COOLING LOAD CALCULATION SHEET

Sl.No	Description	L m	B m	H m	Area sq.m	CMH	Cooling coil Tr	Heating coil kW	# of rows of cooling coil	Static head (supply) Pa	Motor power hp	Selected CMH for return air blowers	Static head (exhaust) Pa	Motor power hp
	100% FRESH AIR (22°C, 50-60% RH) (Pre, Fine, HEPA filters)													
A	**GROUND FLOOR**													
	Emergency OT – AHU1					**6,800**	**32.4**	**8**	**8**	**1400**	***7.1***	**6120**	**500**	***2.3***
B	**FIRST FLOOR**													
	OT1 – AHU2					**8,600**	**38.5**	**7**	**8**	**1400**	***9***	**7740**	**500**	***2.9***
	OT3 – AHU3					**8,600**	**38.5**	**7**	**8**	**1400**	***9***	**7740**	**500**	***2.9***
	OT3 – AHU4					**8,600**	**38.5**	**7**	**8**	**1400**	***9***	**7740**	**500**	***2.9***

3 times calculated value used considering part load operation

Capacity of hot water generator -> 30 kW

After reducing Tr by 30% considering ERW -> 103.64

20% RECIRCULATORY AHU (22/24°C, 60% RH) (Pre, Fine filters)

A FIRST FLOOR

ICU – AHU5		13,200	21.1	6	1200	*11.8*			
Pediatric – AHU6		13,600	21.5	6	1200	*12.2*			
Labour room – AHU7		6,800	10.6	6	1200	*6.1*	1360	500	*0.6*

22°C Indoor Air Temperature considered

FCUs

	L	B	Sqm /TR	Temp		#1.5TR Hiwall	#2TR Hiwall	#3TR FCU
A GROUND FLOOR								
1 CMO Room	7	3.7	15	25	**1.8**	2		
2 X-Ray 1	6.25	5.1	5	25	**6.4**		4	
3 X-Ray 2	6.25	5.1	5	25	**6.4**		4	
4 Ultrasonic	6	4	12	25	**2**		1	
5 ECG room	4.3	3.4	12	25	**1.3**		1	

C SECOND FLOOR

MS Room	7	5.3	12	25	**3.1**		2	
Dy MS Room	7	3.5	12	25	**2.1**	2		
Urinalysis	4	3	8	24	**1.5**	1		
Bio-chemistry	5.6	2.9	8	24	**2.1**			1
Media room	5.6	3.2	8	24	**2.3**			1
Serology	5.6	3.7	8	24	**2.6**			1
Histology	5.6	3.7	8	24	**2.6**			1
Clinical pathology	5.6	3.7	8	24	**2.6**			1
						5	***12***	***5***

Connected TR	*194*
With DF of 80%	*155*
Add future expansion @ 30%	*201*

Chiller capacity -> 3x100 Tr (2W+1S)

VENTILATION CALCULATION SHEET

Sl.No	Description	L m	B m	H m	Volume cum	ACH required	Selected CMH for supply air blowers	Static head (supply) Pa	Motor power hp	Selected CMH for return air blowers	Static head (return) Pa	Motor power hp	Remarks
A	**GROUND FLOOR**												
1	Canteen												
	Exhaust hood	4.2	1							7001			
										7000	**400**	*2.1*	*IAD Fan*
2	Kitchen												
	Cooking range hood	6.1	1.2							13571			
	Dosa, chapathi hoods	4.7	1							7834			
	Steam condensate hood	3.6	1							6000			
							27400	**600**	*12.3*	**27400**	**600**	*12.3*	*IAD & FAD Fans*
3	Laundry	11	10	4.2	462	20				**9300**	**400**	*2.8*	*IAD & FAD Fans*
3	Isolation Ward	7	3.5	4.2	102.9	10				**1100**	**400**	*0.4*	*IAD & FAD Fans*

A FIRST FLOOR

1	CSSD	10	10	4.6	460	25	**11500**	**900**	*7.8*	**10350**	**400**	*3.1*	*Return IAD fan & Supply FAD fan with Pre, Fine filters*
2	Isolation Ward (Maternity)	7	3.2	4.6	103	10				**1100**	**400**	*0.4*	*IAD & FAD Fans*
3	Isolation Ward (Surgery)	7	4	4.6	128.8	10				**1300**	**400**	*0.4*	*IAD & FAD Fans*
4	Isolation Room	3.5	2.4	4.6	38.64	10				**400**	**400**	*0.2*	*IAD & FAD Fans*

A SECOND FLOOR

1	Blood store	5.6	3.2	4.2	75.26	20				**1600**	**400**	*0.5*	*2# 300Φ industrial exhaust fan*

HEAT LOAD ESTIMATION SHEET

JOB/REF No.					ESTIMATED BY:-		DATE:-	
LOCATION:-	**ESIC Hospital, Thirippur, Emergency OT**				CHECKED BY:-		DATE:-	
SHEET	1	OF	1		APPROVED BY:-		DATE:-	

DESIGN DATA

SUMMER			To, °C	Ti, °C	DR °C
d.b. TEMPERATURE			37.2	22	
RELATIVE HUMIDITY			41	55	
HUMIDITY RATIO			0.0168	0.0091	
DAILY RANGE					10.5
RAINY					
d.b. TEMPERATURE			32.3	22	
RELATIVE HUMIDITY			72	60	
HUMIDITY RATIO			0.0222	0.0099	
DAILY RANGE					10.5
LATITUDE:-			12°N		
	WALL:-	LIGHT	MEDIUM	DARK	
	ROOF:-	LIGHT	MEDIUM	DARK	
	GLAZING:-	BLINDS	SHADE	BARE	

Notes:
1. All dimensions in metres.

