

Er. H.P. Singh Executive Engineer

ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ



Estd. Under Punjab Technical University Act, 1996 (Punjab Act No. 1 of 1997)

Ret. No. PTU CC/356/26939

Dated 16-5-11

Sh. Chander Mohan,

House No. 202, Sector 36-A, Chandigarh.

The Director,

Department of Technical Education and Industrial raining, Punjab, Plot No. 1, Sector-36A, Chandigarh.

Sh. H.S. Bains,

Registrar, Punjab Technical University, Jalandhar.

Sh. A. N. Chowdhry (Special Invitee), 3-B, Jyoti Nagar, Jalandhar.

Col. Dharminder Kumar Thakur (Special Invitee)

307-B, GH-II, Sikha Apartments, Mansa Devi Complex, Panchkula, Haryana Sh. S.L. Kaushal, Advisor/Architecture,

2865, Sector 42-C, Chandigarh.

Dr. Nachattar Singh,

Advisor to VC and Dean (P&D), Punjab Technical University, Jalandhar.

Dr. Buta Singh (Special Invitee),

Dean/Academics, Registrar, Punjab Technical University, Jalandhar.

Sh. N. S. Bhatti (Special Invitee), 3040, Sector 19-D, Chandigarh

Sh. P. S. Saini (Special Invitee)

Hospital Engineer, PGI

H.No. 3334, Sector 24-D, Chandigarh

Sub: Construction of new campus of Punjab Technical University – 26th meeting of the Standing Building Construction Committee.

Dear Sir,

26th imeeting of the Standing Building Construction Committee shall be held under the Chairmanship of Dr. R. S. Khandpur, Director General, PGSC at 11.30 hours on 26.05.2011 in his office at SCO 60-61, Sector 34-A, Chandigarh. Agenda and Agenda note for the meeting are enclosed.

You are requested to make it convenient to attend the meeting.

Thanking you

Yours Sincerely,

(H. P. Singh)

Executive Engineer

Copy to:

i. Dr. R. S. Khandpur, DG, PGSC, SCO 60-61, Sector 34-A, Chandigarh.

 Sh. Rajiv Aggarwal, M/s Archigroup Architects, A-14, Sector-15, Noida -201301.

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Kapurthala Campus : Jalandhar-Kapurthala Highway, Post Bag No. 01, Kapurthala.

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PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

Sub : Agenda for the 26th meeting of the Standing Building Construction Committee.

Item No. 26.1: To confirm the Minutes of 25th meeting of Standing Building

Construction Committee held on 20.04.2011.

Item No. 26.2: Action taken on various items discussed during previous meetings of

Standing Building Construction Committee.

Item No. 26.3: To discuss and approve the design basis reports submitted by the

Architect in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems of two towers, one library and one semmar

hall of proposed PIT at main campus, Kapurthala.

Item No. 26.4: Any other point with the permission of the Chair.

111)

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

Sub: Agenda Note for the 26th meeting of the Standing Building Construction Committee.

Item No. 26.1: To confirm the Minutes of 25th meeting of Standing Building Construction Committee held on 20.04.2011.

The minutes of 25th meeting of Standing Building Construction Committee held on 20.04.2011 were circulated on 27.04.2011. These minutes are to be confirmed.

Item No. 26.2: Action taken on various items discussed during previous meetings of Standing Building Construction Committee.

Action taken on various items discussed during previous meeting of Standing Building Construction Committee is as under:

- Applications for recruitment of one Asstt. Executive Engineer (Civil) and one Asstt. Engineer (Civil) required for construction cell has been received and their scrutiny is in progress.
- Notice inviting bids for appointment of Architect for Architectural services for establishment of new Punjab Institute of Technology at Mansa, Ludhiana & Barnala, PTU's Regional campus at Mohali and other future works has been issued and bids are due for submission on 19.05.2011.
- The Architect has submitted the design basis reports in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems of two towers, one library and one seminar hall of proposed PIT at main campus, Kapurthala and same are being discussed in the present meeting.

Item No. 26.3: To discuss and approve the design basis reports submitted by the Architect in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems of two towers, one library and one seminar hall of proposed PIT at main campus, Kapurthala.

During the 23rd meeting of Standing Building Construction Committee held on 15.03.2011, the Conceptual plans of proposed buildings (two towers, one library and one seminar hall) of proposed PIT at main campus, Kapurthala were approved and Architect was advised to start work on services of these buildings. The Architect has submitted design basis reports in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems of these buildings. These design basis reports are to be discussed and approved. These reports are enclosed alongwith.

Item No. 26.4: Any other point with the permission of the Chair.



DESIGN PHILOSOPHY

This document covers the design philosophy for the design of PTU Phase-2 frustitute Buddingda The bldg has the following features:

- The work consists of two institute buildings, one library and one seminar hall. All are independent buildings. the Bldg have overhead water tank on the terrace of all blocks. b)
- d
- The Bldg have lift facility & the lift machine room is on the terrace of all blocks.
- The typical storey height in all the blocks is approx. 4 m, except for seminar hall which may be around 6m The column to column spacing is as per plan.
- The flooring system consists of slabs resting on beams. Û
- All the internal partition walls shall be 115 mm thick brick wall, whereas the external walls, surjoyell walls and the E) lift core walls shall be 230 mm thick brick wall with stone cladding.
- The expansion/separation joint shall be provided as per IS:456, IS:1843, IS:4326

The following are the sizes of the various structural elements proposed for the building in general:

Thickness of Slabs

Thickness of slabs: There will be three types of slab as per thickness requirement i) Slab 1 100 mm

ii) 5lub 2

v) Slab 5 vil Slab 6 240 mm 150 mm

iii) Slab 3

110 mm

IV) Slab 4

120 mm 125 mm

Beauta

I) Primary Beam

300 x 600/750/900 zzum

ii) Secundary Beam

230/300 x 600/750 mm

Columns

2)

The priliminary size of the columns would be 300 x 300 to 900mm.

MATERIALS

- 2.1 Grade of materials
- The grade of concrete shall be M25 for beams, slabs & columns above ground and Higher grade below ground
- The grade of reinforcement steel shall be Fe500 (TMT Bars) for all.
- c) PCC shall have a mix of 1/4/8

2.2 Unit weight of materials

The unit wt, of materials to be used in design are as mentioned below:

a)	RCC	
6)	PCC	25 kN/m ³
()	Brick Masonry (230 thk with plaster)	24 kN/m3
d)	Brick Masonry (115 thk with plaster)	22 kN/m ²
e)	Terracing (Brick Coba)	22 kN/m ³
Ð	Cinder/Brick coba Fill in sunken portion	20 kN/m*
g)	Glazing Glazing	16 kN/m²
h)	Stone clauding	2 kN/m ⁷
J)	Soil	1.5 kN/m²

to be confirmed with the soil report

3. LOADING

The various loads to be carried by the structure are as follows:

- i) Dead Load (as per 18 875 (Part 1))
 - a) The self weight of the beams and columns shall be input as SELFWEIGHT command \ln

ii) 110 mm thick slab iii) 120 mm thick slab iv) 125 mm thick slab iv) 140 mm thick slab	= 0.120X25 = 0.125x25 = 0.14x25	= 2.75 kN/sqm = 3.0 kN/sqm = 3.13 kN/sqm = 3.5 kN/sqm
 Floor Finish (60 mm thk on floor & Terrace (200mm thk.) 	s) 0,060 x 24 0.150 x 20	= 1.45 kN/sqm = 3.00 kN/sqm
d) 230 thk musonry	= 0.20 x (3.0-0.45) ; = 12.90 k/h/i	ër unit weight given above n 22
e) 115 thk mesonry	$0.23 \times (3-0.6) \times 22$ = $0.715 \times (3.0-0.45)$ = 2.04 kN/n	on the basis of a 3.0 floor to floor height x 22 beam not less than 450mm depth envisaged for 230 thk walls.
re Load (as per IS 875 (Part 2))	0.115 x (3-0.6) x 2	on the basis of a 3.0 floor to floor height

ii) Live Load (as per IS 875 (Part 2))

m)	Class Room			
(d)	Passage, Balconies	~ 3.00	kN/sqm	
c)	Toilet	-4.00	kN/sqm	
d)	Stairs	= 2.00	kN/eqm	
n.		-4.00	kN/sqm	
g)	Lift M/C Room (Impact Loading) Terrace	= 10.00	kN/sqm	
k)	Over head water tank	= 1.50	kN/sqm	
I)	office	48	per size of Water Tank	
m)	laboratories	- 3.00	kN/sqm	
n)	libraries	= 3,00	kN/sqtn	
	NO. MILES	= 6.00	kN/sqm	

iii) Seinmic Land (as per 18 1893; 2002)

The following parameters would be considered for seismic loading as per IS 1693:2002, IS 13920:1993

| Zone | IV | Zone Factor | 0.24 | Importance Factor | 1.5 | Response Reduction Factor | 5" | Damping | 5%

iv) Wind Load (as per IS 875 (Part 3))

Note: Buildings are less than 35m height in Zone 4 of earthquake. Hence earthquake forces shall govern over wind forces. Therfore, only seismic analysis has been performed for last than 35m height.

v) Temperature & Shrinkage Load

As the lateral dimension of the building after the provision of Expansion joint does not exceed 45m, therefore as per clause 19.5.1 IS 456-2000, the effects due to temperature & shrinkage can be ignored in design.

