



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015**

COURSE NAME : MECHANICAL AND ELECTRICAL SYSTEM
COURSE CODE : BFC 32602
PROGRAMME : BACHELOR OF CIVIL ENGINEERING WITH HONOURS
EXAMINATION DATE : JUNE 2015 / JULY 2015
DURATION : 2 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

Section A: Please select the most appropriate answer in the following questions and write your answers in the answer script book.

- Q1 Once the heat is extracted from a moist air, it will change the water air vapour into liquid. This process is described as:
- A. Fusion
 - B. Evaporation
 - C. Precipitation
 - D. Condensation
- Q2 Relative humidity is defined as:
- A. The number of grains of water vapor per pound of dry air.
 - B. The intersection of the wet bulb and dry bulb temperature on a psychometric chart.
 - C. The amount of water vapour present in air expressed as a percentage of the amount needed for saturation at the same temperature.
 - D. The ratio of the whole pressure of water vapor (H_2O) in the mixture to the saturated vapor pressure of water at a given velocity.
- Q3 Human being feels very comfortable with the following condition:
- A. 5% - 50% Relative Humidity
 - B. 10% - 50% Relative Humidity
 - C. 30% - 90% Relative Humidity
 - D. 45% - 75% Relative Humidity
- Q4 For a lower U-value of a curtain wall or window assembly, it indicates that it:
- A. is good insulated
 - B. is poorly thermal design
 - C. is good thermal conductivity
 - D. has excellent expansion capabilities

Q5 Calculate the heat gain through windows, based on the following data:

Table 1: Data

No. of windows	4 nos.
Size of one unit window	1.8m x0.6m
Windows U- value	2.8 W/m ² °C
Inside Temperature	20°C
Outside Temperature	42°C

- A. 266.1 Watts
B. 270.1 Watts
C. 275.4 Watts
D. 280.3 Watts
- Q6 Calculate the R-value for the 8mm thick single glazing with k-value 1.053 W/mK.
- A. 0.0076 W/K
B. 0.0076 W/m² K
C. 0.0076 m² K/W
D. 0.0076 W/mK
- Q7 The unit of W /m²K used in building materials thermal performance, refers to:
- A. Shading coefficient
B. Energy efficiency ratio
C. Thermal transmittance
D. Visible transmittance

- Q8 R-value is one of the parameters in deciding thermal insulation for construction material. For the best insulating material, it should have:
- A. low R-value
 - B. high R-value
 - C. fractional R-value
 - D. restricted R-value
- Q9 Plastic, cork and wood are materials that do not allow an easy transfer of heat. These materials are called:
- A. thermal energy
 - B. material insulators
 - C. electrical energizers
 - D. electrical conductors
- Q10 Which of the following may be a source of a building's heat loss?
- A. Insolation
 - B. Air infiltration
 - C. Electric lighting
 - D. Building occupants
- Q11 Under hot and humid climate, which of the following actions may best help to maintain human comfort even in an increased indoor temperature:
- A. Lowering the humidity
 - B. Re-circulating the air supply
 - C. Increasing the ventilation rate
 - D. Lowering the lighting intensity

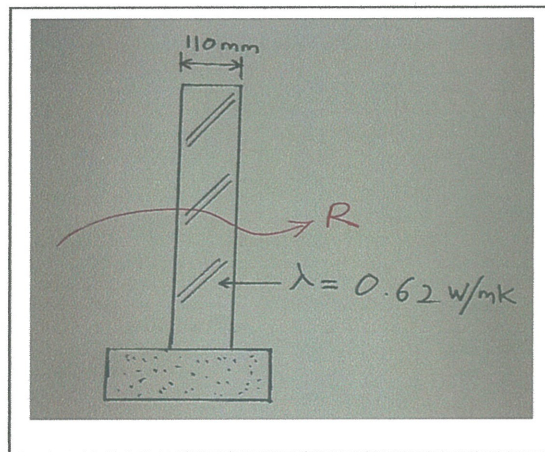
- Q12 Which of these are not the correct units?
- A. 1 year = 8760h
 - B. 60h = 3600min
 - C. $3.6 \times 10^3 \text{s} = 1\text{h}$
 - D. 1h = 360s
- Q13 In contrast to wet-pipe sprinkler system, dry-pipe sprinkler system is used because of the following items:
- A. It will not freeze in unheated spaces
 - B. It is lighter and less expensive to install
 - C. It has fewer valves and fittings to maintain
 - D. It contains water and will not corrode rapidly
- Q14 Which of the following parameters does not affect the lift waiting time?
- A. Rated load
 - B. Number of stops
 - C. Door closing time
 - D. Handling capacity
- Q15 The elevator/lift will include the following basic components, except:
- A. Counterweight
 - B. Geared machine
 - C. Pulley
 - D. Handrail