TRANSMITTED HEAT GAINS AND LOSSES

ITEM No.	DESCRIPTION	AREA, m²	U VALUE	SUMMER TEMP DIFF °C	HEAT GAIN, W.	RAINY TEMP DIFF °C	HEAT GAIN, W.
1	EXT. WALL N	28.56	2.28	15.45	1,006	5.95	387
2	EXT. WALL NE		2.28	15.85	0	7.05	0
3	EXT. WALL E		2.28	15.85	0	10.95	0
4	EXT. WALL SE		2.28	13.15	0	12.55	0
5	EXT. WALL S		2.28	11.95	0	13.65	0
6	EXT. WALL SW		2.28	13.95	0	13.35	0
7	EXT. WALL W		2.28	17.05	0	12.15	0
8	EXT. WALL NW		2.28	16.65	0	7.85	0
9	EXT. GLASS N		5.23	5.05	0	0.15	0
10	EXT. GLASS NE		5.23	5.05	0	0.15	0
11	EXT. GLASS E		5.23	5.05	0	0.15	0
12	EXT. GLASS SE		5.23	5.05	0	0.15	0
13	EXT. GLASS S		5.23	5.05	0	0.15	0
14	EXT. GLASS SW		5.23	5.05	0	0.15	0
15	EXT. GLASS W		5.23	5.05	0	0.15	0
16	EXT. GLASS NW		5.23	5.05	0	0.15	0
17	INT. WALLS.	85.68	2.28	12.20	2,383	7.30	1,426
18	INT. GLASS.		7.1	12.20	0	7.30	0
19	FLOOR WITHOUT CONDITIONED SPACE BELOW		3.19	12.20	0	7.30	0
20	ROOF EXPOSED		0.7	31.65	0	25.75	0
21	ROOF NON EXPOSED WITHOUT CONDITIONED SPACE ABOVE	73.07	3.19	12.20	2,844	7.30	1,702
22	ROOF LIGHTS		5.23	5.05	0	0.15	0
23	MISC.				0		0
A	***TOTAL GAINS AND LOSSES, W.***				***6,233***		***3,515***

SOLAR HEAT GAINS

				SUMMER			RAINY		
ITEM.NO.	DESCRIPTION	AREA, m²	SHADING COEFFICIENT	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.
1	EXT. GLASS N	0	0.7	0.73	237	0	0.73	101	0
2	EXT. GLASS NE	0	0.7	0.56	625	0	0.56	199	0
3	EXT. GLASS E	0	0.7	0.47	644	0	0.47	675	0
4	EXT. GLASS SE	0	0.7	0.30	284	0	0.30	767	0
5	EXT. GLASS S	0	0.7	0.09	126	0	0.09	565	0
6	EXT. GLASS SW	0	0.7	0.07	284	0	0.07	767	0
7	EXT. GLASS W	0	0.7	0.06	644	0	0.06	675	0
8	EXT. GLASS NW	0	0.7	0.07	625	0	0.07	199	0
9	ROOFLIGHTS.	0	0.6	0.12	864	0	0.12	820	0
10	MISC.					0			0
B	***TOTAL SOLAR HEAT GAINS, W.***					***0***			***0***

BODY GAINS

					CLF	SENS., W.	LAT., W.
1	NO.	5	x	60	1	300	
2	NO.	5	x	70			350
C	***TOTAL BODY GAIN.***					***300***	***350***

EQUIPMENT GAINS					USAGE & DIV FACTOR	CLF	SENS., W.	LAT., W.
1	LIGHTING.		x	20	1	1	0	
2	SMALL APPLIANCES		x	100	0.4	1	0	
3	LARGE APPLIANCES		x	1000	0.4	1	0	
4	ELECTRICAL PLANTS				1	1	0	
5	AREA LOADING LIGHT	1	x	1000	1	1	1,000	
6	AREA LOADING POWER	1	x	5000	1	1	5,000	
7	MISC. SENSIBLE				1	1	0	
8	MISC. LATENT				1			0
D	***TOTAL EQUIPMENT GAINS, W.***						***6,000***	***0***

+ve Pressure to be maintained

INFILTRATION GAINS							SUMMER		RAINY	
	AREA	HEIGHT	ac/h		CMH	CMH	SENS., W.	LAT., W.	SENS., W.	LAT., W.
1	73.07	4.2	0	+		0	0	0	0	0
E	***TOTAL INFILTRATION GAINS.***						***0***	***0***	***0***	***0***

HEAT GAIN SUMMARY

ITEM No.	ITEM	SUMMER GAIN, kW.	RAINY GAIN, kW.
1	TRANSMITTANCE.	6,233	3,515
2	SOLAR.	0	0
3	BODY	300	300
4	EQUIPMENT	6,000	6,000
5	INFILTRATION.	0	0
I	**TOTAL ROOM SENSIBLE**	**12,533**	**9,815**
1	BODY	350	350
2	EQUIPMENT.	0	0
3	INFILTRATION.	0	0
II	**TOTAL ROOM LATENT**	**350**	**350**
III	**TOTAL ROOM HEAT LOAD**	**12,883**	**10,165**
	ROOM SUPPLY AIR TEMP (^oC)	13.1	15.0
	PRELIMINARY S.A.V. (m^3/s)	1.14	1.14
IV	**DUCT GAIN = 1230 x SAV x 1^oC (W)**	**1,401**	**1,402**
V	**FAN GAIN (W)**	**3300**	**3640**
	S.A.V. INC. DUCT GAIN & FAN POWER (m^3/s)	1.57	1.73
	MIN HUMIDITY RATIO REQUIRED FOR SUPPLY AIR	0.0090	0.0098
	MIXING RATIO (% FRESH AIR)	1	1
	COIL BYPASS FACTOR	0.05	0.05
	TEMPERATURE OF MIXED AIR (^oC)	37.2	32.3
	HUMIDITY RATIO OF MIXED AIR	0.0168	0.0222
	W_{ADP} OF COOLING COIL	0.0086	0.0092
	T_{ADP} OF COOLING COIL (^oC)	11.8	12.8
	SUPPLY AIR TEMP OF COOLING COIL (^oC)	13.1	13.8
VI	**COOLING COIL SENSIBLE LOAD (W)**	**46,511**	**39,370**
VII	**COOLING COIL LATENT LOAD (W)**	**37,035**	**64,270**
VIII	**COOLING COIL TOTAL LOAD (W)**	**83,546**	**1,03,640**
	COOLING COIL TOTAL LOAD (T.R.)	**23.8**	**29.5**
IX	**HEATING COIL WATTAGE (kW)**	**0.0**	**2.7**
X	**BLOWER AIR DELIVERY (CMH)**	**5,637**	**6,212**
	BLOWER STATIC (Pa)	1400	1400
	BLOWER MOTOR I/P (kW)	3.30	3.64