4. INPUT LOADS AS PER AREA USE

The Input Lands on floors depending up on the type of use are as follows

l) Room (125 thick slab)

a) b)	Self w.L. of slab		= 3.13 kN/sqm
e)	ш	Total DL	= 1.45 kN/sqm = 4.58 kN/sqm
٠,	440		=3.00 kN/pqm

Total =7.5 kN/mm

ti) Parstry(100 thick slab)

a)	Self wt. of alab	= 25 kN/sqm
b)	F	= 1.45 kN/agm
- 1	e) Pilling of 150 mm (brick cobs)	= 1.40 kN/mm
	Total DL	= 6.35 kN/sqm
E)	ц	= 3.00 kN/sqm

Total = 9.35 kN/sqm

[&]quot;The ductile deatailing of the structural elements would be done as per IS 13920:2002, and so the building falls in the category of "Special RC Moment Resisting Frame", hence RF=5 is considered for design.

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iv) Pausagea (100mm bleick alab)
              a) Self wti of slab
                                                      = 2.5 kN/sqm
              b) FF
                                                     = 1.45 kN/sqm
                                        Total DL
                                                     = 3.95 kN/sqm
              e) LL
                                                     -4.00 kN/sqm
                                           Total
                                                     = 7.95 kN/aqea
       Stairs
              a) Self wt. of plab (175THK.)
                                                     = 5.27 kN/sqm
             b) Wt. of Steps (165mm River)
                                                     = 2.45 kN/sqm.
             c) FF
                                                     = 1.65 ktN/sqm
             d) CP
                                                     - .15 kN/aqm
                                        Total DL
                                                    = 9.46 EN/agm.
                   u
                                                     - 4.0 kN/sqm
                                           Total
                                                    ■ 14.46 kN/sqm
      Lift M/C Room
             ii) Self w. of plab (150 Thk)
                                                    = 3.75 kN/sqm
             b) FF
                                                    = 1.45 kN/sqm
                                       Total DL
                                                     = 5.2 kN/sqm
             d LL
                                                   - 10.00 kN/sqm
                                          Total
                                                  = 15.20 kN/sqm
               "LL on lift at/c room accounts for 50% impact, i.e., full loud of the m/c
 vii) Terrace
             e) Self ort of slab
                                                     =3.5 kN/sqm
            c) Brick tile + Brick colm (250 thk)
                                                    =5.00 kN/sqm
                                       Total DL
                                                    = 8.50 kN/sqm
                                                                     As per unit weight
            e) LL
                                                    - 1.50 EN/squa
                                                                     given shows
                                          Total
                                                  ► 10.00 kN/sqm
viii) office (125 thirk slab)
         a)
              Self wt. of slab
                                                   =3.13 kN/sqm
         b)
              FF
                                                   -1.45 kN/agm
                                                   =4.58 kN/sqm
                                     Total DL
              ш
         eì
                                                   =3.00 kN/eqm
                                       Total
                                                   = 7.58 kN/sqm
fs) labortary(125 thick slab)
             Self wt. of plab
        a)
                                                   = 3.13 kN/sgm
        b)
             FF
                                                  = 1.45 kN/sqm
                                                  • 4.58 kN/sqm
                                     Total DL
        e)
             LL.
                                                  = 3,00 kN/aqm
                                      Total
                                                  -7.58 kN/sgm
    Horaries (140 thick slab)
        B)
             Self wt of slab
                                                   -35 kN/sqm
             FF
        b)
                                                  -1.45 kN/agm
                                     Total DL
                                                  ≈4.95 kN/sqm
             ц
        c)
                                                  -6.00 kN/agm
                                      Total
                                                 -1855 kN/squa
```

4. LOAD COMBINATIONS

The various load combinations to be used in design

A	Ultimate Limit State (E.Q. Load)
1	1,5(DL+LL)
2	1.5(DL+EQX)
3	1.5(DIEQX)
4	1.5(DL+EQ2)
5	1.5(DL-EQZ)
6	1,2(DL=LL+EQX)
7	1.2(DL+LL-EQX)
8	1.2(DL+LL+EQZ)
9	1.2(DL+LL-EQZ)
10	1,5(0.6 DL+EQX)
11	1,5(06 DL-EQX)
12	1.5(0,6 DL+EQZ)
13	1,5 (0.6 DL-EQZ)

Ċ	Serviceability Limit State
1	DL+LL
	DL+EQX
	DL-EQX
	DL+EQZ
1	DtEQZ
66	DL+IJ.+EQX
	DL+LL-EQX
3	DL+LU+EQZ
)	DL+UL-EQZ

Note:

DL: Dead Load

LL: Live Load

EQX: Seismir Load in X Direction

BQ2: Seismic Load in Z Direction

5. DEFLECTIONS

The deflections due to service loads should not exceed the following values:

Vertical Deflections;

- i) The final deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports, floors, roofs and all other horizontal members should not exceed span/250.
- ii) The deflection including the effects of temperature, creep and shrinkage occurring after the erection of partitions and the application of finishes should not exceed span/350 or 20 mm. whichever is less

b) Horizontal Deflections:

i) Drift due to EQ: The interstorey drift should not exceed H/250 where H is the storey height,

6 DESIGN BASIS FOR TANK STRUCTURES

The water tanks/liquid retaining structures would be designed as per the provisions of IS 3370

