



Department Architecture

College of Engineering

Salahaddin University

Subject: Building Services (HVAC)

Course Book 3rd Year - Semester 2

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Academic Year: 2021/2022

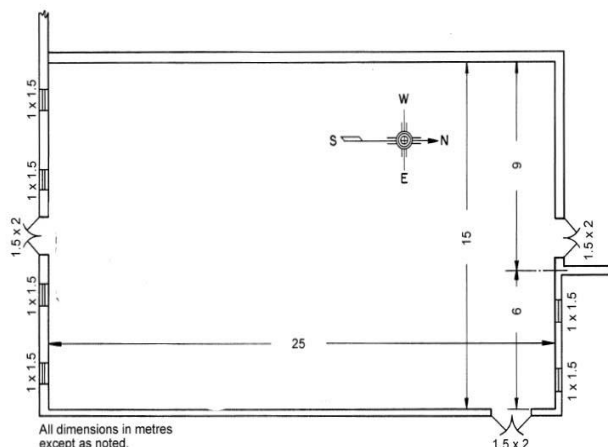
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|--|--------------|
| Homework and assignments | 10 % |
| Final Examination | 60 %. |
| Total Marks | 100% |
| <p><u>15. Student learning outcome:</u> By the end of the course, students should be able to:</p> <p>Upon the completion of this course, students will be able to</p> <ol style="list-style-type: none"> 1- Understand the fundamentals of heat transfer 2- Understand the fundamentals of thermodynamics 3- Understand indoor air quality and its importance 4- Understand the methods of heat transfer in buildings 5- Able to calculate the resistance to heat transfer for different building assemblies. 6- Understand the principles of psychometric. 7- Understand different types of HVAC equipment's 8- Perform simple calculations for heat loads in buildings 9- Perform simple calculations for duct sizing. | |
| <p>16. Course Reading List and References:</p> <ol style="list-style-type: none"> 1- “A Textbook of Refrigeration and Air- Conditioning” by R.S.KHURMI, J.K.GUPTA. 2- “Mechanical Engineering (Conventional and Objective Type) by R.S.KHURMI, J.K.GUPTA. 3-Wang, S.K. and Lavan, Z. “Air-Conditioning and Refrigeration” Mechanical Engineering Handbook Ed. Frank Kreith. 1. 4-ASHRAE, ASHRAE Handbook-Fundamental, New York, USA, 2005. <p>(-ASHRAE → The American Society of Heating, Refrigerating and Air-Conditioning)</p> <p>.....</p> | |
| <p>17. The Topics</p> | |

| The Schedule | |
|--|--------------------------------------|
| Topic Lecture no. | Lecturer Name Dr.Ramzi R.Ibraheem |
| Thermodynamic Principles (Heat Transfer) | Week -1 - |
| Thermodynamic Principles (Heat Transfer) | Week -2 - |
| Thermodynamic Principles | Week -3 - |
| Thermodynamic Principles (Psychometrics) | Week -4 - |
| Comfort Condition | Week -5 - |
| Air-Conditioning | Week -6 - |
| Air-Conditioning Systems | Week -7- |
| Cooling load | Week -8 - |
| | <i>Midterm Examination</i> |
| Cooling load Calculation | Week -9- |
| Cooling load Calculation(Example) | Week -10 - |
| Ducts | Week -11 - |
| Duct Construction, Pressure in Duct, | Week -12 - |
| Duct Design, Methods for determination of Duct Size | Week -13 - |
| Duct Design, Methods for determination of Duct Size | Week -14 - |
| Duct Design, application | Week -15 - |
| Final Examination | |

18. Examinations (Examples):

Q1 \ An air conditioned restaurant function with 30 customers that stands on a well-ventilated measures 15 m width, 25 m length and 4 m height, 3 wooden doors of 100mm thickness $k=0.121$, all walls and roof are 200mm high density concrete $k=0.588$, 6 windows glass of $U=3.12 \text{ W/m}^2\cdot\text{K}$, the floor is 200mm of high density concrete $K=1.73$. All the walls and roof are exposed to external temperature. Calculate the sensible, latent and total heat gains on the storage and what is the required cooling capacity?

Note: make use of the condition data and attached data with the examination sheet.

**(condition) data:-**

Inside conditions : 20°C dry bulb, 50 percent RH, Outside conditions : 50°C dry bulb, 27°C wet bulb

Effective Temp. Difference (ETD) for floor : 15 °C

Lighting load :30 W/m² of floor area , Appliance load : 600 W (Sensible) + 300 W(latent)

Infiltration : 0.5 Air Changes per Hour(ACH), K =thermal conductivity, $\text{W}/(\text{m}\cdot\text{K})$

Table Heat liberated due to occupancy

| Activity | Rate | Room dry Bulb temp. °C | | | | | | | |
|----------------|------|------------------------|----|----|----|----|----|----|----|
| | | 20 | | 22 | | 24 | | 26 | |
| | w | S | L | S | L | S | L | S | L |
| Seated at rest | 115 | 90 | 25 | 80 | 35 | 75 | 40 | 65 | 50 |
| Office work | 140 | 100 | 40 | 90 | 50 | 80 | 60 | 70 | 70 |
| Worker | 145 | 105 | 40 | 95 | 50 | 85 | 60 | 75 | 70 |

Q2/ Select one:

A/ What are the four elements of comfort Air conditioning?

B/ What is AIR HANDLING UNIT and what are its the main parts?

Q3/Explain the four basic locations that supply registers .(16 marks)

Q4/ Define the following :

(Throw, HVAC, Latent heat, Dew point temperature, Specific humidity, Tons Refrigeration)

19. Extra notes:

I will assess the students continuously through their activities in the class. Any student with ideas about learning, and suggestions of alternative way of dealing with problems will be very welcomed.

20. Peer review:

Reviewer's opinion:

1-Does this course book cover the class's main topics and requirements? If it does not, please explain why?

☒ **X Yes**

☐ **NO**

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2-Does this course book provide the necessary background information required for students to understand the course's contents? If it does not, please explain why?

☒ **X Yes**

☐ **NO**

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Name of the reviewer:

Signature:

Date: