CS/B.TECH (AUE)/SEM-6/AUE-604/2012

2012

AUTOMOTIVE POLLUTION AND CONTROL

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) The PCV value is located between the

a) air cleaner and the carburetor

b) intake manifold and the crankcase

c) intake manifold and the air cleaner

d) carburetor and the intake manifold.

ii) The catalyst used in the reduction converter is

a) Rhodium b) Copper

c) Charcoal d) Platinum.

iii) The air fuel ratio required for the efficient operation of a three way converter is approximately

a) 5 : 1 b) 10 : 1

c) 20 : 1 d) 15 : 1.

iv) If lead is added to gasoline, the emission of

a) HC is increased b) HC is reduced

c) NO_x is increased d) PM is increased.

v) Alcohol is the major source for the emission of

a) CO b) HC

c) NO_x d) smoke.

vi) Photochemical smog is produced by

a) complex chemical reaction between hydrocarbon

and oxides of nitrogen

b) complex chemical reaction between carbon

monoxide and hydrocarbon

c) complex chemical reaction between carbon

monoxide and nitrogen

d) complex chemical reaction between SO_x and NO_x.

vii) Spring loaded PCV valve used in crankcase venitilation

system opens

a) less with more vacuum

b) more with more vacuum

c) does not open at all

d) remains open all the time.

viii) During idling, the pollutant formation will decrease if

a) stoichiometric fuel-air mixture is supplied

b) too rich fuel-air mixture is supplied

c) lean fuel-air mixture is supplied

d) none of these.

ix) The invisible emission from the engine tail pipe is

a) smoke b) particulate

c) aldehydes d) soot.

x) Oxides of nitrogen are usually measured by

a) chemiluminescence method

b) non-dispersive infrared analyzer

c) flame ionization detection method

d) obscuration method.

xi) Carbon monoxide emissions are high usually when

a) vehicle is cruising

b) vehicle is accelerating

c) vehicle is decelerating

d) vehicle is idling.

xii) Hydrocarbon emissions are higher, when the air/fuel ratio is

a) too lean b) too reach

c) stoichiometric d) near stoichiometric.

xiii) Compared to invisible pollutants, visible pollutants are

a) more toxic b) more irritant

c) less toxic d) less irritant.

xiv) Hartridge smoke meter is based on

a) Ringelmann chart method

b) Light extinction method

c) Continuous filter type method

d) Spot filter type method.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What are the causes for black smoke, white smoke and blue smoke ?

3. Explain in detail the NDIR technique with a sketch.

4. Explain emission as function of equivalence ratio in a SI and CI engine.

5. What do you understand by the term EGR (with a suitable neat sketch) ?

6. The analysis of the dry exhaust from an internal combustion engine gave : 12% CO_2, 2% CO, 4% CH_4, 1% H_2, 4.5% O_2, and the reminder nitrogen. Calculate the proportions by mass of carbon to hydrogen in the fuel, assuming it to be a

pure hydrocarbon.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) What is a catalytic converter ?

b) Explain the oxidation and reduction reaction in a converter.

c) What are the sources of evaporative emission in petrol engine ? Explain the Evaporative Emission Control system with schematic diagram for SI engine. 2 + 6 + 7

8. a) Derive the Stoichiometric fuel air ratio and describe it.

b) A fuel has the following % composition by weight

C = 84%, O_2 = 1%, H_2 = 14%, S = 1%

i) Estimate the minimum value of air required at NTP for complete combustion

ii) Determine the percentage composition by weight of the product of combustion

(The constituent of air composition by weight is 23% O_2 and 77% N_2, Air measures 0.773 m^3/Kg at NTP)

c) Discuss about the Photochemical smog. 5 + 6 + 4

9. a) Explain the methods by which hydrogen can be used in SI engine as well as CI engine.

b) What alternative fuels can be considered for petrol engines from exhaust emission point of view ? 10 + 5

10. a) Can alcohol be used for CI engines ? Explain.

b) Which are technology options adopting for emission control norms (Bharat Stage IV) in CI engine ?

c) Discuss the factors which may increase the NO_x

concentration in SI engine. 5 + 4 + 6

11. a) Explain the internationally accepted method of measuring the oxides of nitrogen emission.

b) What are particulates ? Describe in detail how particulate emissions are caused. 8 + 7