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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. - 2015

**Automotive Fuels and Combustion**

Time: 3 hrs

Max. Marks: 100

**Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.  
ii) Missing data, if any, may be suitably assumed and stated.

### UNIT - I

- |      |   |    |
|------|---|----|
| 1 a. | Discuss the need for renewable sources of energy.   | 6  |
| b.   | Discuss the advantages and disadvantages of biomass energy.                                 | 6  |
| c.   | Briefly, explain the different applications of solar energy.                                | 8  |
| 2 a. | Discuss the basic families of hydrocarbons used in the fuel along with an example for each. | 12 |
| b.   | Define the following terms :  |    |
|      | i) Calorific value                      ii) Flash point                                     | 8  |
|      | iii) Fire point                          iv) Viscosity.                                     |    |

### UNIT - II

- |      |  |    |
|------|--|----|
| 3 a. | Write the combustion equation used to calculate the amount of oxygen required and the amount of gases produced.  | 10 |
| b.   | The products of combustion of an unknown hydrocarbon $C_xH_y$ have the following composition as measured by an Orsat apparatus: $CO_2 = 8.0\%$ , $CO = 0.9\%$ and $O_2 = 8.8\%$ . and $N_2 = 82.3\%$ . Determine;  | 10 |
|      | i) The composition of fuel   |    |
|      | ii) The air fuel ratio   |    |
|      | iii) The percentage of excess air used.  |    |
| 4 a. | Discuss antiknock quality and volatility properties of gasoline.   | 6  |
| b.   | Explain the rating of C.I engine fuels.  | 4  |
| c.   | A six – cylinder gasoline engine operates on the four – stroke cycle. The bore of each cylinder is 80 mm and the stroke 100 mm. The clearance volume per cylinder is 70 cc. At a speed of 4000 rpm the fuel consumption is 20 kg/h and the torque developed is 150 Nm. Calculate : | 10 |
|      | i) The brake power   |    |
|      | ii) The brake mean effective pressure  |    |
|      | iii) Brake thermal efficiency if the calorific value of the fuel is 43000 kJ/kg  |    |
|      | iv) Compression ratio.   |    |

**UNIT - III**

- 5 a. Explain the stages of combustion in S.I. engines. 6
- b. Discuss the effect of the following engine variables on flame propagation :
- i) Fuel – Air ratio      ii) Compression ratio      iii) Engine speed 10
- iv) Engine size      v) Turbulence
- c. What is meant by detonation in S.I engines? Explain. 4
- 6 a. Explain the Otto cycle. Compare Diesel cycle and Otto cycle. 10
- b. Discuss the advantages and disadvantages of induction swirl in C.I. Engines. 6
- c. What is surface ignition? List the effects of surface ignition. 4

**UNIT - IV**

- 7 a. What is dual fuel engine? Where does this type of engine finds application? 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. Discuss the important factors that affect combustion in a dual - fuel engine. 10
- b. What are the methods by which knock in a dual - fuel engine can be controlled? 4
- c. List the advantages of dual - fuel engine over a diesel engine. 6

**UNIT - V**

- 9 a. Discuss briefly about the stratified charge engine. 4
- b. Describe the following methods 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
- 10 a. List and discuss the challenges in HCCI engine development. 10
- b. Write a note on VCR (Variable Compression Ratio). 4
- c. With neat sketch, describe BICERI piston. 6

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