Temperature required to be reset to acheive minimum 20 ACH requirement

	SUMMER	RAINY
Room S.H.R. (%)	*97%*	*97%*
No. of Air Changes per hour	*18.0*	*20.0*
$T_{OUT, BAL}$ (^oC)	*-73.7*	*-32.0*
Solar time used for glass load	*6*	*6*

AHU DESIGN SUMMARY

I	**COIL LOAD**	**32.4 Tr**
II	**AIR HANDLING CAPACITY**	**6,833 CMH**
	(Both i/c of 10% safety factor)	
	CFM/Tr	*124*
	Sq.m/Tr	*2.3*

HEAT LOAD ESTIMATION SHEET

JOB/REF No.					ESTIMATED BY:-		DATE:-	
LOCATION:-	**ESIC Hospital, Thirippur, OT 1-3**				CHECKED BY:-		DATE:-	
SHEET	1	OF	1		APPROVED BY:-		DATE:-	

DESIGN DATA

SUMMER		To, ^oC	Ti, ^oC	DR ^oC
d.b. TEMPERATURE		37.2	22	
RELATIVE HUMIDITY		41	56	
HUMIDITY RATIO		0.0168	0.0092	
DAILY RANGE				10.5
RAINY				
d.b. TEMPERATURE		32.3	22	
RELATIVE HUMIDITY		72	60	
HUMIDITY RATIO		0.0222	0.0099	
DAILY RANGE				10.5
LATITUDE:-		12°N		
WALL:-	LIGHT	MEDIUM	DARK	
ROOF:-	LIGHT	MEDIUM	DARK	
GLAZING:-	BLINDS	SHADE	BARE	

Notes:
1. All dimensions in metres.

TRANSMITTED HEAT GAINS AND LOSSES

ITEM No.	DESCRIPTION	AREA, m^2	U VALUE	SUMMER TEMP DIFF ^oC	HEAT GAIN, W.	RAINY TEMP DIFF ^oC	HEAT GAIN, W.
1	EXT. WALL N		2.28	15.45	0	5.95	0
2	EXT. WALL NE		2.28	15.85	0	7.05	0
3	EXT. WALL E		2.28	15.85	0	10.95	0
4	EXT. WALL SE		2.28	13.15	0	12.55	0
5	EXT. WALL S		2.28	11.95	0	13.65	0
6	EXT. WALL SW		2.28	13.95	0	13.35	0
7	EXT. WALL W		2.28	17.05	0	12.15	0
8	EXT. WALL NW		2.28	16.65	0	7.85	0
9	EXT. GLASS N		5.23	5.05	0	0.15	0
10	EXT. GLASS NE		5.23	5.05	0	0.15	0
11	EXT. GLASS E		5.23	5.05	0	0.15	0
12	EXT. GLASS SE		5.23	5.05	0	0.15	0
13	EXT. GLASS S		5.23	5.05	0	0.15	0
14	EXT. GLASS SW		5.23	5.05	0	0.15	0
15	EXT. GLASS W		5.23	5.05	0	0.15	0
16	EXT. GLASS NW		5.23	5.05	0	0.15	0
17	INT. WALLS.	138	2.28	12.20	3,839	7.30	2,297
18	INT. GLASS.		7.1	12.20	0	7.30	0
19	FLOOR WITHOUT CONDITIONED SPACE BELOW	81.9	3.19	12.20	3,187	7.30	1,907
20	ROOF EXPOSED		0.7	31.65	0	25.75	0
21	ROOF NON EXPOSED WITHOUT CONDITIONED SPACE ABOVE	81.9	3.19	12.20	3,187	7.30	1,907
22	ROOF LIGHTS		5.23	5.05	0	0.15	0
23	MISC.				0		0
A	***TOTAL GAINS AND LOSSES, W.***				***10,213***		***6,111***

SOLAR HEAT GAINS

				SUMMER			RAINY		
ITEM.NO.	DESCRIPTION	AREA, m^2	SHADING COEFFICIENT	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.
1	EXT. GLASS N	0	0.7	0.73	237	0	0.73	101	0
2	EXT. GLASS NE	0	0.7	0.56	625	0	0.56	199	0
3	EXT. GLASS E	0	0.7	0.47	644	0	0.47	675	0
4	EXT. GLASS SE	0	0.7	0.30	284	0	0.30	767	0
5	EXT. GLASS S	0	0.7	0.09	126	0	0.09	565	0
6	EXT. GLASS SW	0	0.7	0.07	284	0	0.07	767	0
7	EXT. GLASS W	0	0.7	0.06	644	0	0.06	675	0
8	EXT. GLASS NW	0	0.7	0.07	625	0	0.07	199	0
9	ROOFLIGHTS.	0	0.6	0.12	864	0	0.12	820	0
10	MISC.					0			0
B	***TOTAL SOLAR HEAT GAINS, W.***					***0***			***0***

