

Air-Conditioning & Refrigeration

BSc

Lecture 13

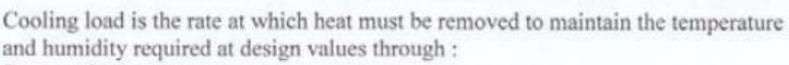
Course weekly Outline &

Ch. (Introduction to Air conditioning & Refrigeration)

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Chapter Four: Cooling load calculations:





Structural components,

Windows,

Infiltration,

Occupants and appliances.

4.1 : Cooling load through structural components :

The Cooling Load Temperature Difference (CLTD) method will be used to calculate the structural components load. This method combine the effect of the temperature difference between indoor and outdoor, solar radiation and considered thermal capacity of the enclosure.

$$Q = U A (CLTD)$$
 where :

U: overall heat transfer coefficient

A : area of wall ,roof ,or glass

CLTD: cooling laod temperature difference given in tables for walls ,roofs and glass

4.2 : Cooling loads through windows:



Solar Heat Gain (SHG) includes effects of both transmission and solar radiation, SF is the shade factor,

CLF is the cooling load factor.

4.3 : Cooling load through partitions, ceiling, and floor:

4.4 : Cooling load due to ventilation and infiltration :

$$\begin{array}{lll} Qs = \rho.V.\text{CP}\left(T_o - T_i\right) &= 1.22 & \forall \text{flow} \left(T_o - T_r\right) \\ Ql = 2500 \, \rho \, V_{flow}\left(W_o - W_i\right) &= \text{zq40} \, \forall \text{flow} \left(W_o - W_r\right) \\ Qtotal &= \rho \, V_{flow}\left(h_o - h_i\right) &= 1.2 \, \forall \text{flow} \left(h_o - h_r\right) \end{array}$$

Where: V_{flow} is the ventilation requirements from standard tables.

4.5: Internal cooling load due to occupants, lights and appliances:

People:

Q = 70 W/person or from tables according to activities.

Qs =N * (sensible heat gain) * CLF

Ol = N * (latent heat gain)

Where N is the number of people in the space and, CLF is cooling load factor.

Lights:

 $Q_{elc} = W F_u F_s CLF$, where: W is the watts input of the light, Fu is lighting use factor, Fs is special allowance factor.



Power:

 $Q_p = P E_f CLF$ where P is power rating, E_f is efficiency factor.

Appliances:

Q = 470 W for both kitchen and laundry for single family

Q = 350 W for multi-family

For latent cooling load calculate for individual components or estimate as 30% Qs.

OR:

Os = sensible heat gain * F_u

Ql = latent heat gain * F_u

MARIANA

4.6 Applications

lecture (9 \$ 10911)



OUT SIDE DESIGN CONDITION DATA FOR IRAQ

											-		
			1				*				(MECHA	FICAL S	EC.)
No.		OCATION.	ACTUAL		APPROX. LATITUDE	LONGITUDE		FLEVATION ABOVE MSL.	SUMMER * WINTE			TER	
					, N.	,E ,		M.	D.B.	R.H.	RANGE	D. B.	R.H.
1	SALAHADDIN	1 1	36	23′	3.2	44"	13'	1088	37.5	23	11.4	_0,5	50
2	SINJAR	- NORTH -	36°	19"		41"	50"	538	39.5	17	12.5	1.5	78
3	MOUSLE		36*	19		43"	09"	272.6	44	18.5	21.2	0.5	92
4	SULAIMANIYA		35°	33"		45°	27"	853	40	15	15	_1.5	77
5	KIRKUK		35°	28		44"	25'	330.8	44	14	16	3	61
5	AHA	HIDDLE -	34"	28"	33,	41°	57	138.5	43	21	17.6	1	68
7	KHARAQIN		34"	18"		¿s°	25"	292.2	45	15	13.4	3	81
8	HADITHA		34 *	04'		42°	22'	10.8	43.5	15	18	1	93
9	НАВВАНПА		33°	22"		43*	34'	43 . 6	44	17	18.3	2.5	85
0	SASHDAD		33*	14"		444.	1/2	34 . 1	45	-15.	18.7	1.5	84
1	RUTBA		33"	02		40*	47	815.5	40	15	17.3	0.5	82
2	HAI		32°	10			03'	14 . 3	45	18.5	17.3	4	64
3	HAJAF	SOUTH,	32*	01	31.0	44"	19"	50	45.5	14	17	4	62
4	DIWANIYA .		31*	59'		44*	59	20 .4	44.5	19.5	19.3	3.5	83
5	AKARA		31	51		47*	. 10'	7.5	46	13	19	4.5	30
5	SAMAWA		31°	18		45°	15'	6	45	14	13.5	4.5	\$5
7	NASIRIYA		31"	05		46*	14' -	3	45	18	18,4	4.5	79
œ.	BASRAH		30*	34		47*	47'.	2.4	43	38	15	5.5	89