COVER FOR STRUCTURAL ELEMENTS

The clear cover for the various structural elements accordinly would be as follows:

a) Slabs	20 mm	Walls	25 mn
b) Beams	25 mm	Fdin.	50 mm
c) Columns	40 mm		-0 38 08

8 STRUCTURAL WATER PROOFING

The structural water proofing shall be done as per the contract specifications.

9. LIST OF STANDARDS/ REFERENCES

- 1) IS 456 : 2000 Code of Practice for Plain and Reinforced Concrete
- IS 875 (Pari 1 to 5): 1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures
- IS 1893 (Part1): 2002 Criteria for Earthquake Resistant Design of Structures
- IS 13920: 1993 Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
- 5] SP 16 : Design Aids to IS 456 : 1978
- 5P 34: Handbook on Concrete Reinforcement and Detailing
- 7) Reinforced Concrete Designer's Handbook by Reyholds and Steedman

PTU, Phase III

HVAC Design Basis Report

May 3, 2011

Client:
PUNJAB TECHNICAL UNIVERSITY
JALANDHAR

Architect:
ARCHIGROUP ARCHITECTS (REGD.)
A-14, First Floor, Sector 15, Noida
Tel: 0120-4312431

Consultant:
V.S. KUKREJA & ASSOCIATES (P) LTD.

165-A, Gautam Nagar, Adjoining Gulmohar Commercial Complex, New Delhi-49
Tel: 011-26520175

[This report covers the HVAC design basis for construction of two colleges, one seminar block, a library and an open air theatre, in phase III of Punjab Technical University, Jalandhar]

AIR CONDITIONING SYSTEM

GENERAL

The project consists of developing various buildings in the existing Punjab Technical University Campus.

The Buildings to be developed are 2 nos. College buildings, a library building and a seminar hall.

The buildings are envisaged to be air conditioned (Only Cooling to be provided).

The following factors are assumed for various seasons for designing the HVAC system of the Buildings:-

a) Outside Conditions

i) Summer:

D.B.: - 43.30° C (110°F) W.B. - 23.88° C (75°F)

ii) Monsoon:

D.B. - 35.00° C (95°F) W.B. - 28.30° C (83°F)

iv) Lighting Load - As per the use of the area under consideration.

b) Inside Conditions

Lecture Hall, Tutorial, Library, Seminar Hall etc.

Summer & Monsoon

D.B. - 26.0±1.0° C (79±2° F)

R.H. - 55%±5% Fresh Air - 17 CFM/ Person

Laboratory, Common Room, Cafeteria etc.

ii) Summer & Monsoon

D.B. - 26.0±1.0° C (79±2° F) R.H. - 55%+5%

R.H. - 55%±5% Fresh Air - 21 CFM/ Person

c) Design Criteria

Fresh Alr Lecture Hall, Tutorial, Library, Seminar Hall etc – 17

CFM/Person

Laboratory, Common Room, Cafeteria etc - 21 CFM/Person

Lighting Load 2.0 watt/sift

(Labs, Tutorial, library etc)

d) Factor Considered

i) Glass:

Solar heat gain factor = 0.56

U-VALUE = 1.13 BTU / Hr - Sq.ft. - °F

II) Walls:

'U' Value = 0.35 BTU / Hr - Sq.ft, - °F.

iii) Roof:

'U' Value = 0.12 BTU / Hr – Sq.ft. - °F (assuming the roof is Insulated.)

iv) Internal Partition:

'U' Value = 0.35 BTU / Hr - Sq.ft, - °F.

HVAC Design Conditions:

The following factors have been considered for the design of HVAC services:

- Individual and quickly responding temperature control for each area.
- Draft-free air distribution
- Toilet room exhaust
- Acceptable noise tevel
- Reliability
- Ease of maintenance
- Operating efficiency
- Use of space

SPECIAL REQUIREMENT

It is suggested that the top roof of the building should be insulated with a minimum of 50 mm thick expanded polyurethane (thermocole or equivalent) of minimum 16 Kg/Cum density; all the glass panes be covered with heat reflecting film. In addition Double glazed units (DGUs) are to be provided in the library.

LOAD ESTIMATION & EQUIPMENT SELECTION

The Air Conditioning loads and the recommended indoor units for the College 1, College 2 & Library Block are as follows:

	ZNDOOR UNIT SELECTED	(TRXQTY)			1.0x1=1.0	2.0x1=2.0 1.5x1=1.5	+	+	-	H	-	[5v1=15	-	H	-					
	INDOOR	TYPE			Hi-Wall	Hi-Wall	H-Wall	II.Wa	Hi-Wall	Hi-Wall	Tower	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall		Tower Unit Hi-	Tower Unit His Wall Tower Unit His	Tower Unit His Wall Tower Wall Tower Unit His	Tower Unit Hi- Wall Tower Unit Hi- Wall Tower Unit Hi- Wall Tower Unit Hi- Wall
	даялорая нгаяч тр ягл	(W)	CPM		252	294	84	42	153	273	265	105	63	105	105		378	378	378 378	378
	CEW DEHMMIDIEIED MONROOM	3	₩ W		1555	989	416	247	551	759	1386	318	271	393	393		2231	2231	2231 2231 2231	2231 2231 2231 1906
DESCENDANTA CITATIONS	CEM DEHTMIDITIED SOMMER	(K)	CFM		1589	331	492	359	683	1023	1607	418	376	526	526	2070	7897	2687	2687	2687
DESIGN DAY	dV01 NOOSNOW	6	E.		4.62	22.2	1.35	0.75	2,11	3.29	18.9	1.32	0.94	1.45	1.45	24.7	2/20	6.75	6.75	6.75
	гоммев гоча	ε	유		4.44	2,93	1.40	0.95	2.11	3.27	5.90	1.31	90T	1.55	1.55	7.13	200	7.33	7.33	7.33
MARY FOR COLLEGE BUILDING-1	алот т т д д	8	KOW		7.2	1.0	5.0	B.1	1.8	1.0	1.0	1.0	1.0	2.70	2.70	200	7,00	2700	2.00	2.00
TOR ROLL	GA0J THƏIJ	(H)	W/SQ.FT.		8	2.00	2.00	2.00	2.00	2.00	2,00	2.00	2.00	2.00	2,00	2.00		2.00	2.00	2.00
COLUMN TO A STATE OF THE PARTY	осспьчист	(5)	NOS.		12	14	9	2	0	13	35	ıŋ	3	S	2	13		18	18 18	18 18 20
100	NOITION	<u>e</u>	5		25±5%	55±5%	55±5%	55±59%	55±5%	5525%	\$515%	55±5%	8515%	965±58	55±5%	25±5%		%S455	55±59% 55±59%	55±5% 55±5% 55±5%
	GN COND	(3)	TEMP (C)		1±0'92	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1		26,0±1		26.0±1		26.0±1		
EASY OF DEGICA	INSIDE DESIGN CONDITION	(D)	MIN VENTILATION RATE CFM/PERSON		21.0	21.0	21,0	21.0	17.0	21.0	17.0	21.0		21.0		21.0		2T.0	21.0	21.0
55	тиэвиц	(3)	Ę		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0		12,0	12.0	12.0
	VAIRV CONDITIONED VCLEVE VIII	(B)	SQ.FT.		328	315	172	192	268	372	584	200	174	06I	190	1292		1292	1292	1292
	CONDITIONED SPACE	(A)		Ground Floor	Associate Professor	Воу Соттол Room	Clerical	Director PA Room	Director's Room	Girls Cammon Room	Library	Professor Room-3	Professor Room-4	Professor Room-1	Professor Room-2	Research Lab-1		Research Lab-2	Research Lab-2 Research Lab-3	Research Lab-2 Research Lab-3 Research lab-4
	8			-	1.1	1.2	E 7	1.4	E T	1.6	1.7	1.8	9.6	1.10	1.11	1.12		1.13	1.13	1.13

2.22 2.21 2,20

Sub Total

11076.0

Clerical Room
Professor Room-5 Professor Room-6

170 200 200

12.0 12.0 12.0

21.0 21.0

26.0±1 55±5% 26.0±1 55±5% 26.0±1 55±5%

S 4

2.00 2.00

1.0

1.42 1.47

1.36 1.33

523 468 413

418 328 309

105

III-Wall

1.5x1=1.5

Hi-Wall Hi-Wall

1.5xI=1.5 1.5x1=1.5

90.8

96.7

28634.4

22980.3