BODY GAINS

					CLF	SENS., W.	LAT., W.
1	NO.	5	x	60	1	300	
2	NO.	5	x	70			350
C	***TOTAL BODY GAIN.***					***300***	***350***

EQUIPMENT GAINS

					USAGE & DIV FACTOR	CLF	SENS., W.	LAT., W.
1	LIGHTING.		x	20	1	1	0	
2	SMALL APPLIANCES		x	100	0.4	1	0	
3	LARGE APPLIANCES		x	1000	0.4	1	0	
4	ELECTRICAL PLANTS				1	1	0	
5	AREA LOADING LIGHT	1	x	1000	1	1	1,000	
6	AREA LOADING POWER	1	x	5000	1	1	5,000	
7	MISC. SENSIBLE				1	1	0	
8	MISC. LATENT				1			0
D	***TOTAL EQUIPMENT GAINS, W.***						***6,000***	***0***

+ve Pressure to be maintained

INFILTRATION GAINS

							SUMMER		RAINY	
	AREA	HEIGHT	ac/h		CMH	CMH	SENS., W.	LAT., W.	SENS., W.	LAT., W.
1	81.9	4.6	0	+		0	0	0	0	0
E	***TOTAL INFILTRATION GAINS.***						***0***	***0***	***0***	***0***

HEAT GAIN SUMMARY

ITEM No.	ITEM	SUMMER GAIN, kW.	RAINY GAIN, kW.
1	TRANSMITTANCE.	10,213	6,111
2	SOLAR.	0	0
3	BODY	300	300
4	EQUIPMENT	6,000	6,000
5	INFILTRATION.	0	0
I	**TOTAL ROOM SENSIBLE**	**16,513**	**12,411**
1	BODY	350	350
2	EQUIPMENT.	0	0
3	INFILTRATION.	0	0
II	**TOTAL ROOM LATENT**	**350**	**350**
III	**TOTAL ROOM HEAT LOAD**	**16,863**	**12,761**
	ROOM SUPPLY AIR TEMP (^oC)	13.4	14.7
	PRELIMINARY S.A.V. (m^3/s)	1.56	1.38
IV	**DUCT GAIN = 1230 x SAV x 1^oC (W)**	**1,914**	**1,700**
V	**FAN GAIN (W)**	**4570**	**4330**
	S.A.V. INC. DUCT GAIN & FAN POWER (m^3/s)	2.17	2.05
	MIN HUMIDITY RATIO REQUIRED FOR SUPPLY AIR	0.0092	0.0098
	MIXING RATIO (% FRESH AIR)	1	1
	COIL BYPASS FACTOR	0.05	0.05
	TEMPERATURE OF MIXED AIR (^oC)	37.2	32.3
	HUMIDITY RATIO OF MIXED AIR	0.0168	0.0222
	W_{ADP} OF COOLING COIL	0.0088	0.0092
	T_{ADP} OF COOLING COIL (^oC)	12.1	12.8
	SUPPLY AIR TEMP OF COOLING COIL (^oC)	13.4	13.8
VI	**COOLING COIL SENSIBLE LOAD (W)**	**63,509**	**46,815**
VII	**COOLING COIL LATENT LOAD (W)**	**50,038**	**76,429**
VIII	**COOLING COIL TOTAL LOAD (W)**	**1,13,547**	**1,23,244**
	COOLING COIL TOTAL LOAD (T.R.)	**32.3**	**35.0**
IX	**HEATING COIL WATTAGE (kW)**	**0.0**	**2.4**
X	**BLOWER AIR DELIVERY (CMH)**	**7,801**	**7,394**
	BLOWER STATIC (Pa)	1400	1400
	BLOWER MOTOR I/P (kW)	4.57	4.33

	SUMMER	RAINY
Room S.H.R. (%)	*98%*	*97%*
No. of Air Changes per hour	*21.0*	*20.0*
$T_{OUT, BAL}$ (^oC)	*#DIV/0!*	*#DIV/0!*
Solar time used for glass load	*6*	*6*

Temperature required to be reset to acheive minimum 20 ACH requirement

AHU DESIGN SUMMARY

I	**COIL LOAD**	**38.5**	**Tr**
II	**AIR HANDLING CAPACITY**	**8,581**	**CMH**
	(Both i/c of 10% safety factor)		
	CFM/Tr	*131*	
	Sq.m/Tr	*2.1*	

HEAT LOAD ESTIMATION SHEET

JOB/REF No.					ESTIMATED BY:-		DATE:-	
LOCATION:-	**ESIC Hospital, Thirippur, ICU**				CHECKED BY:-		DATE:-	
SHEET	1	OF	1		APPROVED BY:-		DATE:-	

DESIGN DATA

SUMMER			To, °C	Ti, °C	DR °C
d.b. TEMPERATURE			37.2	24	
RELATIVE HUMIDITY			41	50	
HUMIDITY RATIO			0.0168	0.0093	
DAILY RANGE					10.5
RAINY					
d.b. TEMPERATURE			32.3	24	
RELATIVE HUMIDITY			72	51	
HUMIDITY RATIO			0.0222	0.0095	
DAILY RANGE					10.5
LATITUDE:-			12°N		
	WALL:-	LIGHT	MEDIUM	DARK	
	ROOF:-	LIGHT	MEDIUM	DARK	
	GLAZING:-	BLINDS	SHADE	BARE	

Notes:
1. All dimensions in metres.

