



Name :
Roll No. :
Invigilator's Signature :

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 × 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.



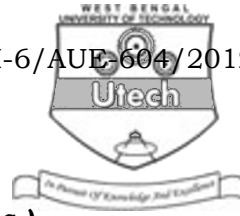
- iii) The air fuel ratio required for the efficient operation of a three way converter is approximately
- a) 5 : 1 b) 10 : 1
- c) 20 : 1 d) 15 : 1.
- iv) If lead is added to gasoline, the emission of
- a) HC is increased b) HC is reduced
- c) NO_x is increased d) PM is increased.
- v) Alcohol is the 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 ventilation 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 rich
 - 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. $3 \times 5 = 15$

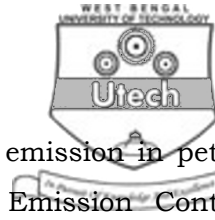
2. What are the causes for black smoke, white smoke and blue smoke ?
3. Explain in detail the NDIR technique with a sketch.
4. Explain emission as function of equivalence ratio in a SI and CI engine.
5. What do you understand by the term EGR (with a suitable neat sketch) ?
6. The analysis of the dry exhaust from an internal combustion engine gave : 12% CO₂, 2% CO, 4% CH₄, 1% H₂, 4.5% O₂, 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

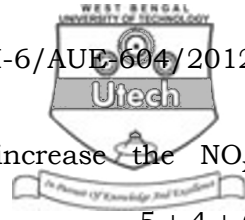
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

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%, O₂ = 1%, H₂ = 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% O₂ and 77% N₂, Air measures 0.773 m³/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

=====