7852.0

2.19

Lecture Hall-2

896

12.0

17.0

26.01 55±5%

62

Z,00

0.50

8.85

10.97

2121

1816

1054

Tower Unit

3.0x4=12.0

700

12

7

26.0±1 55±5%

30

ы

5

5.68

6.20

1663

1387

510

HI-Wall

2.0x3=6,0 1.0x1=1,0

1861

1020

Mi-Wall

2.0x4=8.0 1.5x2=3.0

2.18

Tutorial-10

2.18		2.17		2.16	-	1 1 1	214	2.13	2.12		2.11		2,1			2.9	29	6.0	2.5		1	2 12	3	0 0	117	1	,		2.4.4	1.18		1.17
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700	b46	CAL	100	430	385	430	025	0.24	000		1292		1292		1292	179		592	145		140.0	484	485	103	103		10474.0		968	430	420	
	12			10.0	120	12.0	12.0	12.0			12		12		12	12.0		12.0	12.0		12.0	12.0	12.0	12.0	12.0				12.0	12,0	12.0	
	17		17	17.0	110	170	21.0	21.0		Ţ	21		21		21	Z1.0		21.0	21.0	0.T.7	0 20	210	210	21.0	21.0				17.0	17.0	17.0	46
	26.0±1 5		26.0+1 5	26.0 -1				26.0±1		710.07	3000	_	26.0+1			26.0+1	140,041	26.011	260-1	26,041	T+0.07	740.07	350.01	26041	760.1	1		- Parker	26.0+1	26.0	1+0.92	
	55±5%	1	55+5%	55±5%	5525%	44CTCC	To Take	55±5%		55±5%		07.070	20.00	1	55+5%	707.702	O%CZCC	000000	ri na	5515%		-	_					Weter .			1 55±5%	
	60		77	36	43	87		20		10		ĹŪ	i	è	20	٥	60	Ca.	,	3.0	6.00	8.00	0.00	3.00				0 0			29	
	2	K	1	2.00	2.00	2,00	0.00	200		2		2		1	2.00		2.00	2.00		2.0	2.00	2.00	2.00	2,00				2,00	2.00		2.00	
	-	ىر	1	+	0	1.0	T.U	2		2		2		4	1.2		1.4	1.4		1.5	1.2	1.6	1.9	1.9				0.50	1.00		1.00	
0.70	707	4.69	07.16	4 70	5.87	5.41	5.41			7.39		7,39		7.39	1.66		J.52	1.32		23	2,60	2.79	0.62	0.82		79,8		8.85	5.87		202	
10,16		5.55	5,90	7.20	726	5.97	5.97			6.71		6.71		6.71	1.63		0.16	1.11	į	2 2	770	2.51	0.82	0.82		8Z.B		10.87	7.36	19.67	1	
1775		1290	1189	7561	000.7	1456	1456		010	2016		3016		3016	646	1	1312	497	202	200	000	000	386	266	1000000	250970		2121	1352	1448		
1961		1060	1009	1161	5201	6201	300		1677			2297		2297	647	1011	1027	325	2001	/59	125	200	100	200	1,64507			1816	1161	1014		
1020		+	+	731	888	980	1		178			270		378	62	HOT	9		0.68	126	168	63	03		0.62.0		101	1054	-	476		
H-W-III	1000	HE-Wall	H-W-II	H-W-III	Hi-Wall	HJ-Wall	TIPAL	-Hallun	Tower	Wail	Unit Hi-	Mall	Chit Hi-	Townson	Hī_lika-III	Hi-Wall	HI-Wall		Hi-Wall	HI-Wall	HI-Wall	Hi-Wall	HI-Wall				TUTI	HI-Wall		Hj-Wall		
	1.5x1=1.5	2.0x3=6.0	TOATEO,O	2.0×4=9.0	2.0x3=6.0	2.0x3=6.0		1.0x1=1.0	3.5xZ=7.0		3.5x2=7.0 1.0x1=1.0		3.5x2=7,0 1.0x1=1.0	2.0X1=2,0	1.5x1=1.5	2.0x1=2.0	1.5x1=1.5	1.5x1=1.5	1.0x1=1.0	1.5x2=3.0	1.5x2=3.0	I:0x1=1.0	1.0x1×1.0				5.thx4=12;0	2.0x4=8.0	1.5x1=1.5	2.Uk2=4.0		-

-	Second Pare						1	-	0.0		2000	4 100	4774	026	Us Well	1 5-1-1 50
3.1	Associate Professor	328	12.0	21.0	26.0±1	50 15 15 15 15 15 15 15 15 15 15 15 15 15	2	80	7.7	‡.	4.62	6851	1991	757	HI-Wall	1.bx1=1.0
3.2	Вву Соттоп Воот	315	12	21	26.0±1	55±5%	14	2	-	2.93	3.25	831	929	294	Hi-Wall	2.0x1=2.0 1.5x1=1.5
2.2		173	12.0	21.0	26.0+1	55+5%	+	2.00	5.0	1.40	1.05	492	916	84	Hi-Wall	1.5×1=1.5
9 4	Director De Doom	197	12.0	21.0	26.0+1	%5+S5	2	2,00	00.1	96'0	0.75	950	247	42	Hi-Wall	1.0x1=1.0
P 10	Director on noon	288	120	17.0	26.0+1	55+5%	0	2.00	1,8	2.11	2.11	683	551	153	Hi-Wall	2.0x1 = 2.0
0.0	Cirlo Common Doom	222	12.0	21.0	26.0+1	5515%	13	2.00	1,0	0.27	3,29	1023	759	273	Hi-Wall	2.0x2=4.0
3.7	Library	584	12.0	17.0	26.0±1	55±59%	32	2.00	1.0	2.90	6.91	1607	1386	595	Tower	3.5x2=7.0
0	Declaces Boom-3	200	12.0	21.0	26.0+1	55+5%	N	2.00	1.0	1.31	1.32	418	318	105	Hi-Wall	1.5x1=1.5
0.0	Professor Poorman	174	12.0	210	26.0+1	25+5%	(7)	2.00	1.0	1.06	0.94	376	271	63	Hi-Wall	1.5x1=1.5
6.5	Professor Pooring	190	120	21.0	26.0+1	55+5%	un	2.00	2.70	1.55	1.45	\$26	393	105	Hi-Wall	1.5×1=1.5
01.10	Professor Room-1	190	12.0	21.0	26.0+1	55+5%	ın	2.00	2.70	1.55	1.45	526	393	105	Hi-Wall	1.5x1=1.5
3.12	Research Lab-1	1292	12	21	26.0±1	55±5%	18	2	121	7.33	6,75	2697	2231	976	Tower Unit Hi- Wall	3,5x2=7.0 1.0x1=1.0
3.13	Research Lab-2	1292	12	12	26.0±1	55±5%	18	72	2	7.33	6.75	2687	2231	378	Tower Unit Hi- Wall	3.5x2=7.0 1.0x1=1.0
3.14	Research Lab-3	1292	12	21	26.0±1	55±5%	18	2	2	7.33	6.75	2687	223.1	378	Tower Unit Hi- Wall	3.5x2=7.0 1.0x1=1.0
3.15	Research lab-4	1355	12	21	26.0±1	55±5%	20	2	7	6.51	6.44	2241	1906	420	Tower Unit Hi- Wall	3.5x2=7.0 1.0x1=1.0
3.16	Tutorial-3	420	12	17	26.0±1	55±5%	28	2	-	5.05	5.27	1438	1014	476	Hrwall	Z.0x2=4.0 1.5x1=1.5
3.17	Tutorial-2	420	12	17	26.0±1	%5 7 56	28	2	н	5.05	5.27	1438	1014	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5
0.	Tutorial.1	430	12.0	17.0	26,0+1	\$5±5%	43	2.00	1.00	5.87	7.36	1352	1161	731	Hi-Wall	2.0×4=8.0
3.19	Lecture Hall-01	896	12.0	17.0	26.0±1	_	62	2.00	0.50	8.85	10.97	2121	1816	1054	Tower	3.0×4=12.0
	Sub Total	10474.0								79.8	82.8	25082.8	20549.7	6362.0		
4	Third Floor					_	1	000	0,	000	000	376	200	63	Hi-lu/all	0x1=1.0
4,1	Assistant Professor-1	103	12.0	21.0	26.0=1	_	00.0	2.00	10	200	0.02	266	206	69	Hi-Wall	1.0x1=1.0
4.2	Assistant Professor-2	103	12.0	0.15	26.0±1	0010000 0010000	000	2.00	1.6	2.79	2.51	086	725	168	Hi-Wall	1.5x2=3.0
4 P	Assistant Professor-3	999	12.0	0.12	76.0-1	-	6.00	2.00	1.2	2.60	2.28	964	759	126	Hi-Wall	1.5x2=3,0
4. 6.	Assistant Professor-4 Assistant Professor-5	140.0	12.0	21.0	26.0-1	_	3.0	2.0	1.5	2.3	2.3	556	1005	63	HI-Wall	1.0x1=1,0 1.5x1=1,5

[m 	5.7	5.6	5.5	5.4	5.3	5.2	1.2	S		4.22	4.21	4.20	4.19	4.18	4.17	4.16	4.15	4.14	4.13	4.12	Ē	2	: 6	4.8	5	40
Professor Room-3	Library	Girls Common Room	Director's Room	Director PA Room	Clerical	Boy Common Room	Associate Professor	Fourth Floor	Sub Total	Professor Room-6	Professor Room-5	Clerical Room	Lecture Hall-2	Tutorial-10	Tutorial-9	Tutorial-8	Tutorial-7	Tutorial-4	Tutorial-6	Turorial-5	Research Lab-7	Research Lab-6	Research Lab-5	Associate Professor-7	Associate Profisser-6	ASSOCIATE PROTISSER-3
200	584	372	288	192	172	315	328		11076.0	200	200	170	968	700	646	430	385	430	420	420	1292.00	1292.00	1292,00	179	592	140
12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0			12.0	12.0	12.0	12.0	12.00	12,00	12.00	12.0	12.0	12.0	12.0	12.00	12.00	12.00	12.0	12.0	12.0
21.0	17.0	21.0	17.0	21.0	21.0	21.0	21.0			21.0	21.0	21.0	17.0	17.00	17.00	17,00	17.0	17.0	21.0	21,0	21.00	21.00	21,00	21.0	21.0	22.0
26.0±1 55±5%	26.0±1	Z6.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1			26.0±1	26.0±1	26.0±1	26,0±1	26.0±1	26.0≛1	26,0±1	26,0±1	26.0±1	26,0±1	26.0±1	26.0±1	26.011	26,0±1	26.041	26.0±1	10.010