TRANSMITTED HEAT GAINS AND LOSSES

ITEM No.	DESCRIPTION	AREA, m²	U VALUE	SUMMER TEMP DIFF °C	HEAT GAIN, W.	RAINY TEMP DIFF °C	HEAT GAIN, W.
1	EXT. WALL N		2.28	13.45	0	3.95	0
2	EXT. WALL NE		2.28	13.85	0	5.05	0
3	EXT. WALL E	58.88	2.28	13.85	1,859	8.95	1,202
4	EXT. WALL SE		2.28	11.15	0	10.55	0
5	EXT. WALL S		2.28	9.95	0	11.65	0
6	EXT. WALL SW		2.28	11.95	0	11.35	0
7	EXT. WALL W		2.28	15.05	0	10.15	0
8	EXT. WALL NW		2.28	14.65	0	5.85	0
9	EXT. GLASS N		5.23	4.15	0	-0.75	0
10	EXT. GLASS NE		5.23	4.15	0	-0.75	0
11	EXT. GLASS E	17.664	5.23	4.15	383	-0.75	-69
12	EXT. GLASS SE		5.23	4.15	0	-0.75	0
13	EXT. GLASS S		5.23	4.15	0	-0.75	0
14	EXT. GLASS SW		5.23	4.15	0	-0.75	0
15	EXT. GLASS W		5.23	4.15	0	-0.75	0
16	EXT. GLASS NW		5.23	4.15	0	-0.75	0
17	INT. WALLS.	171.58	2.28	10.20	3,990	5.30	2,073
18	INT. GLASS.		7.1	10.20	0	5.30	0
19	FLOOR WITHOUT CONDITIONED SPACE BELOW	151.9	3.19	10.20	4,943	5.30	2,568
20	ROOF EXPOSED		0.7	29.65	0	23.75	0
21	ROOF NON EXPOSED WITHOUT CONDITIONED SPACE ABOVE	151.9	3.19	10.20	4,943	5.30	2,568
22	ROOF LIGHTS		5.23	4.15	0	-0.75	0
23	MISC.				0		0
A	***TOTAL GAINS AND LOSSES, W.***				***16,118***		***8,342***

SOLAR HEAT GAINS

				SUMMER			RAINY		
ITEM.NO.	DESCRIPTION	AREA, m²	SHADING COEFFICIENT	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.
1	EXT. GLASS N	0	0.7	0.65	237	0	0.65	101	0
2	EXT. GLASS NE	0	0.7	0.74	625	0	0.74	199	0
3	EXT. GLASS E	17.664	0.7	0.80	644	6,370	0.80	675	6,677
4	EXT. GLASS SE	0	0.7	0.74	284	0	0.74	767	0
5	EXT. GLASS S	0	0.7	0.23	126	0	0.23	565	0
6	EXT. GLASS SW	0	0.7	0.14	284	0	0.14	767	0
7	EXT. GLASS W	0	0.7	0.11	644	0	0.11	675	0
8	EXT. GLASS NW	0	0.7	0.14	625	0	0.14	199	0
9	ROOFLIGHTS.	0	0.6	0.44	864	0	0.44	820	0
10	MISC.					0			0
B	***TOTAL SOLAR HEAT GAINS, W.***					***6,370***			***6,677***

BODY GAINS

					CLF	SENS., W.	LAT., W.
1	NO.	12	x	60	1	720	
2	NO.	12	x	70			840
C	***TOTAL BODY GAIN.***					***720***	***840***

EQUIPMENT GAINS

					USAGE & DIV FACTOR	CLF	SENS., W.	LAT., W.
1	LIGHTING.		x	20	1	1	0	
2	SMALL APPLIANCES		x	100	0.4	1	0	
3	LARGE APPLIANCES		x	1000	0.4	1	0	
4	ELECTRICAL PLANTS				1	1	0	
5	AREA LOADING LIGHT	5	x	151.9	1	1	760	
6	AREA LOADING POWER	50	x	151.9	1	1	7,595	
7	MISC. SENSIBLE				1	1	0	
8	MISC. LATENT				1			0
D	***TOTAL EQUIPMENT GAINS, W.***						***8,355***	***0***

+ve Pressure to be maintained

INFILTRATION GAINS

							SUMMER		RAINY	
	AREA	HEIGHT	ac/h		CMH	CMH	SENS., W.	LAT., W.	SENS., W.	LAT., W.
1	151.9	4.6	0	+		0	0	0	0	0
E	***TOTAL INFILTRATION GAINS.***						***0***	***0***	***0***	***0***

HEAT GAIN SUMMARY

ITEM No.	ITEM	SUMMER GAIN, kW.	RAINY GAIN, kW.
1	TRANSMITTANCE.	16,118	8,342
2	SOLAR.	6,370	6,677
3	BODY	720	720
4	EQUIPMENT	8,355	8,355
5	INFILTRATION.	0	0
I	**TOTAL ROOM SENSIBLE**	**31,563**	**24,093**
1	BODY	840	840
2	EQUIPMENT.	0	0
3	INFILTRATION.	0	0
II	**TOTAL ROOM LATENT**	**840**	**840**
III	**TOTAL ROOM HEAT LOAD**	**32,403**	**24,933**
	ROOM SUPPLY AIR TEMP (^oC)	14.0	14.0
	PRELIMINARY S.A.V. (m^3/s)	2.57	1.96
IV	**DUCT GAIN = 1230 x SAV x 1^oC (W)**	**3,166**	**2,407**
V	**FAN GAIN (W)**	**6000**	**4560**
	S.A.V. INC. DUCT GAIN & FAN POWER (m^3/s)	3.32	2.52
	MIN HUMIDITY RATIO REQUIRED FOR SUPPLY AIR	0.0092	0.0094
	MIXING RATIO (% FRESH AIR)	0.2	0.2
	COIL BYPASS FACTOR	0.1	0.1
	TEMPERATURE OF MIXED AIR (^oC)	26.6	25.7
	HUMIDITY RATIO OF MIXED AIR	0.0108	0.0120
	W_{ADP} OF COOLING COIL	0.0091	0.0091
	T_{ADP} OF COOLING COIL (^oC)	12.6	12.7
	SUPPLY AIR TEMP OF COOLING COIL (^oC)	14.0	14.0
VI	**COOLING COIL SENSIBLE LOAD (W)**	**51,512**	**36,212**
VII	**COOLING COIL LATENT LOAD (W)**	**15,863**	**20,091**
VIII	**COOLING COIL TOTAL LOAD (W)**	**67,375**	**56,303**
	COOLING COIL TOTAL LOAD (T.R.)	**19.2**	**16.0**
IX	**HEATING COIL WATTAGE (kW)**	**0.0**	**0.0**
X	**BLOWER AIR DELIVERY (CMH)**	**11,956**	**9,083**
	BLOWER STATIC (Pa)	1200	1200
	BLOWER MOTOR I/P (kW)	6.00	4.56

