

Department Architecture College of Engineering

Salahaddin University

Subject: Building Services (HVAC)

Course Book 3rd Year - Semester 2

Assist. Prof. Ramzi Raphael Ibraheem Barwari B.Sc. University of Technology, Baghdad H. Diploma University of Technology, Baghdad M.Sc. University of Technology, Baghdad Ph.D. University of Technology, Baghdad

Academic Year: 2021/2022

1.Course name	services(HVAC)			
2.Lecturer in charge	Dr. Ramzi R. Ibraheem Barwari			
3.Department/College	Architectural Engineering/ Engineering			
4.Contact	Email:ramzi.raphael@gmail.com Mob: 07504349609			
5.Time (in hours) per week	4 hrs. / week, to be assigned			
6.Office hours	Monday 1:30-5:30			
7.Course Code	ARC4125			
8. Teacher's academic profile	 B.Sc. in Mechanical Engineering – University of Technology, Baghdad – 1979 H. Diploma in Mechanical Engineering University of Technology, Baghdad – power section 1981. M.Sc. in Mechanical Engineering University of Technology, Baghdad – power section 1983. Ph.D. in Mechanical Engineering – University of Technology, Thermal power -2004 			
9. Key words	 Thermodynamic Principles (Heat Transfer), Thermodynamic Principles(Psychometrics) , Air -conditioning. 			

10. Course overview (description):

This course is intended to introduce the students to the concepts of indoor air quality control and desired ambient conditions that most people find comfortable. The students will be introduced to active and passive methods of air-conditioning and ventilation. The students will also be introduced to the types of air-condition systems to help them design sustainable designs.

11. Course objective:

- 1- To equip students with the knowledge of mechanical ventilation /HVAC and the required technology for application.
- 2- Integrating these technologies with their architectural design.
 - 3- Evolve an understanding in students to choose appropriate systems.

12. Student's obligation

The attendance of students in both lectures and tutorials hours will have extra credit. He/she is required to continuously follow the lectures, submits homework and assignments. Expect quizzes any time. This is part of the assessment defined in 8.

13. Forms of teaching

Contact hours: 2 theoretical weekly hours

14. Assessment scheme	
Midterm Examination	25 %
Quizzes	5%

Homework and assignments	10 %
Final Examination	60 %.
Total Marks	100%
. Student learning outcome:	

By the end of the course, students should be able to:

Upon the completion of this course, students will be able to

- 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.

16. Course Reading List and References:

- 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.

(-ASHRAE →	The American Society of	Heating, Refrigerating	and Air-Conditioning)

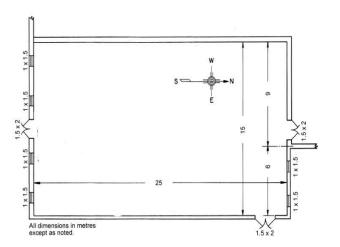
17. The Topics

The Schedule			
Topic	Lecturer Name		
Lecture no.	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 -		
	Week -5 -		
Comfort Condition	Wools 6		
Air-Conditioning Air-Conditioning Systems	Week -6 - Week -7-		
Cooling load	Week -8 -		
Cooming toau	Midterm Examination		
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 concretek=0.588,6 windows glass of U= 3.12 W/m².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, W/(m·K)

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Activity	Rate	Room dry Bulb temp. Co							
	w	20		22		24		26	
		S	L	S	L	S	\mathbf{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

Table Heat liberated due to occupancy

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.				
explain why? □X Yes	□ NO	oics and requirements? If it does not, please		
understand the course's cont □X Yes	tents? If it does not, p	ekground information required for students to lease explain why?		
Name of the reviewer:				
Signature:				
Date:				