55.5%	5515%	S515%	55±5%	S5-5%	\$5±5%	S5 <u>+</u> S9%	55±5%			88755	5515%	S545%	S5±S%	55±5%	\$5±5%	\$5±5%	55±5%	55±5%	\$545%	55±5%	55±5%	551+5%	55±5%	55±5%	55±5%	OKCTOR
5	35	13	9	2	4	14	12			S	S	4	62	30.00	60,00	32,00	36	43	28	28	18,00	18,00	18,00	J	8	u
2.00	2.00	2,00	2,00	2.00	2,00	2.00	¢o.			2.00	2.00	2.00	2.00	2.00	2.00	2.00	2,00	2.00	2.00	2.00	2.00	2.00	2,00	2.00	2.00	2.00
1.0	1.0	1,0	1.8	1.8	5.0	1.0	7.2			1.0	1.0	4.7	0.50	1.50	1.00	1.00	1.0	1.0	1.0	1.0	2,00	2.00	2,00	L.2	L4	1.4
1.31	5.90	3.27	2.11	0.95	1,40	2.93	4.4		8.06	1,30	1.42	1.47	8.85	5.68	7.95	4.69	4.70	5.67	5,41	5.41	7.39	7.39	7.39	1.66	3,52	1.5.1
1.32	6.81	3.29	2.11	0.75	1.35	3.25	4.62		96.7	1.30	1.33	1.36	(0.87	6.20	10,16	5.55	5.90	7,36	5.97	5.97	6.71	6.71	6.71	1.63	3.16	1.1.1
418	1607	1023	683	359	492	831	1589		28634.4	413	468	520	2121	1663	1775	1290	1189	1352	1456	1456	3016	3016	3016	646	1312	62.4
318	1386	759	551	247	416	656	1555		22980.3	309	328	418	1916	1387	1561	1060	1009	1161	1025	1025	2297	2297	2297	647	1077	200
105	595	273	153	42	9.6	294	252		7852.0	105	105	84	1054	510	1020	54 4	612	731	588	588	J78	378	376	63	168	00
H.Wall	Tower Unit	Hi-Wall	Hi-Wall	HI-Wall	Hi-Wall	Hi-Wall	Hi-Wall			Hi-Wall	Hi-Wall	H5-Wall	Tower	Hi-Wall	Hi-Wall	Hi-Wall	Hj-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Tower Unit Hi- Wall	Tower Unit Hi- Wall	Tower Unit HI- Wall	HE-W-IH	IIEM-IH	He ax-III
15x1=15	3.5x2=7.0	1.5x2=3.0	2.0xJ=2.0	1.0x1=1.0	1.5x1=1.5	2.0x1=2.0 1.5x1=1.5	1.5x3=4,50 1.0x1=1.0			1.5x1=1.5	1.5#1=1.5	1.5x1=1.5	3.0x4=12.0	2.0x3=6.0 1.0x1=1.0	2,0x4=8.0 1.5x2=3.0	2.0x2=4.0 1.5x1=1.5	2.0x3=6.0	2.0x4=8.0	Z.0x3=6.0	2.0x3=6.0	3.5x2=7.0 1.0x1=1.0	3.5x2=7.0 1.0x1±1.0	3,5x2=7.0 1.0x1=1.0	Z.0x1=2.0	2.0x1=2.0 1,5x1=1.5	C'T=TXC'T

A 12 tomas (1) person by . .

26024 5525% 5 2.00 2.70 1.55 1.45 5.56 399 1.45 5.26 399 1.45 1.45 1.45 1.45 1.45 1.45 1.55 399 1.15 1.44	I.	r	1/4	12.0	21.0	26.0+1	1 554.504		000			1	State of the state				
Recearch Lub-1 1723 12.0	=		190	120	210	0000	-		200	1,0	1,06	0.94	376	274	13		
Recearch label	7	1	180	13.0	0.70	TO:07	_		2.00	2.70	1.55	1.45	262	200	20	HI-W-III	1,5x1=1.5
Recearch Lub-2 1292 120 2404 554596 18 200 200 733 6.75 2667 2331 739 710erra 100			200	12.0	27.0	26.0±	_		2.00	270	1 56		970	393	105	HI-Wall	15x1=1.5
Retairch Labe-3 1292 120 210 26.641 55.55% 18 2.00 7.33 6.75 2.687 2.587 2.687 2.283 378 70 mils 1.00 mi		-	1292	12.0	21.0	26.0±	_		200	200	T.33	1.45	925	393	105	H-Wall	Sv1=15
Receasery Lab-2 122 120 210 260 155 55-56 10 200 2.0	1					100	-		201	2.00	199	6.75	2687	2231	378	Tower	3.5x2=7.0
Recearch lab-4 1292 120 210 26021 55.55% 18 2.00 2.00 2.03 5.64 2.241 5.667 2.212 3.08 10 link lab-4 1.155 1.20 2.10 2.6021 55.55% 2.2 2.0			1292	12.0	21.0	76.04	_									Unit HI-	1.0x1=1.0
Receaserch lab-j 1292 120 210 26041 5545% 18 2.00 2.00 7.13 6.75 2667 2221 378 70 wear that the control lab-j 135 120 2.0041 5545% 20 2.00 2						10.01	_	_	200	2,00	7.33	6.75	2687	7731	370	Wal	
Recearch lab-4 1355 12.0 21.0 26.041 55.25% 18 2.00 2.00 7.33 6.75 2.697 2.241 1906 4.20 100 mt. H.	13													1	0/1	Tamor	3-5x2=7.0
Propriet	+	_	1292	12.0	21.0	26.0±1	-	1	2.00	0000	1					Wall	L0x1=1.0
Publication 1,155 12.0 21.0 26.021 55.25% 29 2.00 1.00 5.05 5.27 14.38 1014 4.76 1014 1.906 4.00 1018 1.00 4.00 1018 4.76 4.00 4.							_		001	77.7	1.33	6.75	2687	2231	378	Tower	3.5x2=7.0
The property 4.0 1.0 1.0 26.04 55.5% 28 2.0 1.0 5.05 5.2 14.38 10.14 1906 430 Int. National Property 4.0	0	100	1,355	12,0	21.0	26.0+1	_	20	2.00	2.00	651	8.44	27.60			Wali	1,0x1=1.0
Theorial-3 420 120 170 26024 5525% 29 2.00 1.00 5.05 5.27 14.98 1014 476 Hi-Wall Theorial-1 430 120 170 26024 5525% 43 2.00 1.00 5.05 5.27 14.98 1014 476 Hi-Wall Theorial-1 430 120 170 26024 5525% 43 2.00 1.00 5.05 5.27 14.98 1014 476 Hi-Wall Theorial-1 430 120 170 26024 5525% 43 2.00 1.00 5.05 8.85 10.87 21.21 10.64 1.04 Theorial-1 430 120 120 2.00 2.00 1.00 0.00 0.00 2.00 1.00 0.00 Theorial-1 430 120 120 2.00 2.00 1.00 0.00 0.00 0.00 0.00 0.00 Theorial-1 430 120 120 2.00 2.00 1.00 0.00 0.00 0.00 0.00 Assistant Policasor-2 405 120 2.10 2.00 2.00 1.0 0.00 0.00 0.00 0.00 0.00 Assistant Policasor-3 405 120 2.10 2.00 2.00 1.0 0.00 0.00 0.00 0.00 0.00 Assistant Policasor-4 404 1.2 2.10 2.00 2.00 1.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 Assistant Policasor-5 405 1.20 2.10 2.00 2.00 1.0 0.00 0.	14	Tolledal									100	100	2241	1906	420	Tower	3.5x2=7.0
Tritorial-3 420 12.0 12.0 26.0c, 1 55.25% 43 2.00 1.00 5.05 5.27 14.18 10.14 4.76 Hi-Wall		7-IEI Min	420	12.0	17.0	26.0±1	-	28	2.00	1,00	5.05	5.27	1470	210	1	Wall	OT=TXO.7
Titorial-1 430 12.0 17.0 26.0±1 55.25% 4.0 2.00 0.50 8.87 7.36 1362 1161 731 H-Wall	Pr.	Tutorial-3	420	12.0	17.0	26.0±1	_	28	200	100	202	100		\$IAT	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5
December 145 12.0 20021 55±5% 62 2.00 0.50 8.65 1367 1671 1916 1054 104401 106190 12.0 2.0021 55±5% 62 2.00 0.50 8.65 10.87 2.121 1916 1054 104401 104401 106190 12.0 2.0021 55±5% 2.00 2	1-1	Tutorial-1	430	120	140	4	-			3	20.0	77.0	1438	1014	476	Hi-Wall	20x2=4.0
Discriment 145 12.0 24.04 55.5% 6.2 2.00 6.50 6.85 10.87 2121 10.04	_	Lecture Hall-01	896	450	O'AT	70.02	-	43	2,00	1.00	5.87	7.36	1353	4160			1.5x1=L5
Dity Canteen 145 12.0 24.04 55.5% 10.0				4.4.0	1/10	26.0±1	_	62	2.00	0.50	8.85	10.87	3171	1017	731	Hi-Wall	2.0x4=B.0
10619.0 1.00		Dry Canteen	145	12.0	21.0	26.0+1	_							9707	1054	Tower	3.0x4=12.0
Secondaria 103 12.0 21.0 26.0±1 55±5% 3.00 2.00 1.9 0.69 0.67 2.95 2.33 6.3 Hi-Wall 1.2 21.0 26.0±1 55±5% 3.00 2.00 1.9 0.69 0.67 2.95 2.33 6.3 Hi-Wall 1.2 21.0 26.0±1 55±5% 3.00 2.00 1.9 0.69 0.67 2.95 2.33 6.3 Hi-Wall 1.2 21.0 26.0±1 55±5% 3.00 2.00 1.9 0.69 0.87 2.95 2.33 6.3 Hi-Wall 1.2 2.1 2.0±1 2.5±5% 3.00 2.00 1.9 0.89 0.87 2.95 2.33 6.3 Hi-Wall 1.2 2.1 2.0±1 2.5±5% 3.0 2.00 1.5 3.2 3.4 1176 9.96 1.0 1.8 1.9 Hi-Wall 1.2 2.1 2.0±1 2.5±5% 3.0 2.00 1.5 2.43 2.37 9.96 1.0 1.9 Hi-Wall 1.2 2.1 2.0±1 2.5±5% 3.2 2.0 1.4 1.4 1.4 1.4 1.5 0.95 1.0	1	Cub Total									1					Hi-Wall	1.0x1=1.0
13 12.0 12		With Class	10619.0								200						
1202 12.00 21.00 26.0±1 55±5% 3.00 2.00 1.9 0.899 0.897 2955 2313 6.3 H1-Wall 6.	1	Accierate Dank								1	06/	8778	25082,0	20549,7	6362.0		
