No. of Printed Pages : 02 **Roll No. .....**

19CC1304

M. Tech. EXAMINATION, 2020

(Third Semester)

(C Scheme) (Main & Re-appear)

(ME)

MET631C

IC ENGINE PROCESS MODELING

Time : 2½ *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

1. (a) Overview historical prospective on development of diesel engine.

(b) Compare the Otto, diesel and dual cycles for same compression ratio.

2. (a) Show the energy and availability flows of four stroke petrol engine on a P-V diagram.

(b) A four stroke engine is based on Otto cycle (compression ratio = 8) is running at 2000 rpm. The displaced volume is 1.5 liters. At the start of compression, the air is at 293K and 0.1013 MPa, the heat addition to the cycle is 950 kJ/kg of working substance. Assume compression and expansion is reversible and adiabatic. Make a complete thermal analysis (first law and second law efficiency) assuming Otto cycle as air standard cycle.

3. (a) Discuss the volumetric efficiency of engine. Highlight the influence of engine speed and engine load.

(b) What do you understand by adiabatic fuel temperature and heat of reaction ? Discuss.

4. (a) Enlist and explain the factors affecting the detonation.

(b) How the Octane and Cetane number affects combustion performance ? Discuss.

(c) Discuss the various theories for detonation and diesel knock in brief.

5. (a) Write a short note on burning speed and flame propagation.

(b) Derive the formulation $\mathrm{Qp} = \sum_{i=1}^{5} \mathrm{N}_i \Delta\bar{h}_i$, where N_i designate to number of moles and $\Delta\bar{h}_i = \bar{h}_1(\mathrm{T}) - \bar{h}_i(298)$. State the assumptions clearly.

6. (a) Derive the expression of instant volume V as a function of crank angle θ in a IC engine piston-cylinder. Consider basic notations.

(b) Draw the P-V diagram for S.I. Engine processes and also derive relation for temperature at start of compression, $\mathrm{T}_1 = \dfrac{r\mathrm{T}_m}{r - 1 + (\mathrm{T}_m / \mathrm{T}_5)}$ if specific heat of reactant and product is same (here T_m and T_5 are initial entry temperature at ambient pressure, and blow down temperature at ambient pressure). '*r*' is compression ratio.

7. (a) What are major pollutants releases from engine exhaust ? How can you control them in cyclinder itself ?

(b) What are modeling techniques of engine exhaust ? Discuss the models for NOx formation for IC Engine in detail.

8. (a) Discuss BOOST software with its basic modules.

(b) What are different inbuilt computational approaches in commercial ANSYS Software ? Discuss in detail with focus on IC engine process modeling.