Minoufia University Faculty of Engineering Mechanical Power Eng. Dept Academic Year: 2016-2017 Date: 7-6-2017	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 [20 marks]

a- Vapours and gases are types of air contaminants inside closed space, Explain the difference between them and discuss one contaminant of each type.

b- Explain air cleaning method which is used to control and treat the indoor air pollutants.

c- Describe using diagrammatic sketch the thermal effect on the natural ventilation system and report its advantages and disadvantages.

d- 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.

Question-2 [25 marks]

a- What are the chief requirements of an air ventilation duct systems?

b- Explain with sketch the difference type of a centrifugal fans and mention advantages and disadvantage of each type.

c- Explain with the aid of a diagram the performance curve of a fan under specific conditions of fan (volume flow rate, system static pressure and efficiency).

d- Discuss the different steps to increase the energy efficiency of air fans.

e- Discus the purposes of hood ventilation and the meaning of capture velocity. Also, explain with sketch the different types of Ventilation hoods.

Question-3 [55 marks]

- An industrial welding shop has the dimensions as shown in the next figure. . Two inlet openings have dimensions (60 cm×225 cm). The exit ventilation openings have dimensions (40 cm×200 cm). The difference between the levels of inlet and exit opening (i.e. ΔH) is 1.5 m and the discharge coefficient C_D is 0.6 for all the openings. The dynamic pressure head at the inlet opening is assumed 0.38 Pa. The average

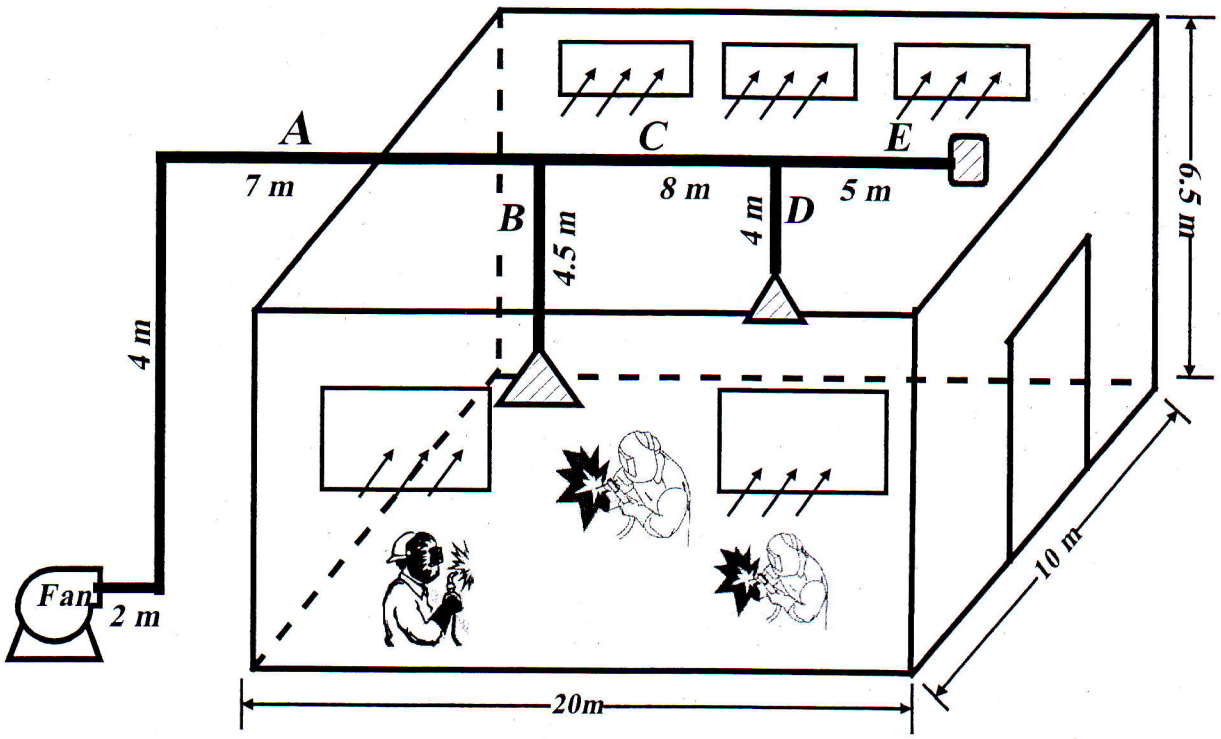
temperature inside the welding shop is 45 °C while the outside temperature is 27 °C. The air flow rate from duct openings are Q_B =40% of the fan flow rate and Q_D=30 % of the fan flow rate. Take the pressure loss coefficients at bend is 0.8 and the exit is 1.0 along the duct. Also, take the velocity for the main duct is 8 m/s, air density 1.23 kg/m^3 and the fan efficiency is 89%. *Assume any required data and calculate the following:*

i- The required air flow rate if the air change rate (ACR) equals 15,

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

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

iv. The fan horse Power (HP),



Use the following relations if you need:

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

$$\dot{V} = A_e\,C_e\sqrt{\frac{2\,g\,\Delta H\,\Delta T}{\overline{T}}} \quad , \quad \frac{1}{(A_eC_e)^2} = \frac{1}{\left(\sum A_iC_i\right)^2} + \frac{1}{\left(\sum A_oC_o\right)^2}$$

With best wishes

Dr. Ashraf Amin