SSOT-2 103 12.0 21.0 26.0±1 55.55% 3.00 2.00 1.5 0.89 0.87 295 233 63 Hi-Wail SSOT-4 485 12.0 21.0 26.0±1 55.5% 3.00 2.0 1.2 3.3 3.43 1176 912 25.2 Hi-Wail SSOT-4 484 12.0 21.0 26.0±1 55.5% 9.0 2.0 1.2 3.2 3.0 1147 931 1.89 Hi-Wail SSOT-7 145 12.0 21.0 26.0±1 55.5% 3 2.0 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.4 1.5 6.7 1.4	1	Angiotati P. TOTESSOF-1	103	12.0	21.0	26.0+1	55+5%	3.00	200	0.	000	-					
Section	1	Assistant Professor-2	LOI	12.0	21.0	26.0+1	25+504	300	2000	21	69.0	0.87	295	233	63	HCWell	1 Del -1 0
SSOT-4 464 12 21 26.0±1 55.5% 9.0 2.0 1.6 3.5 3.43 1176 912 25.2 H;Wall SSOT-5 140 12.0 21.0 26.0±1 55±5% 9.0 1.2 3.4 1.47 996 1041 6.3 H;Wall SSOT-7 145 12.0 21.0 26.0±1 55±5% 3 2.00 1.5 2.37 996 1041 6.3 H;Wall SSOT-7 179 12.0 21.0 26.0±1 55±5% 3 2.00 1.3 4.3 4.14 1.46 1.5 6.9 H;Wall SSOT-7 179 12.0 21.0 26.0±1 55±5% 12.0 2.0 1.3 4.14 1.5 6.9 4.14 1.4 1.5 1.4 1.4 1.4 1.5 6.9 H;Wall H;Wall 1.5 6.0 1.3 2.0 1.3 4.14 1.5 6.7 H;Wall		Assistant Professor-3	485	12.0	21.0	26.047	26.504	0000	2.00	7.9	68.0	0.87	295	233	69	Hi-Wall	1.0XI=1.0
SSet-7 140 12.0 2.0 1.5 3.2 3.0 1147 931 189 H-Wall SSet-7 145 12.0 2.0 1.5 2.43 2.37 996 1041 63 H-Wall SSet-7 12.0 21.0 26.0±1 55±5% 3 2.00 1.4 1.41 1.18 5.35 403 63 H-Wall SSet-7 12.0 21.0 26.0±1 55±5% 12.00 2.00 1.35 4.14 1.45 1.54 1.54 1.94 1.84 <td></td> <td>Assistant Professor-4</td> <td>484</td> <td>12</td> <td>21</td> <td>26.041</td> <td>20772</td> <td>0071</td> <td>7.00</td> <td>F.6</td> <td>3.53</td> <td>3.43</td> <td>1176</td> <td>912</td> <td>757</td> <td>Hi-br-n</td> <td>TOTAL TO</td>		Assistant Professor-4	484	12	21	26.041	20772	0071	7.00	F.6	3.53	3.43	1176	912	757	Hi-br-n	TOTAL TO
SSGI-5 145 12.0 21.0 2.0 1.5 2.43 2.37 996 1041 6.3 H:Wall SSGI-6 592 12.0 21.0 26.0±1 55±5% 3 2.00 1.4 1.41 1.16 535 403 6.3 H:Wall SSGI-7 12.0 21.00 26.0±1 55±5% 12.00 2.00 1.3 4.34 1.540 1291 252 H:Wall SSGI-7 17.9 12.0 21.00 26.0±1 55±5% 18.00 2.00 1.2 1.77 1.72 698 694 63 H:Wall SSGI-7 12.00 26.0±1 55±5% 18.00 2.00 2.0 7.39 6.71 3016 2.297 378 H:Wall 1292 12.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 26.0±1 55±5% 18.00 2.00		Assistant Professor-5	140	12.0	21.0	26 011	OK DATE	2.0	2.0	1.2	3.2	3.0	1147	931	189	HALLANDII.	1.5XZ=3.0
88eT-6 592 12.0 21.0 26.0±1 55±5% 3 2.00 1.4 1.41 1.18 535 403 63 Hi-Wall 88eT-6 592 12.0 21.00 26.0±1 55±5% 12.00 1.20 1.72 4.33 4.14 1.54 1.54 1.291 252 Hi-Wall 8501-7 1.20 21.00 26.0±1 55±5% 18.00 2.00 1.2 1.72 698 694 63 Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2.297 378 Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2.297 378 Tower 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.		Accordate Dead				-	0/11/100	7	2.00	1.5	2,43	237	966	1041	63	Hi-Wall	1.0x1=1.0
SSO1-7 12.00 21.00 26.0±1 55±5% 12.00 1.35 4.34 4.14 1.540 1291 25.2 Hi-Wall SSO1-7 1.29 12.00 21.00 26.0±1 55±5% 18.00 2.00 1.2 1.77 1.72 698 694 63 Hi-Wall 1.292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2.297 37B Hi-Wall 1.292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2.297 37B Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2.297 37B Hi-Wall 1292 12.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 37B Unit Hi-Hi-Mall		According Designation	145	12.0	21.0	26.0±1	55+5%	67	2.00	1.4	1 44	47.7					L5x1=1.5
SSOL-7 179 12.0 21.0 26.0±1 55±5% 3 2.00 1.2 1.77 1.72 6.71 6.71 3016 2297 378 Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Hi-Wall 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower Mall Mall Mall Mall Mall Mall Mall Mall		O-lassifor officer	265	12.00	21.00		55±596	12.00	2.00	1.35	7437	1.16	535	4 03	63	Hi-Wall	1.5x1=1.5
1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 1.2 1.77 1.72 698 694 63 HI-Wall Line Hi- 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower Unit Hi- Wall Wall Children Unit Hi- Wall Chi		According Desferons	100							7.33	1.00	4.14	1540	1291	252	Hi-Wall	2.0x1=2.0
1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 H-Wall Unit Hi- 1292 12.00 21.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower Unit Hi- Wall Wall Unit Hi-	1	Responded to the	671	12.0	21.0		55±5%	9	2.00	12	1 77	(40)					1.5x1=1.5
1292 12.00 21.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower 1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower Wall Wall Wall Wall	_	C-OPT INTEGRAL	1292	12.00	21.00	_		18,00	1	-	7.77	L.7.2	869	669	63	HI-Wall	2.0x1×2.0
1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 378 Tower Unit Hi-	-										65.7	0.71	3016	2297	37B	Tower	3.5x2=7.0
1292 12.00 21.00 26.0±1 55±5% 18.00 2.00 2.00 7.39 6.71 3016 2297 378 Tower Wall Wall House		Research Lab-6	1292	12.00	21.00		%5t	18.00	1	+	7.30	140				Wall	1.0x1=1.0
26.0±1 55±5% 18.00 2.00 7.39 6.71 3016 2297 379 Tawer Unit Hi-	-	Research Lab-7	1292	12.00	4	_					7	1/0	3016	2297	378	Tower Unit His	3.5x2=7.0 1.0x1=1.0
Tower Unit Hi-				Anima T	77.00		%5∓ ∓2%	(8.00		-	7.39	6.71	3016	2207	270	Wall	
	-													1673	8/7	Jower Unit Hi-	1.5x2=7.0

6.13 Tutoriai-6	420	120	240	170,02	-	97	7.00	7.0	2.68	6.17	1578	1136	888	H-Wall	2.023=6.0
Tuborial-4	430	420	0.10	170.07	_	82	2.00	1.0	5.68	6.17	1578	1136	588	Hi-Wall	20v3m50
Tuorial-7	200	410	0-71	20.0±1	-	43	2'00	1.0	6,15	7.57	1476	1274	731	Hi-Wall	20rt-90
Tutorial.0	200	46.0	17.0	26.0±1	-	36	200	1.0	4,95	60'9	1301	1110	613	H; Mr.11	0 0000
O. Inc.	430	12.0	17.0	26.0±1	%S+55	32	2.00	1.0	4 97	575	4414	44 80	440	The state of	C-DK3=D-D
Tutorial-9	949	12.0	17.0	76.041		60	0000		117	07.0	1919	11/3	544	H-Wall	Z0x3=60
•				1	PART I	8	7.00	1.0	B.36	10.47	1961	1731	1020	HI-Wall	2.0x4=8.0
Turorial-10	700	12.0	170	26.041	CELEGA	20	400	1				1			$1.5 \pm 2 = 3.0$
				1		20	7.00	150	6.13	6.54	1865	1571	510	H-Wall	2.0x2=4.0
Clerical Room	170	12.0	21.0	26.0+1	SC+504	7	3.00	70.7	7					The second second	Z-2X1=2.5
Professor Room-5	200	120	210	34.0.4	_	-	2.00	1./1	757	144	572	462	84	HFWall	2.0x1=2.0
Purificent Doom.	300	200	NT7	740'07	-	0	200	1.00	1.55	F\$T	526	381	105	H-Wall	1 Colod
D-IIIOON INCOM	200	17.0	21.0	26.0+1	55+5%	LF.	2 00	4.00	0.4.0	4 400			-	10 A	L.OAL-L.
Lecture Hall-01	896	12.0	170	25.025	AC. CA.		200	A.C.O.	7.95	1.40	4/1	362	105	H-Wall	1.5r1=1.5
				1	Ration	70	00.7	050	9.85	10.87	2121	1916	1054	Tower	3.0x4=12.0
Sub Total	11076.0														
		T							92.6	96.5	26902.0	21758.2	6735.0		
Grand Total	64705.0	1													
	NEC JES								503.6	528.3	1594193	470944	Adenta		1

