4. (a) Enlist all combustion modeling techniques you know. Discuss the zero dimensional model for combustion analysis is CI engines. **7**

(b) Explain SOOT and its formation phenomena; also explain modeling of NO_x emissions from SI engines ? **8**

Unit III

5. (a) Develop a simplified model for CI engine simulation. **7**

(b) Derive the formulation $Qp = \sum_{i=1}^{5} N_i \Delta\bar{h}_i$.

Where N_i designate to number of moles and $\Delta\bar{h}_i = \bar{h}_i(T) - \bar{h}_i(298)$. State the assumptions clearly. **8**

6. (a) What is progressive combustion ? Discuss in detail. **7**

(b) What are different simulation techniques used for combustion modeling and pollutant formation modeling from IC engines ? Discuss. **8**

No. of Printed Pages : 05 **Roll No. .....**

CC-88

M. Tech. EXAMINATION, May 2017

(Third Semester)

(Re-appear Only)

(ME)

MET-623-B

IC ENGINES PROCESS MODELING

Time : 3 *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 *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks. Assume suitable values for missing parameters (if any).

Unit I

1. (a) Give historical perspective on early developments of petrol engine. Compare the 4-stroke petrol cycle at full throttle and actual 4-stroke petrol cycle at part throttle at P-V coordinates. **7**

(b) A one liter cubic capacity, four stroke, four cylinder SI engine has brake thermal efficiency of 30% and indicated power is 40 kW at full load. At half load, it has a mechanical efficiency of 65%. Assuming constant mechanical losses, compute :

(i) Frictional power

(ii) Mechanical efficiency

(iii) Indicated thermal efficiency. If the volume decreases by eight fold during compression stroke

(iv) Calculate clearance volume. **8**

2. (a) What is irreversibility ? Show the availability flows of diesel engine processes on a P-V diagram. **5**

(b) A gas engine operating on the ideal Otto cycle has a compression ratio of 6 : 1. The pressure and temperature at the commencement of compression are 1 bar and 27ºC. Heat added during constant volume combustion process is 1170 kJ/kg. Assume compression and expansion is reversible and adiabatic. Make first law and second law analysis (take $c_v = 0.717$ kJ/kg-K and $\gamma = 1.4$). **10**

Unit II

3. (a) What is CO_2 dissociation in combustion ? How the adiabatic flame temperature is affected by it ? **5**

(b) Explain the various stages of combustion in CI engines. Explain the phenomenon of knock in CI engines and compare it with SI engine knock. **10**

Unit IV

7. Describe FIRE Solver along with its modules. **15**

8. How does CFD software ANSYS work ? Discuss the design process for ANSYS Software. **15**

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