Minoufiya University Faculty of Engineering Mechanical Power Eng. Dept Academic Year: *2016-2017* Date: 2-1-2017	Minufiya University	Subject: Industrial Ventilation Code: MPE 610 Academic level: Master. Time allowed: 3 hours Total degree : 100 marks

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

Question-1 [20 marks]

a-What is the preferred ventilation system of the following situation:

i- Dilute non-toxic odors in the warehouse,
ii- welding table.

b- Explain the design parameters of industrial ventilation.

c- Why is the industrial ventilation suitable for many applications?

d- Discuss with sketch the component and the advantages of local exhaust system.

Question-2 [25 marks]

a- Explain with sketch the dilution ventilation system and discuss the limitation of used dilution system for industrial activates.

b-Discuss with the aid of sketch the main characteristics of hoods and show the different types of hoods.

c- Define the following: Natural ventilation, Indoor air quality, Air change rate, Air makeup, Breathing zone and Exfiltration.

d- A rectangular duct with 40 cm ×30 cm is used to ventilate the class room. The dimensions of the room are 6m × 10m × 4m. If the air change rate (ACR) is 8 determine the following:

i- the required air flow rate (m^3/min)
ii- the air velocity through duct (m/s)
iii- the equivalence hydraulic diameter of the duct (cm).

Question-3 [30 marks]

a- Explain with diagrammatic sketch (the air flow pattern and the concentration change) of the artificial piston ventilation (PV) system and the arterial mixing ventilation (MV) system.

b- It is proposed to air-condition a room 10m × 5m × 4m ceiling height and having a heat gain of 0.05 kW/m^2, by supplying cool air from a grille mounted on a small side wall 25 cm below the ceiling. Select a suitable grille and asses the thermal environment in the occupied (breathing) zone.

Question-4 [25 marks]

a- Explain the meaning of air free jet and discuss with the suitable sketch the different regions of the air free jet, also show the relation between center line velocity and free jet velocity with the jet length.

c- A room of dimensions 5m × 5m × 4m ceiling height with a thermal load of 175 Wm^{-2}, is to be supplied with cool air from a circular diffuser mounted at the center of the ceiling. For a supply/extract air temperature difference of −7 K, Design the suitable size diffuser and assess the thermal environment in the room.

Use the following relations if you need:

Side-wall supply	*Circular ceiling diffusers*
$N = 7.84\sqrt[3]{qB/[(B+H)L^2]}$ h^{-1}	$v_r = 0.143\, L\sqrt{(L^2/4 + H^2)}$ m s^{-1}
$\Delta t_o = 3q/(NH)$ K	$\dot{V} = qLB/(\rho C_p \Delta t_o)$ m^3 s^{-1}
$T = 11.6\sqrt{(M_o/\rho)} = 11.6\, U_o\sqrt{A_o}$ m	$A_o = 0.0484\rho(\dot{V}/v_r)$ m^2
$r = 34.2\left[\frac{A_o d}{y}\left(\frac{L^3(B+H)}{(BH)^3}\right)\right]^{2/3}$	$T = 4\,K_v^2 U_o^2 h$ m
	$K_v \approx 1.05.$

With best wishes

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