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## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Automobile Engineering

Semester End Examination; Dec - 2016/Jan - 2017

### Automotive Fuels and Combustion

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

#### UNIT - I

- 1 a. Why there is a need for renewable sources of energy? Explain. 6
- b. List the advantages and disadvantages of Biomass energy. 6
- c. Briefly, explain the different applications of solar energy. 8
- 2 a. Describe the process of petroleum refining. 10
- b. Discuss briefly the following properties of fuels :
- i) Calorific value                      ii) Viscosity                              iii) Specific gravity                      10
- iv) Vapour pressure                      v) Cloud and pour point.

#### UNIT - II

- 3 a. Write the combustion equations used to calculate the amount of oxygen required and the amount of gases produced. 10
- b. The gasoline used in an engine may be approximated to be hexane  $C_6H_{14}$ . The percentage of dry exhaust gasses by volume at a particular load and speed of the engine are observed as:  $CO_2 = 8.5\%$ ,  $CO = 7.8\%$  and  $N_2 = 83.7\%$ . Determine; 10
- i) The air fuel ratio required for chemically complete combustion
- ii) The mixture strength (A.F. ratio) in the test as a percentage of the chemically correct mixture.
- 4 a. List the important qualities of SI engine fuels and discuss any two. 10
- b. How is the rating done for CI Engine fuels? 4
- c. An engine working on Otto cycle has the following conditions :  
Pressure at the beginning of compression is 1 bar and pressure at the end of compression is 11 bars. Calculate the compression ratio and air-standard efficiency of the engine. 6  
Assume  $\gamma = 1.4$ .

#### UNIT - III

- 5 a. List and discuss the stages of combustion in SI engines. 10
- b. Discuss any five variables which affect the flame propagation in SI engine. 10
- 6 a. Describe the various stages of combustion process in CI engine. 12
- b. Discuss the differences in the knocking phenomenon in SI and CI engines. 8

**UNIT - IV**

- 7 a. Discuss the meaning of a multi-fuel engine and its application areas. 4  
b. Explain the different characteristics of a multi-fuel engine. 8  
c. Discuss the working principle of dual-fuel engine. Explain any two factors affecting dual fuel combustion. 8
- 8 a. What are the important factors that affect combustion in a dual-fuel engine? 4  
b. Discuss the methods by which knock in a dual-fuel engine can be controlled. 10  
c. List the advantages of dual-fuel engine over a diesel engine. 6

**UNIT - V**

- 9 a. What is a stratified charge engine? Explain briefly. 4  
b. Discuss the following types of charge stratification by fuel injection and positive ignition :  
i) The first approach 10  
ii) Pre-chamber stratified charge.  
c. List the advantages and disadvantages of stratified charge engines. 6
- 10a. Discuss the various challenges in HCCI engine development. 10  
b. Write a note on VCR (Variable Compression Ratio). 4  
c. What is meant by a BICERI piston? Discuss with a neat sketch. 6

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