	SUMMER	RAINY
Room S.H.R. (%)	*97%*	*97%*
No. of Air Changes per hour	*17.0*	*13.0*
$T_{OUT, BAL}$ (^oC)	*-75.2*	*-42.3*
Solar time used for glass load	*8*	*8*

AHU DESIGN SUMMARY

I	**COIL LOAD**	**21.1**	**Tr**
II	**AIR HANDLING CAPACITY**	**13,151**	**CMH**
	(Both i/c of 10% safety factor)		
	CFM/Tr	*367*	
	Sq.m/Tr	*7.2*	

HEAT LOAD ESTIMATION SHEET

JOB/REF No.					ESTIMATED BY:-		DATE:-	
LOCATION:-	**ESIC Hospital, Thirippur, Pediatric Unit**				CHECKED BY:-		DATE:-	
SHEET	1	OF	1		APPROVED BY:-		DATE:-	

DESIGN DATA

SUMMER		To, ^oC	Ti, ^oC	DR ^oC
d.b. TEMPERATURE		37.2	24	
RELATIVE HUMIDITY		41	50	
HUMIDITY RATIO		0.0168	0.0093	
DAILY RANGE				10.5
RAINY				
d.b. TEMPERATURE		32.3	24	
RELATIVE HUMIDITY		72	50	
HUMIDITY RATIO		0.0222	0.0093	
DAILY RANGE				10.5
LATITUDE:-		12°N		
WALL:-	LIGHT	MEDIUM	DARK	
ROOF:-	LIGHT	MEDIUM	DARK	
GLAZING:-	BLINDS	SHADE	BARE	

Notes:
1. All dimensions in metres.

TRANSMITTED HEAT GAINS AND LOSSES

ITEM No.	DESCRIPTION	AREA, m^2	U VALUE	SUMMER TEMP DIFF ^oC	HEAT GAIN, W.	RAINY TEMP DIFF ^oC	HEAT GAIN, W.
1	EXT. WALL N		2.28	13.45	0	3.95	0
2	EXT. WALL NE		2.28	13.85	0	5.05	0
3	EXT. WALL E	69	2.28	13.85	2,179	8.95	1,408
4	EXT. WALL SE		2.28	11.15	0	10.55	0
5	EXT. WALL S	16.1	2.28	9.95	365	11.65	428
6	EXT. WALL SW		2.28	11.95	0	11.35	0
7	EXT. WALL W		2.28	15.05	0	10.15	0
8	EXT. WALL NW		2.28	14.65	0	5.85	0
9	EXT. GLASS N		5.23	4.15	0	-0.75	0
10	EXT. GLASS NE		5.23	4.15	0	-0.75	0
11	EXT. GLASS E	20.7	5.23	4.15	449	-0.75	-81
12	EXT. GLASS SE		5.23	4.15	0	-0.75	0
13	EXT. GLASS S	4.83	5.23	4.15	105	-0.75	-19
14	EXT. GLASS SW		5.23	4.15	0	-0.75	0
15	EXT. GLASS W		5.23	4.15	0	-0.75	0
16	EXT. GLASS NW		5.23	4.15	0	-0.75	0
17	INT. WALLS.	209.3	2.28	10.20	4,867	5.30	2,529
18	INT. GLASS.		7.1	10.20	0	5.30	0
19	FLOOR WITHOUT CONDITIONED SPACE BELOW	155	3.19	10.20	5,043	5.30	2,621
20	ROOF EXPOSED		0.7	29.65	0	23.75	0
21	ROOF NON EXPOSED WITHOUT CONDITIONED SPACE ABOVE	155	3.19	10.20	5,043	5.30	2,621
22	ROOF LIGHTS		5.23	4.15	0	-0.75	0
23	MISC.				0		0
A	***TOTAL GAINS AND LOSSES, W.***				***18,053***		***9,506***

SOLAR HEAT GAINS

				SUMMER			RAINY		
ITEM.NO.	DESCRIPTION	AREA, m^2	SHADING COEFFICIENT	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.
1	EXT. GLASS N	0	0.7	0.65	237	0	0.65	101	0
2	EXT. GLASS NE	0	0.7	0.74	625	0	0.74	199	0
3	EXT. GLASS E	20.7	0.7	0.80	644	7,465	0.80	675	7,825
4	EXT. GLASS SE	0	0.7	0.74	284	0	0.74	767	0
5	EXT. GLASS S	4.83	0.7	0.23	126	98	0.23	565	439
6	EXT. GLASS SW	0	0.7	0.14	284	0	0.14	767	0
7	EXT. GLASS W	0	0.7	0.11	644	0	0.11	675	0
8	EXT. GLASS NW	0	0.7	0.14	625	0	0.14	199	0
9	ROOFLIGHTS.	0	0.6	0.44	864	0	0.44	820	0
10	MISC.					0			0
B	***TOTAL SOLAR HEAT GAINS, W.***					***7,563***			***8,264***

BODY GAINS

					CLF	SENS., W.	LAT., W.
1	NO.	5	x	60	1	300	
2	NO.	5	x	70			350
C	***TOTAL BODY GAIN.***					***300***	***350***

EQUIPMENT GAINS

					USAGE & DIV FACTOR	CLF	SENS., W.	LAT., W.
1	LIGHTING.		x	20	1	1	0	
2	SMALL APPLIANCES		x	100	0.4	1	0	
3	LARGE APPLIANCES		x	1000	0.4	1	0	
4	ELECTRICAL PLANTS				1	1	0	
5	AREA LOADING LIGHT	5	x	155	1	1	775	
6	AREA LOADING POWER	30	x	155	1	1	4,650	
7	MISC. SENSIBLE				1	1	0	
8	MISC. LATENT				1			0
D	***TOTAL EQUIPMENT GAINS, W.***						***5,425***	***0***