- Q16 Which are true about fire fighting systems in large buildings?
- A. Never need to be tested after being commissioned
 - B. Have a fire control panel identifying which parts of the system is activated
 - C. Are all filled with water
 - D. Not connected to the computer-based building management system
- Q17 What does ventilating a building mean?
- A. Maintaining indoor air circulation
 - B. Exhausting clean air
 - C. Provides of moisture and odours into each room
 - D. Provide warm air into each room
- Q18 Which of these can affect asthma sufferers?
- A. Excess of outside air ventilation
 - B. House dust mites
 - C. Warm indoor air
 - D. Humid and warm indoor air
- Q19 Which is not a means of extinguishing fire?
- A. Cool the burning material
 - B. Calling the fire brigade
 - C. Stop the supply of more fuel
 - D. Closing doors and windows and evacuating the building
- Q20 Identify the essential components of a fire?
- A. Fire and air
 - B. Combustible material and air
 - C. Paper, wood, solvents, air and heat
 - D. Fuel, oxygen and ignition temperature

(40 marks)

Section B: Answer all questions.

- Q1 (a) List **SIX (6)** importances of the mechanical and electrical system for a building. (6 marks)
- (b) Heat is transferred from a hot body to a cold body in **THREE (3)** basic modes. Name the modes (3 marks)
- (c) **FIGURE 1** shows a brick wall with a thermal conductivity, $\lambda = 0.62 \text{ W/m K}$ and a thickness of 110 mm, find the thermal resistance of this brick wall. (4 marks)

**FIGURE 1**

- (d) **FIGURE 2** shows a cavity wall of an existing house has outer and inner brickwork leaves each 105 mm with a 50 mm air gap between them, finished with a 16 mm layer of plaster inside. The relevant values of thermal conductivity (k -value), are: brickwork 0.73 W/m K and plaster 0.46 W/m K. The standard thermal resistances (R-value), are: outside surface (R_{so}) 0.055 $\text{m}^2 \text{ K/W}$, inside surface (R_{si}) 0.123 $\text{m}^2 \text{ K/W}$ and air gap 0.18 $\text{m}^2 \text{ K/W}$.

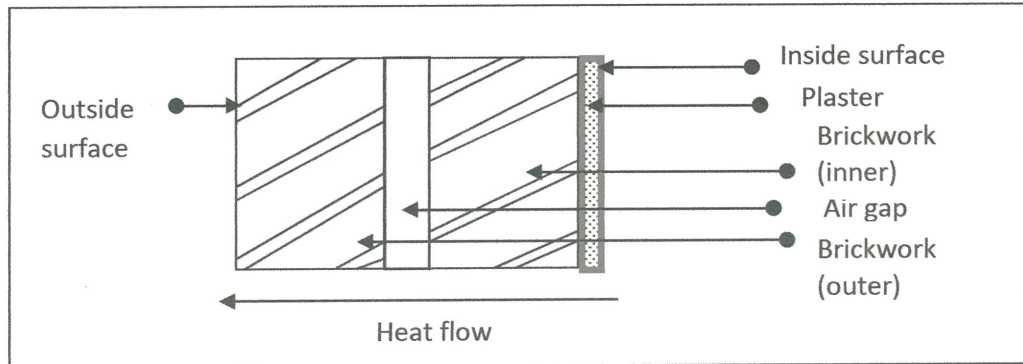


FIGURE 2

Calculate the followings:

- (i) The U-value of the existing wall. (13 marks)
- (ii) The U-value of the wall if the cavity is completely filled with foamed urea formaldehyde (k -value = 0.026 W/m K). (4 marks)

- Q2**
- (a) State the purpose of ventilation and explain how it can help to improve indoor air quality (IAQ). (5 marks)
 - (b) Explain how the fan assisted mechanical ventilation system can improve the indoor air quality of a building. (5 marks)
 - (c) Compare the differences between natural and mechanical ventilation. (5 marks)
 - (d) A conference room with a size of 14 m × 6 m × 2.9 m is supplied with air at the rate of 12 air changes per hour (ACH) using a fan to improve the room indoor air quality (IAQ). The air leaving the room using square duct at a velocity of 8.5 m/s.

Answer the following questions:

- (i) Calculate the volumetric flow rate of the supplied air. (3 marks)
- (ii) Calculate the dimensions of the duct. (4 marks)
- (iii) Make an inference/conclusion from the above question regarding the relationships between ACH, IAQ and energy consumption of the fan. (3 marks)

- (e) A room with a size of $5\text{ m} \times 3\text{ m} \times 3\text{ m}$ as shown in **FIGURE 3** is supplied with air using a fan to improve the room indoor air quality (IAQ). The air leaving the room using rectangular duct with a size of $250\text{ mm} \times 200\text{ mm}$ at a velocity of 5 m/s . Find the room air change rate (ACH).

(5 marks)

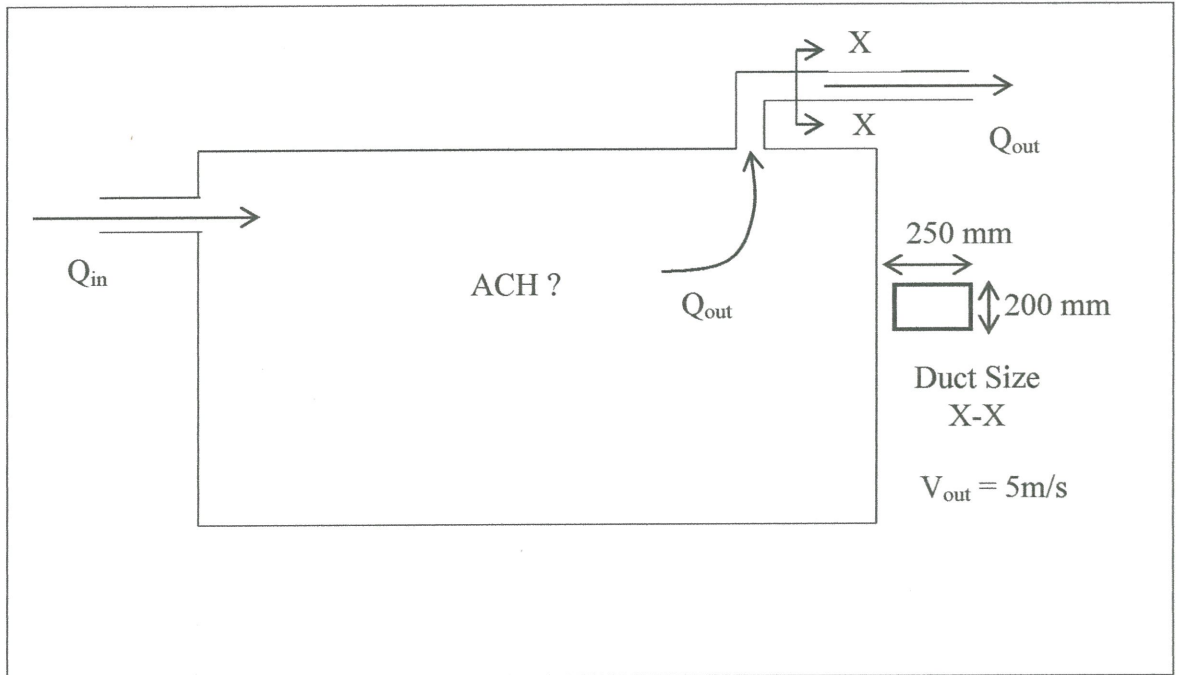


FIGURE 3

- END OF QUESTION -