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			BASIS	BASIS OF DESIGN	OF DESIGN						DESIGN DA	DATA SUMMARY	RY			
5. NO.	CONDITIONED SPACE	ACTUAL AIR CONDITIONED ABRA	тнызн	INSIDE DESIGN CONDITION	IGN CONE	ITION	YONATUOO	акот тнэгл	пкол тяра	даот язимог	TOVD MON20ON	DEHOMIDIEIED SUMMER	СЕМ ДЕЖОМІДИВІЕД МОИЗООМ	GARLURED H2384 ATQ SIA	INDOO	INDOOR UNIT SÉLECTED
	(A)	(H)	(0)	(a)	(E)	(F)	(0)	(H)	Ξ	8	0)	(K)	(1)	(M)	TYPE	(TRKQTY)
		SQ.FT.	E	MIN VENTILATION RATE CFM/PERSON	TEMP (C)	臣	NOS.	W/SQ.FT.	KW	Ħ	Ħ	CFM	CFM	CFM		
1	Ground Floor															
1.1	Associate Professor	312	12	21	26.0+1	55+5%	12	8	8	4.32	4.24	1533	1345	2\$2	Hi-Wall	1.0x2=2.0 1.5x2=3.0
1.2	Boys Common Room	323	12.0	21.0	26.0±1	965±55	14	2.00	0.5	3.42	3.61	1053	653	294	Hi-Wall	2.0x1=2.0 1.5x1=1.5
1.3	Clerical Room	194	12.0	21.0	26.0±1	55±59%	4	2.00	4.1	1.45	1.31	518	392	94	Hi-Wall	1,5x1=1,5
1.4	Director's PA Room	215	12.0	21.0	26.0+1	85±55	3	2,00	2.0	1.14	0.98	409	292	63	Hi-Wall	1.5x1=1.5
1.5	Director's Room	323	12.0	21.0	26,0±1	55±59%	6	2.00	2.0	2.15	2.24	959	508	189	Hi-Wall	2.5×1=2,5
9.1	Girls Common Room	410	12.0	21.0	26.0±1	55±59%	14	2,00	1.0	4.09	4.17	1356	1151	294	Hi-Wall	2.0x2=4.0
1.7	Lecture Hall-01	896	12.0	17.0	26,0±1	55+5%	29	2.00	0.5	9.11	11.06	2239	1917	1054	Tower Unit	3.0x4=12.0
1.8	Library	581	12.0	17.0	26.0±1	55±5%	35	2.00	1.0	5,39	6.48	1377	1211	595	TowerUmit	3.0x1=3.0 3.5x1=3.5
6.1	Professor Room-01	215	12.0	21.0	26.0±1	55±5%	3	2.00	0.93	1,20	66.0	437	566	63	Hi-Wall	1.5x1=1.5
1.10	Professor Room-02	215	12.0	21.0	26.0+1	55-5%	3	2.00	0.93	1.20	66.0	437	299	63	Hi-Wall	1.5x1=1.S
1,11	Professor Room-03	150	1,2.0	21.0	26.0+1	55±5%	60	2.00	2.0	1.07	0.93	380	692	63	Hi-Wall	1.0x1=1.0
1.12	Professor Roam-04	168	12.0	21.0	26.0±1	55+59%	CC3	2.00	2.0	1.07	96'0	377	281	63	Hi-Wall	-1.0x1=1.0
1.13	Research Lab-1	1140	12.0	21.0	Z6.0±1	55±5%	18	2,00	2.0	95'9	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
1.14	Research Lab-2	1140	12.0	21.0	26.0±1	%5755	18	2.00	2,00	95.9	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
1.15	Research Lab-3	1140	12.0	21.0	26.0±1	55±59%	18	2.00	2.00	95'9	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
1.16	Research Lab-9	1140	12.0	21.0	26.0±1	55±5%	18	2.00	2.00	95.9	6,10	2338	1381	378	Tawer Unit	3.5x2=7.0
1.17	Technician Room-01	98	12.0	21.0	Z6.0±1	85±58	2	2,00	2.00	0.57	0.54	190	134	42	Hi-Wall	1.0x1=1.0
1.18	Technician Room-02	86	12.0	21.0	26.0±1	55±5%	2	2.00	2.00	0.82	0.68	300	602	45	Hi-Wall	1,0x1=1.0
1.19	Technician Room-03	108	12.0	21.0	26.0±1	55±5%	3	2,00	2.00	0.97	0.89	335	244	63	Hi-W-III	1.0x1=1.0
1.20	Technician Room-04	97	12.0	21.0	26.0+1	55±59%	CO.	2.00	2.00	0.82	0.76	267	176	63	Hi-Wall	1.011=1.0
17.1	Tutorial-01	425	12.0	17.0	26.0+1	55±5%	43	2.00	05.0	6.32	7.59	1557	1284	731	Hi-Wall	2.0x4=8.0
T.22	Tutorial-02	420	12.0	17.0	26.0±1	55±5%	28	2.00	1.00	4.33	5.10	1112	925	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5
1.23	Tutorial-03	420	12.0	17.0	26.0±1	55±5%	28	2.00	1.00	4.33	5.10	1112	925	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5

1 Image: Property of the property of t	9	AND LABOR DOOR	2	273		28.05	0±3 55±5%	42								12-W-13	
	-		1.	2							0.08	83.0	74995 2	+	+		
The part The part	4										-	0.00	44773.0	+	+	0	
Tutorial-log 120 1	7	Tallerial-67	430		100	26.0+	-	+	+	-	1				-		
Thurnerial-type Sept 12.0 13.0 26.041 S55.96 30.00 2.00 1.0 2.27 9.56 148.3 17.95 510 144.94 1.0	7	Tutorai-06	430			26.0+	-	-	+	TO	67.0	6.03	1483	1295	\$10	Hi-Wall	2.0x3=6.0
Assistant Professor-02 1.05 1.20 2.00.1 55.5% 3.0.0 1.0 1.0 5.1 5.7 1.5 1.5 5.10 1.4 Mail 1.5	17	Tutorial-09	592			96.0	-	-	-	TT	5.29	6.03	1483	1295	510	Hi-Wall	2.0x3=6.0
Assistant Professor 21 1.2 1.2 2.0.0 1.2 2.0.0 1.2	-	Turorial-10	646	+	+	ZB:U+	-	-	-	1.0	7.37	92.6	1576	1369	986	Hi-Wall	2,0x2=4,0
Assistant Professor-O3 10.0 12.0 22.0 26.041 55.55% 3 2.00 1.03 1.03 1.05 5.00 1.03 1.04 1.04 1.05 1.05 2.00 1.05 2.00 1.05 1.	10	Associate Professor-01	-	150	-	26.0+	_	-		1.0	5.14	5.77	1415	1166	610	100 100	D.0=+XC.1
Assistant Professor 10 17.0 2.00 2	V	Arrival of the Control of the Contro		17.0	+	26.0±	-		2.00	1.23	1.57	140	105	200	OTC	HI-Wall	1.5x4=6.0
Assistant Professor—O4 511 1.0 1.0 1.0 2.0 1.0 2.0	1	Application of the state of the		12.0		26.0+	_		2.00	1.0	180	1 1 1	100	076	63	Hi-Wall	1.5x1=1.5
Assistante Professor-Osta 561 1.2.0 2.0.1 2.6.0.1 2.0.0 2.0.0 2.0.0 3.04 3.15 1.2.4 2.2.2 H-Wall Assistante Professor-Ost 1.06 1.2.0 2.0.1 2.0.0 2.0.0 2.0.0 3.04 3.15 1.2.4 2.2.7 H-Wall Assistante Professor-Ost 1.06 1.2.0 2.0.1 2.0.0 2.0.0 2.0 3.04 3.05 3.14 2.15 4.2 H-Wall Resistant Professor-Ost 1.06 1.2.0 2.0.0 2.0.0 2.0.0 3.04 3.05 3.14 2.15 4.2 1.14 2.0.0 3		Assistant Professor-02		12.0		26.0+	-	L	3.00	2.0	7.00	17/3	807	710	63	Hi-Wall	2.0x1=2.0
Assistant Professor-13 106 12.0 21.0 26.0 25.5 42.0 2.0 0.85 14.9 314 315 215 4.2 HtWall Assistant Professor-14 162 12.0 21.0 26.0 25.5 4.0 1.3 21.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 4.0 21.0 21.0 25.5 21.0	6	Associate Professor-04		12.0		26.0+	_	1	2000	0.2	3.08	3.12	696	744	252	Hi-Wall	1.0x4=4.0
Assistant Profesor—94 108 12.0 21.0 26.0±1 55.25% 2 2.00 2.0 0.085 0.69 314 215 4.2 H-Wall Assistant Profesor—2	6	Assistant Professor-03		12.0		2604			7007	0.2	3.74	3.85	1269	1134	252	Hi-Wall	1.0x4=4.0
Associare Professor 1.67 1.20 21.0 2.60±1 5.45±9% 3 4 1.34 1.36 1.36 1.34 1.36 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.34 1.36 1.36 1.34 1.36 1.36 1.34 1.36 1.36 1.34 1.36 1.36 1.36 1.34 1.36 1.36 1.36 1.36 1.34 1.36 1.36 1.36 1.34 1.36 1.36 1.36 1.34 1.36 1.36 1.36 1.34 1.36 1.	0	Assistant Professor-04		12.0		26.04	-		007	2.0	0.85	69.0	314	215	42	Hi-Wall	1.0x1=1.0
Recearch Lab.	-	Associate Professor-02		12.0		26.04	_	1	00.2	2.0	0.85	69.0	314	215	4.2	Hi-Wall	1.Dv1=1.0
Research Lab.	64	Research Lab-1	1140	-	21.0	26.01	_	1	2.00	2.0	1.34	1.11	505	363	63	H-Wall	1.5x!=15
Messarch Lab+3 1140 12.0 21.0 26.041 55.55% 4 2.00 2.0 6.56 6.10 2338 1881 379 Twwer bink of Central Room 194 12.0 21.0 26.041 55.55% 4 2.00 2.0 6.6 6.10 2338 1881 378 Twwer bink of Central Room 26.041 55.55% 4 2.00 2.0 6.10 1.06 2.239 1917 1054 Twwer bink of Central Room 2.0 12.0 12.0 26.041 55.55% 2.0 2.0 0.5 9.17 11.06 2.239 1917 1054 Twwer bink of Central Room 2.0	m	Research Lab-2	1140		21.0	26.04	-	1	7.00	2.0	6.56	6.10	2338	1881	378	Tower Unit	