+ve Pressure to be maintained

INFILTRATION GAINS

							SUMMER		RAINY	
	AREA	HEIGHT	ac/h		CMH	CMH	SENS., W.	LAT., W.	SENS., W.	LAT., W.
1	155	4.6	0	+		0	0	0	0	0
E	***TOTAL INFILTRATION GAINS.***						***0***	***0***	***0***	***0***

HEAT GAIN SUMMARY

ITEM No.	ITEM	SUMMER GAIN, kW.	RAINY GAIN, kW.
1	TRANSMITTANCE.	18,053	9,506
2	SOLAR.	7,563	8,264
3	BODY	300	300
4	EQUIPMENT	5,425	5,425
5	INFILTRATION.	0	0
I	**TOTAL ROOM SENSIBLE**	**31,341**	**23,495**
1	BODY	350	350
2	EQUIPMENT.	0	0
3	INFILTRATION.	0	0
II	**TOTAL ROOM LATENT**	**350**	**350**
III	**TOTAL ROOM HEAT LOAD**	**31,691**	**23,845**
	ROOM SUPPLY AIR TEMP (^oC)	14.1	13.8
	PRELIMINARY S.A.V. (m^3/s)	2.58	1.88
IV	**DUCT GAIN = 1230 x SAV x 1^oC (W)**	**3,170**	**2,306**
V	**FAN GAIN (W)**	**7230**	**5220**
	S.A.V. INC. DUCT GAIN & FAN POWER (m^3/s)	3.43	2.48
	MIN HUMIDITY RATIO REQUIRED FOR SUPPLY AIR	0.0093	0.0093
	MIXING RATIO (% FRESH AIR)	0.2	0.2
	COIL BYPASS FACTOR	0.1	0.1
	TEMPERATURE OF MIXED AIR (^oC)	26.6	25.7
	HUMIDITY RATIO OF MIXED AIR	0.0108	0.0119
	W_{ADP} OF COOLING COIL	0.0091	0.0090
	T_{ADP} OF COOLING COIL (^oC)	12.7	12.5
	SUPPLY AIR TEMP OF COOLING COIL (^oC)	14.1	13.8
VI	**COOLING COIL SENSIBLE LOAD (W)**	**52,885**	**36,076**
VII	**COOLING COIL LATENT LOAD (W)**	**15,875**	**19,517**
VIII	**COOLING COIL TOTAL LOAD (W)**	**68,759**	**55,594**
	COOLING COIL TOTAL LOAD (T.R.)	**19.6**	**15.8**
IX	**HEATING COIL WATTAGE (kW)**	**0.0**	**0.0**
X	**BLOWER AIR DELIVERY (CMH)**	**12,355**	**8,913**
	BLOWER STATIC (Pa)	1400	1400
	BLOWER MOTOR I/P (kW)	7.23	5.22

	SUMMER	RAINY
Room S.H.R. (%)	*99%*	*99%*
No. of Air Changes per hour	*17.0*	*13.0*
$T_{OUT, BAL}$ (^oC)	*-54.2*	*-30.3*
Solar time used for glass load	*8*	*8*

AHU DESIGN SUMMARY

I	**COIL LOAD**	**21.5**	**Tr**
II	**AIR HANDLING CAPACITY**	**13,591**	**CMH**
	(Both i/c of 10% safety factor)		
	CFM/Tr	*372*	
	Sq.m/Tr	*7.2*	

HEAT LOAD ESTIMATION SHEET

JOB/REF No.					ESTIMATED BY:-		DATE:-	
LOCATION:-	**ESIC Hospital, Thirippur, Labour Room**				CHECKED BY:-		DATE:-	
SHEET	1	OF	1		APPROVED BY:-		DATE:-	

DESIGN DATA

SUMMER			To, °C	Ti, °C	DR °C
d.b. TEMPERATURE			37.2	22	
RELATIVE HUMIDITY			41	58	
HUMIDITY RATIO			0.0168	0.0095	
DAILY RANGE					10.5
RAINY					
d.b. TEMPERATURE			32.3	22	
RELATIVE HUMIDITY			72	60	
HUMIDITY RATIO			0.0222	0.0099	
DAILY RANGE					10.5
LATITUDE:-			12°N		
	WALL:-	LIGHT	MEDIUM	DARK	
	ROOF:-	LIGHT	MEDIUM	DARK	
	GLAZING:-	BLINDS	SHADE	BARE	

Notes:
1. All dimensions in metres.

TRANSMITTED HEAT GAINS AND LOSSES

ITEM No.	DESCRIPTION	AREA, m²	U VALUE	SUMMER TEMP DIFF °C	HEAT GAIN, W.	RAINY TEMP DIFF °C	HEAT GAIN, W.
1	EXT. WALL N		2.28	15.45	0	5.95	0
2	EXT. WALL NE		2.28	15.85	0	7.05	0
3	EXT. WALL E		2.28	15.85	0	10.95	0
4	EXT. WALL SE		2.28	13.15	0	12.55	0
5	EXT. WALL S	36.8	2.28	11.95	1,003	13.65	1,145
6	EXT. WALL SW		2.28	13.95	0	13.35	0
7	EXT. WALL W		2.28	17.05	0	12.15	0
8	EXT. WALL NW		2.28	16.65	0	7.85	0
9	EXT. GLASS N		5.23	11.15	0	6.25	0
10	EXT. GLASS NE		5.23	11.15	0	6.25	0
11	EXT. GLASS E		5.23	11.15	0	6.25	0
12	EXT. GLASS SE		5.23	11.15	0	6.25	0
13	EXT. GLASS S	11.04	5.23	11.15	644	6.25	361
14	EXT. GLASS SW		5.23	11.15	0	6.25	0
15	EXT. GLASS W		5.23	11.15	0	6.25	0
16	EXT. GLASS NW		5.23	11.15	0	6.25	0
17	INT. WALLS.	100.28	2.28	12.20	2,789	7.30	1,669
18	INT. GLASS.		7.1	12.20	0	7.30	0
19	FLOOR WITHOUT CONDITIONED SPACE BELOW	55.2	3.19	12.20	2,148	7.30	1,285
20	ROOF EXPOSED		0.7	31.65	0	25.75	0
21	ROOF NON EXPOSED WITHOUT CONDITIONED SPACE ABOVE	55.2	3.19	12.20	2,148	7.30	1,285
22	ROOF LIGHTS		5.23	11.15	0	6.25	0
23	MISC.				0		0
A	***TOTAL GAINS AND LOSSES, W.***				***8,732***		***5,746***

