Minoufiya University		Subject: *Industrial Ventilation*
Faculty of Engineering		Code: *MPE 610*
Mechanical Power Eng. Dept	Minufiya University	Academic level: Master.
Academic Year: *2014-2015*		Time allowed: *3 hours*
Date: *3-6-2015*		Total degree : *100 marks*

Answer all the following questions: *Assume any missing data*

Question-1   [30 marks]

a- Discuss with the aid of sketch the difference between the natural and industrial ventilating of the industrial zones.   (6 marks)

b- *Discuss* the important role of the United State Organization to determine the industrial limits. And *what is the meaning* of the following abbreviations: ACGIH, OSHA and ANSI ?   (6 marks)

c- The metal workshop contains the high level of carbon dioxide (CO_2). The sources of this pollutants are outside air C_o (1.2 µg/m³), initial concentration C_i and generating during the activity. The concentration can be calculated from the following equation $C(t) = \int_0^t [C_i + C_o (t + e^{-2t}) + 0.0002\, t]\, dt,$ where C (µg/m³) and t (hrs). If the mole fraction (y_i) is 1 PPM, *calculate the following:*

 i- Initial concentration (mg/m³) at standard temperature and pressure (STP),

 ii-The concentration based on Time-Weighted Average (TWA-8 hrs),

 iii- The concentration based on Short-Term Exposure Limits (STEL).

(18 marks)

Question-2   [40 marks]

a- Field measurements is method which are used to determine the contaminant generation. *Explain* this method and *mention* some examples about evaporation and diffusion processes for the industrial activities.   (8 marks)

b- Trichlorethylene [C_2HCl_3] is a common nonflammable hydrocarbon used to clean metal surfaces. The molecular weight is 131. The enthalpy of vaporization at 86 °C and atmospheric pressure *(P)* is 57.5 cal/g, *find the following:*

 i- *the vapor pressure (P_c) at 28 °C, in mmHg*
 ii- *The diffusion coefficient of C_2HCl_3 in air in square meter per second*, if critical parameters of Trichlorethylene are T_c =593 K and v_c=315.5 cm³/g.mol. Also, critical parameters of Air are T_c =126.2 K and v_c=90 cm³/g.mol and M_{air}=28.9.

iii- A thin layer of Trichlorethylene is put inside open drum with the following conditions: drum cross section area equals 0.25 m², drum height is 0.8 m and the room temperature is 24 °C. *Estimate the evaporation rate inside room (g/hr).*

(32 marks)

Question-3 [30 marks]

a- *Explain with the aid of diagram* the performance curve of fan under specific conditions of fan volume and system static pressure. (6 marks)

b- *Mention the differen*t methods are used to control the fan air flow. (6 marks)

c- It is proposed to air-condition a room 9m × 5m × 3.25m ceiling height and having a heat gain of $42 Wm^{-2}$, by supplying cool air from a grille mounted on a small side wall 180 mm below the ceiling. *Select a suitable grille and assess* the thermal environment in the occupied zone, assumed 1.75 m high. (18 marks)

Use the following relations if you need:

For evaporation and diffusion	For the Side-wall supply
$$-C_i = \frac{M\, y_i P}{R_u T}$$	$$N = 7.84 \sqrt[3]{qB/[(B+H)L^2]} \quad h^{-1}$$
$$-\ln \frac{P_2}{P_1} = \left(\frac{h_{fg}}{R_u}\right)\left(\frac{T_2 - T_1}{T_2 T_1}\right)$$	$$T = 11.6\sqrt{(M_o/\rho)} = 11.6\, U_o\sqrt{A_o} \quad m$$
$$-D_{12}\left(\frac{cm^2}{s}\right) = \frac{0.43}{K}\left(\frac{T}{100}\right)^{1.81}\sqrt{\left[\left(\frac{1}{M_1}\right)-\left(\frac{1}{M_2}\right)\right]}$$	$$\Delta t_o = 3q/(NH) \quad K$$
where $K = P\left(\frac{T_{c1}\, T_{c2}}{10000}\right)^{0.1405} E$, and	$$v_r = 0.73\sqrt{[M_o/(BH)]}$$
$$E = \left[\left(\frac{v_{c1}}{100}\right)^{0.4} - \left(\frac{v_{c2}}{100}\right)^{0.4}\right]^2$$	$$y = H - (Z + d + 0.5b + \delta)$$
$$-N_c = \left[\frac{D_{12}\, P}{R_u T\,(Z_2 - Z_1)}\right] \ln\left[1 - \left(\frac{P_c}{P}\right)\right]$$	$$r = 34.2\left[\frac{A_o d}{y}\left(\frac{L^3(B+H)}{(BH)^3}\right)\right]^{2/3}$$

With best wishes

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