

**FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI**  
**SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY**  
**DEPARTMENT OF MECHANICAL ENGINEERING**

2019/2020 HARMATTAN SEMESTER DATE: 11/02/2021 TIME ALLOWED: 3HRS

COURSE: INDUSTRIAL VENTILATION & POLLUTION CONTROL SYSTEMS (ARE 507)

**INSTRUCTIONS: ANSWER FOUR QUESTIONS. BONUS MARKS WILL BE AWARDED FOR CORRECT USE OF DIAGRAMS IN ANSWERING QUESTIONS.**

1. (a) Define the following terms:  
(i) Pollutants (ii) Pollution (iii) Pollution Prevention (iii) Exfiltration (iv) Infiltration  
(b) List four sources of Indoor Air Pollution (IAP) and activities that encompass pollution prevention.  
(c) State three reasons for the measurement of ground level concentrations  
(d) Give five hazards of poor or no ventilation in an industry  
(e) Briefly explain how a local exhaust system works.
2. (a) What is natural ventilation?  
(b) Give five merits and demerits of natural ventilation.  
(c) If Owerri Municipal Local Government regulations stipulate that the minimum amount of fresh air which may be supplied to a place of public entertainment is 8litres/sec per person and that the minimum amount of space allowable in the room is  $12\text{m}^3$  per person, calculate the concentration of carbon dioxide present after one hour, expressed as a percentage. Assume that fresh air contains 0.032 percent of carbon dioxide and that human respiration produces  $4.72 \times 10^{-3}$  litres/sec of carbon dioxide per person. Also, that the supply and exhaust points are above the occupied zone and that  $(t_s - t_r) < 0$ . Take  $e_v = 0.95$
3. (a) What is local exhaust ventilation? State five situations that will necessitate the use of local exhaust ventilation system/technique  
(b) Give four advantages and two disadvantages of local exhaust ventilation  
(c) List two advantages of cross-flow ventilation.  
(d) Give two disadvantages of single sided ventilation  
(e) State two differences between natural and mechanical ventilation
4. A garage measures  $60\text{m} \times 30\text{m} \times 3\text{m}$  high and contains a number of motor cars which produce a total of  $0.0024\text{m}^3/\text{sec}$  of carbon monoxide.  
a) If the maximum permissible concentration is to be 0.01percent of carbon monoxide, what number of air changes per hour are required if the garage is in continual use?  
b) If the garage is in use for periods of 8hours only, and at the start of any such period, the concentration of carbon monoxide is zero, what number of air changes per hour is needed if the concentration is to reach 0.01 percent only by the end of the 8hour period?  
c) What is the concentration after the first 20minutes of an 8-hour period

If at the end of an 8-hour period, the concentration is 0.1 percent, for how long should the ventilation plant be run in order to reduce the concentration to 0.001 percent?

5. (a) State two roles played by ventilation in the industry  
(b) Give five reasons for testing ventilation systems  
(c) Briefly explain what you understand by "dilution ventilation"  
(d) Give three instances when it is appropriate to apply dilution ventilation  
(e) State four advantages and four disadvantages of dilution ventilation.
6. (a) Define industrial ventilation.  
(b) State four purposes of ventilation in a work environment.  
(c) State four ways to control contaminants apart from use of dilution ventilation and local exhaust ventilation in a work environment.  
(d) Write briefly on the following  
(i) Adsorption (ii) Absorption (iii) Catalytic conversion (iv) Thermal Oxidation