SOLAR HEAT GAINS

				SUMMER			RAINY		
ITEM.NO.	DESCRIPTION	AREA, m²	SHADING COEFFICIENT	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.	COOLING LOAD FACTOR	SHGF	HEAT GAIN, W.
1	EXT. GLASS N	0	0.7	0.89	237	0	0.89	101	0
2	EXT. GLASS NE	0	0.7	0.27	625	0	0.27	199	0
3	EXT. GLASS E	0	0.7	0.27	644	0	0.27	675	0
4	EXT. GLASS SE	0	0.7	0.49	284	0	0.49	767	0
5	EXT. GLASS S	11.04	0.7	0.83	126	808	0.83	565	3,624
6	EXT. GLASS SW	0	0.7	0.38	284	0	0.38	767	0
7	EXT. GLASS W	0	0.7	0.17	644	0	0.17	675	0
8	EXT. GLASS NW	0	0.7	0.21	625	0	0.21	199	0
9	ROOFLIGHTS.	0	0.6	0.85	864	0	0.85	820	0
10	MISC.					0			0
B	***TOTAL SOLAR HEAT GAINS, W.***					***808***			***3,624***

BODY GAINS

					CLF	SENS., W.	LAT., W.
1	NO.	8	x	60	1	480	
2	NO.	8	x	70			560
C	***TOTAL BODY GAIN.***					***480***	***560***

EQUIPMENT GAINS					USAGE & DIV FACTOR	CLF	SENS., W.	LAT., W.
1	LIGHTING.		x	20	1	1	0	
2	SMALL APPLIANCES		x	100	0.4	1	0	
3	LARGE APPLIANCES		x	1000	0.4	1	0	
4	ELECTRICAL PLANTS				1	1	0	
5	AREA LOADING LIGHT	5	x	55.2	1	1	276	
6	AREA LOADING POWER	30	x	55.2	1	1	1,656	
7	MISC. SENSIBLE				1	1	0	
8	MISC. LATENT				1			0
D	***TOTAL EQUIPMENT GAINS, W.***						***1,932***	***0***

INFILTRATION GAINS							SUMMER		RAINY	
	AREA	HEIGHT	ac/h		CMH	CMH	SENS., W.	LAT., W.	SENS., W.	LAT., W.
1	55.2	4.6	0.5	+		126.96	659	774	447	1,306
E	***TOTAL INFILTRATION GAINS.***						***659***	***774***	***447***	***1,306***

HEAT GAIN SUMMARY

ITEM No.	ITEM	SUMMER GAIN, kW.	RAINY GAIN, kW.
1	TRANSMITTANCE.	8,732	5,746
2	SOLAR.	808	3,624
3	BODY	480	480
4	EQUIPMENT	1,932	1,932
5	INFILTRATION.	659	447
I	**TOTAL ROOM SENSIBLE**	**12,612**	**12,229**
1	BODY	560	560
2	EQUIPMENT.	0	0
3	INFILTRATION.	774	1,306
II	**TOTAL ROOM LATENT**	**1,334**	**1,866**
III	**TOTAL ROOM HEAT LOAD**	**13,946**	**14,095**
	ROOM SUPPLY AIR TEMP (^oC)	13.9	13.9
	PRELIMINARY S.A.V. (m^3/s)	1.27	1.23
IV	**DUCT GAIN = 1230 x SAV x 1^oC (W)**	**1,562**	**1,514**
V	**FAN GAIN (W)**	**2960**	**2310**
	S.A.V. INC. DUCT GAIN & FAN POWER (m^3/s)	1.72	1.62
	MIN HUMIDITY RATIO REQUIRED FOR SUPPLY AIR	0.0093	0.0095
	MIXING RATIO (% FRESH AIR)	0.2	0.2
	COIL BYPASS FACTOR	0.1	0.1
	TEMPERATURE OF MIXED AIR (^oC)	25.0	24.1
	HUMIDITY RATIO OF MIXED AIR	0.0110	0.0123
	W_{ADP} OF COOLING COIL	0.0091	0.0092
	T_{ADP} OF COOLING COIL (^oC)	12.7	12.8
	SUPPLY AIR TEMP OF COOLING COIL (^oC)	13.9	13.9
VI	**COOLING COIL SENSIBLE LOAD (W)**	**23,583**	**20,149**
VII	**COOLING COIL LATENT LOAD (W)**	**8,906**	**13,880**
VIII	**COOLING COIL TOTAL LOAD (W)**	**32,490**	**34,028**
	COOLING COIL TOTAL LOAD (T.R.)	**9.2**	**9.7**
IX	**HEATING COIL WATTAGE (kW)**	**0.0**	**0.0**
X	**BLOWER AIR DELIVERY (CMH)**	**6,210**	**5,819**
	BLOWER STATIC (Pa)	1200	1200
	BLOWER MOTOR I/P (kW)	2.96	2.31

	SUMMER	RAINY
Room S.H.R. (%)	*90%*	*87%*
No. of Air Changes per hour	*24.0*	*23.0*
$T_{OUT, BAL}$ (^oC)	*-45.4*	*-44.2*
Solar time used for glass load	*12*	*12*

AHU DESIGN SUMMARY

I	**COIL LOAD**	**10.6**	**Tr**
II	**AIR HANDLING CAPACITY**	**6,830**	**CMH**
	(Both i/c of 10% safety factor)		
	CFM/Tr	*378*	
	Sq.m/Tr	*5.2*	