calculate equilibrium constant K for formation of Ammonia from Nitrogen and Hydrogen. Given, [N2] =8.5x10-2M; [H2] = 3.1x10 -3M [NH3] = 3.1x10 -2M. | CO1 | 4 |
| (OR) | | | | |
| 2. | a. | Define adiabatic flame temperature and state the assumptions made in computing it. | CO1 | 4 |
| 2. | b. | Determine the adiabatic flame temperature of ethane when it burns in air. Assume ambient temperature to be 25°C. Take specific heats at constant pressure for Oxygen, water vapour and Nitrogen as 54.3, 41.2 and 32.7 J/mol.K respectively. Heat of combustion of ethane is 1423×103 J/mol.K. | CO1 | 6 |
| c. | A fuel contains 70% Propane and 30% Butane by volume. Calculate i. stachiometric air fuel ratio and ii. excess air required, if there is 9% CO2 in dry analysis. | CO1 | 10 |
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| 3. | a. | List the various combustion generated pollutants. Describe the methods employed to control NOx. | CO6 | 10 |
|  | b. | Elaborate on the occurrence of ‘homogeneous’ and ‘heterogeneous’ mixtures in internal combustion engines. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | Based on ‘laminar flame thickness’ how would you classify the various flame regimes? | CO2 | 10 |
|  | b. | Describe briefly the harmful effects of engine emissions. Also, explain the method of monitoring the emission of any one such pollutant. | CO6 | 10 |
| 5. | a. | Elaborate on the various designs of combustion chambers for SI engines. | CO3 | 10 |
|  | b. | Define knock in SI engines. Explain the effect of engine variables on knock. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Enumerate and elaborate on the factors affecting flame speed in SI engines. | CO3 | 10 |
|  | b. | Explain the concept of ‘stratified charge engine’. How is charge stratification brought about? Explain with sketches. | CO3 | 10 |
| 7. | a. | Mention the factors to be considered in designing an effective combustion chamber for CI engines. Sketch any one type of combustion chambers for CI engines. | CO4 | 6 |
|  | b. | A six-cylinder, four-stroke diesel engine has a bore to stroke ratio of 360:500 mm. During the trial, following results were obtained : Mean area of the indicator diagram, 7.8 cm2; length of the indicator diagram, 7.5 cm; spring number, 700 kPa per cm of compression; brake torque, 14,000 N.m; speed, 8 r.p.s.; fuel consumption, 240 kg/hr; calorific value of fuel oil, 44,000 kJ/kg; jacket cooling water used, 320 kg/minute; rise in temperature of the cooling water, 40°C; piston cooling oil (specific heat, 2.1 kJ/kg K) used, 140 kg/min., with a temperature rise of 28°C. The exhaust gases give up all their heat to 300 kg/minute of water circulating through the exhaust gas calorimeter and raise its temperature through 42°C. Calculate the brake specific fuel consumption in kg per kW-hour and mechanical efficiency of the engine and draw up a heat balance sheet of the engine on the basis of 1 kg of fuel oil. | CO4 | 14 |
| (OR) | | | | |
| 8. | a. | Explain the various stages of combustion in CI engines. | CO4 | 10 |
|  | b. | What is diesel knock? Bring out the significance of air swirl in CI engines. | CO4 | 10 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Elaborate on the different operating conditions required to be satisfied by a gas turbine combustion system. | CO5 | 10 |
|  | b. | Write notes on i. Flame stabilization and ii. re-circulation in gas turbines. | CO5 | 10 |

ALL THE BEST