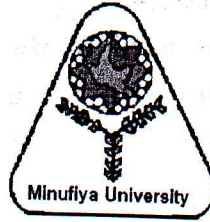Menofia University
Faculty of Engineering
Mechanical Power Eng. Dept
Academic Year: 2017-2018
Date: 30-5-2018

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
[15 marks]

a) Mention the sources of indoor air pollution, and classify the contaminants of particulate matters.
(6 marks)

b) The healthy air should be available in breathing zone. Explain with details the contents of healthy air and define Indoor Air Quality (IAQ).
(4 marks)

c) Space air distribution is one method which is used to control the level of air pollution inside closed spaces. Explain with details this method.
(5 marks)

Question-2
[20 marks]

a- What is the difference between air conditioning process and the air ventilation processes?
(6 marks)

b- Describe using diagrammatic sketch, how the temperature difference between inside places and the outside surrounding can be used to modify the natural ventilation system and explain with sketch how the solar radiation can be used to improve the natural ventilation.
(8 marks)

c- 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.
(6 marks)

Question-3
[15 marks]

a- Discuss the difference between fans, blowers and compressors with respect to the pressure ratio.
(5 marks)

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

c- Mention the different methods are used to control the fan air flow.
(5 marks)

Question-4

The dilution ventilation is used of the wood factory. The factory has the dimensions 30m×15m×6m as shown in the next figure. Three inlet and two exit openings have the same shape and the same dimensions (0.75m×3m). The difference height between inlet and exit opening (i.e. H) is 1.5 m and the discharge coefficient C_D is 0.61 for all the openings. The dynamic pressure head at the inlet opening is 1.25 Pa. The average temperature inside the factory is 35 °C while the outside temperature is 23 °C. The air flow rate from duct openings are Q_B=30% of the fan flow rate and $Q_D=Q_F$=35% 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 0.87. _Assume any required data and calculate the following:_

i- The required air flow rate if ACR=8.

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

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

v- The fan horse Power (HP).

30 m
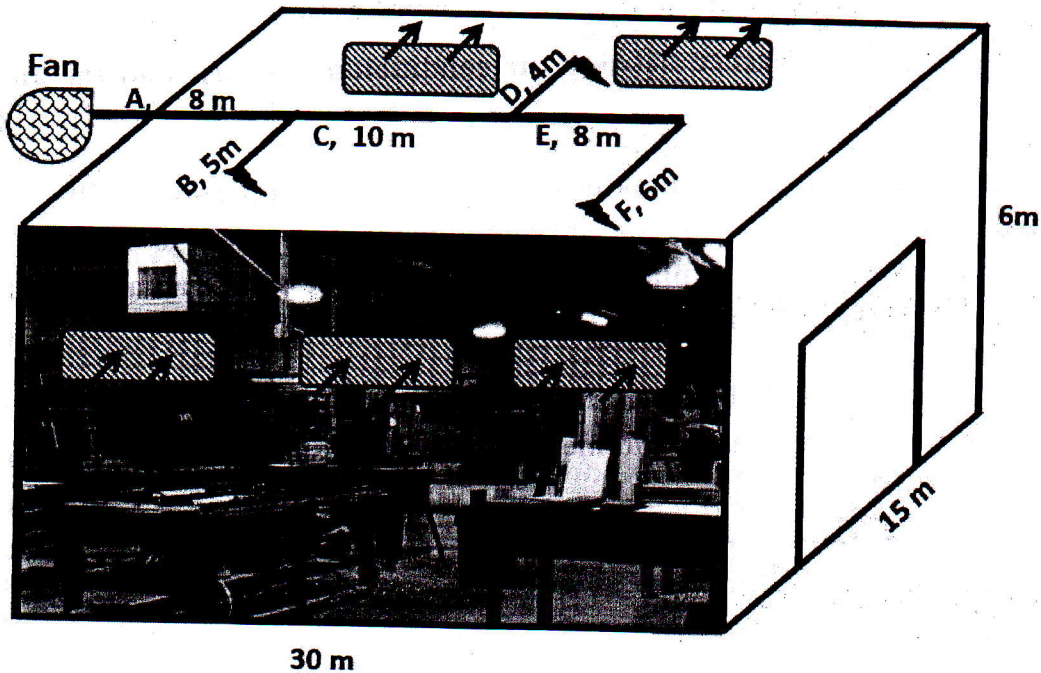
Use the following relations if you need:

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

$$V_{wind} = \sqrt{\frac{2\,\Delta P}{\rho_{air}}}, \quad \dot{Q}_{boy} = A_e\, C_e \sqrt{\frac{2\,g\,\Delta H\,\Delta T}{\overline{T}}} \quad , \quad \frac{1}{(A_e C_e)^2} = \frac{1}{(\sum A_i C_i)^2} + \frac{1}{(\sum A_o C_o)^2}$$

With best wishes

Dr. Ashraf Amin