Minoufiya University Faculty of Engineering Mechanical Power Eng. Dept Academic Year: 2015-2016 Date: 11-6-2016	Minufiya University	Subject: *Industrial Ventilation* Code: *MPE 502* Academic level: Diploma. Time allowed: *3 hours* Total degree : *100 marks*

Answer all the following questions:

Question-1 **[40marks]**

a- Mention the different sources of pollutants inside the closed spaces. (6 marks)

b- Explain with details the meaning of IAQ. (6marks)

c- Classify the contaminants inside the closed space and mention one example of each type. (6 marks)

d- Describe using diagrammatic sketch the operation of natural ventilation system and report its advantages and disadvantages. (8 marks)

e- Show the difference between the two methods of industrial ventilation system (i.e. dilution and local exhaust), and mention only the disadvantages of each method. (8 marks)

f- What are the general rules for duct design to obtain the optimum performance? (6 marks)

Question-2 **[60 marks]**

- A garage has the dimensions as shown in the next figure. The inlet and exit ventilation openings have the same shape and the same dimensions (25 cm×75 cm). The difference between the levels of inlet and exit opening (i.e. ΔH) is 1.0 m and the discharge coefficient C_D is 0.61 for all the openings. The dynamic pressure head at the inlet opening is neglected. The average temperature inside the garage is 35 °C while the outside temperature is 25 °C. The air flow rate from duct openings are Q_B=40% of the fan flow rate and Q_D=Q_E=30% of the fan flow rate. Take the pressure loss coefficients at bend is 0.8 and the exit is 1.0 along the duct. Also, take the velocity for the main duct is 8 m/s and the fan efficiency is 0.82. *Assume any required data and calculate the following:*

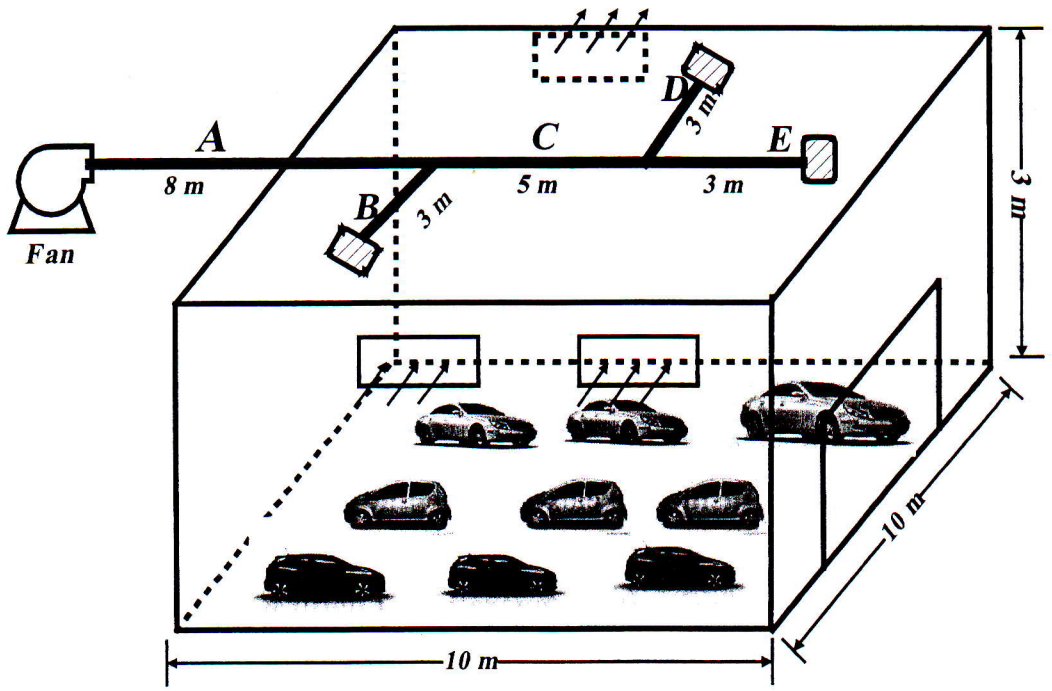
i- The required air flow rate if the air change rate (ACR) equals 6.

ii- The natural flow rate based on the buoyancy effect only.

iii- Design the ventilation duct using the equal friction coefficient method.

iv- The pressure losses at the exit damper.

v- The fan horse Power (HP).



Use the following relations if you need:

$$\frac{\Delta P_f}{L} = \frac{0.022243\,\dot{Q}_{air}^{1.85}}{D^{4.973}} \quad , \quad D_{eq,B} = D_{eq,A}\left(\frac{Q_B}{Q_A}\right)^{\left(\frac{1.85}{4.973}\right)} \quad , \quad D_{eq} = 1.3\frac{(a\,b)^{0.625}}{(a+b)^{0.25}}$$

$$\dot{V} = A_e\,C_e\sqrt{\frac{2\,g\,\Delta H\,\Delta T}{\overline{T}}} \quad , \quad \frac{1}{(A_e C_e)^2} = \frac{1}{\left(\sum A_i C_i\right)^2} + \frac{1}{\left(\sum A_o C_o\right)^2}$$

With best wishes

Dr. Ashraf Amin