Certical Reorn 194 12.0 21.0 26.0±1 55.5% 18 2.00 2.0 6.56 6.10 2388 1881 376 Tower-Univ like 1.0	4	Research Lab-3	1140	-	21.0	26011	_	1	2,00	2.0	6.56	6.10	2338	1881	378	Tower Unit	
Tutorial-03 966 12.0 17.0 26.04.1 25.45% 2.40 4.12 1.45 1.31 518 392 84 Hi-Wall Hi-Wal	LO.	Clerical Room	194	12.0	210	76.011	_	1	2.00	2.0	6.56	6.10	2338	1881	376	Tuwer Unit	
Tutorial-03 420 12.0 12.0 26.0±1 55±5% 28 2.00 1.0 4.33 5.10 1112 9.25 4.76 Hi-Wail 1.00 1.00 4.23 5.10 1112 9.25 4.76 Hi-Wail 1.00 4.23 1.00 1.0 4.23 5.10 1.11 9.25 4.76 Hi-Wail 1.00 1.00 4.23 5.10 1.11 9.25 4.76 Hi-Wail 1.00 1.20 2.00 1.0 2.00 2.0	9	Lecture Hall-01	896	12.0	17.0	26.04	-	1	2,00	4,12	1.45	1.31	518	392	40	Hi-Wall	1.5x1=1.5
Tutorial-02 420 12.0 17.0 26.0±1 55±5% 28 2.00 1.0 4.33 5.10 1112 925 476 Hi-Wail 1.0 1.0 4.25 12.0 1.0 4.25 1.2	N	Tutorial-03	420	420	4		-		00.2	550	9.11	11.06	5239	1917	1054	Tower Unit	3.0x4=12.0
Tutorial-Oti 420 12.0 17.0 26.0±1 55±5% 28 2.00 1.0 6.33 5.10 11.12 92.5 4.5 H·Wail 1.0 1.0 26.0±1 55±5% 4.3 2.00 0.5 6.32 7.59 15.57 1284 7.31 H·Wail 1.0 1.0 1.2 1.0 2.0±1 55±5% 3 2.00 2.0 0.97 0.89 335 2.44 6.3 H·Wail 1.0 1.2 1.2 2.0±1 55±5% 2 2.00 2.0 0.97 0.89 335 2.44 6.3 H·Wail 1.0 1.2 2.0±1 55±5% 2 2.00 2.0 0.97 0.89 335 2.44 6.3 H·Wail 1.0 1.2 2.0±1 2.5±5% 2 2.00 2.0 0.97 0.89 335 2.44 6.3 H·Wail 1.0 1.2 2.0±1 2.5±5% 2 2.00 2.0 0.97 0.89 335 2.44 6.3 H·Wail 1.0 1.2 2.0±1 2.5±5% 3 2.00 2.0 0.97 0.95 335 3.0 3.0 3.0 1.0 1.0 1.0 1.2 2.05 2.0 2.0 2.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 4.2 H·Wail 1.0 4.0 4.2 H·Wail 1.0 4				I.c.D	TV.	7.0.0±	_		2.00	1.0	4.33	5.10	1112	925	476	HI-Wall	2,0x2=4,0
Tutorial-Otilic	. 1	70-Pronn	450	12.0	17.0	26.0±1			2.00	1.0	4.33	5.10	1112	36,0	25.8		2.0%2=4.0
Technician Roon-03 106 12.0 21.0 25.0 6.3 7.59 15.7 12.84 7.31 Hi-Wall Technician Roon-02 86 12.0 21.0 25.0 20.0 20.0 20.7 15.9 15.9 15.4 6.3 Hi-Wall Technician Roon-01 86 12.0 21.0 26.0 20.0 <td>_</td> <td>Tutorial-01</td> <td>425</td> <td>12.0</td> <td>17.0</td> <td>26.0+1</td> <td>_</td> <td>43</td> <td>0000</td> <td>i d</td> <td></td> <td></td> <td></td> <td>647</td> <td>076</td> <td>III-W4III</td> <td>1.5x1=1.5</td>	_	Tutorial-01	425	12.0	17.0	26.0+1	_	43	0000	i d				647	076	III-W4III	1.5x1=1.5
Technician Room-02 86 12.0 21.0 22.00 2.0 0.97 0.89 335 244 6.3 lit-wall Technician Room-01 86 12.0 21.0 25.0 0.97 0.89 335 244 6.3 lit-wall Professor Room-04 86 12.0 21.0 26.0+1 55±5% 3 2.00 2.0 0.87 0.89 300 209 42 H-Wall Professor Room-03 150 12.0 21.0 26.0+1 55±5% 3 2.00 2.0 0.57 0.95 377 281 42 H-Wall Assistant Professor Co. 40 12.0 26.0+1 55±5% 3 2.00 2.0 0.97 380 2.6 3 H-Wall Assistant Professor Co. 40 12.0 26.0+1 55±5% 12 2.00 2.0 2.73 2.94 80 4.3 14-Wall Assistant Professor Co. 31 12.0 2.0		Technician Room-03	108	12.0	21.0	76.0±	+	2	00'5	50	6,32	7.59	1557	1284	731	Hi-Wall	2.0x4±B.0
Professor Room-01 86 12.0 21.0 26.0±1 25.5% 2.00		Technician Room-02	98	12.0	21.0	76 041	201070	9 1	2.00	2.0	26.0	68'0	335	244	63	Hi-Wall	1.0x1=1.0
Professor Room-04 168 12.0 22.0 2.00 2.0 0.57 0.54 190 134 42 H·Wall Professor Room-03 150 12.0 21.0 2.00 2.0 0.57 0.56 377 281 62 H·Wall Assistant Professor-05 400 12.0 26.041 554.5% 3 2.00 2.0 1.07 0.96 377 281 63 H·Wall Sub Talal 10582.0 12.0 26.041 554.5% 12 2.00 2.03 2.73 2.94 809 645 55 H·Wall Second Floor 10.0 1.20 2.0 2.0 2.0 2.73 2.94 809 645 2.52 H·Wall Associate Professor 312 12.0 2.0.1 55.5% 14 2.00 0.5 3.42 4.24 153 1345 252 H·Wall 11 Associate Professor 32 12.0 2.0 3.42		Technician Room-01	86	12.0	21.0	26.041	0404040	4 (00.2	2.0	0.82	89.0	300	209	42	Hi-Wall	1.0×1=1.0
Professor Room-03 150 12.0 21.0 22.0 1.07 0.96 377 281 63 Hi-Wall Assistant Professor-05 400 12.0 21.0 25.5% 3 2.00 2.0 1.07 0.93 380 2.69 645 25.5% 12.0 26.0±1 55.5% 12 2.00 2.0 1.07 0.93 380 2.69 645 25.5 Hi-Wall Second Thora 5bc Dat 2.0 2.0 2.0 2.03 2.94 909 645 25.2 Hi-Wall Second Floor 312 12.0 2.0 2.0 2.03 2.94 909 64.3 25.5 Hi-Wall 1 Associace Professor 312 12.0 2.0 12.0 2.0	_	Professor Roam-04	168	12.0	21.0	76.041	-	7	2.00	0.2	0.57	0.54	190	134	42	Hi-Wall	1.0x1=1.0
Assistant Professor-O5 400 12.0 2.00 2.00 2.00 2.00 2.00 2.03 380 269 645 55-5% Hi-Wall Sub Total Sub Total 10582.0 1.20 2.00 2.00 2.03 2.73 2.94 809 645 12.0 Hi-Wall Second Floor 312 1.2 2.00 2.0 2.73 2.94 809 64.3 12.0 Hi-Wall Associate Professor 312 1.2 2.0.4 2.00 0.5 4.32 4.24 4.24 1533 1345 252 Hi-Wall 1 Boys Common Roam 323 12.0 2.0.4 55.5% 14 2.00 0.5 3.42 3.61 3.62 3.42 3.61 3.62 4.14.Wall 1 Director's Roam 323 12.0 2.0 2.0 4.1 2.00 4.1 2.00 4.1 4.25 3.42 3.62 3.62 4.1 4.1 4.23		Professor Room-03	150	12.0	21.0	26.0+1	_	7 0	2.00	2.0	1.07	96.0	377	281	63	Hi-Wall	1.0x1=1.0
al 10582,0 12 2.00 2.0 2.73 2.94 809 645 252 Hi-Wall dessor 312 12 21.0 21.0 25.5% 12 8 8 4.32 4.24 1530 1345 252 Hi-Wall 1 oom 21.0 21.0 26.0±1 55±5% 1 2.00 4.1 1.45 1.31 518 853 294 Hi-Wall 1 om 21.0 21.0 26.0±1 55±5% 4 2.00 4.1 1.45 1.31 518 89 4.1 1.45 1.31 518 89 4.1 4.20 4.24 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.25 4.24 4.24 4.25 4.24 4.24 4.24 4.24 4.24 4.24		Assistant Professor-05	400	12.0	21.0	26041	-	2 5	2.00	2:0	1.07	0.93	380	268	63	Hi-Wall	1,0x1=1.0
al 10582,0 12 25.0±1 55±5% 12 68.7 95.4 26556.1 21084.6 7773.0 7773.0 Ifessor 312 12 21 25.0±1 55±5% 12 8 8 4.32 4.24 1530 1345 252 Hi-Wall com 323 12.0 21.0 26.0±1 55±5% 14 2.00 0.5 1.45 1.31 518 59 Hi-Wall 1 on 215 22.0 25.0±1 55±5% 4 2.00 2.0 1.45 1.31 518 59 Hi-Wall 1 on 215 22.0 25.0±1 55±5% 4 2.00 2.0 1.45 1.31 518 59 Hi-Wall 1 saza 12.0 21.0 25.0 2.0 2.14 0.98 4.09 292 84 Hi-Wall 1 saza 12.0 25.0 2.0 2.14 0.98	1					200	P	77	7.00	2.0	2.73	2.94	806	645	252	Hi-Wall	1.0x3=3.0
flessor 312 12 21 25.0±1 55±5% 12 8 8 4.32 4.24 1530 1345 7773.0 non 323 12.0 21.0 26.0±1 55±5% 14 2.00 0.5 3.42 3.51 1053 853 294 Hi-Wall non 215 12.0 21.0 26.0±1 55±5% 4 2.00 4.1 1.45 1.31 518 392 84 Hi-Wall non 215 12.0 21.0 26.0±1 55±5% 4 2.00 2.0 1.45 1.31 518 392 84 Hi-Wall non 215 12.0 26.0±1 55±5% 9 2.00 2.0 1.14 0.98 4.09 392 84 Hi-Wall non 21.0 21.0 26.0±1 55±5% 9 2.00 2.0 1.14 0.98 4.09 2.92 6.3 Hi-Wall non		Sub Total	10582,0								1						
dessur 312 12 21 25.0±1 55±5% 12 8 6.32 6.32 6.24 1533 1345 252 Hi-Wall dom 323 12.0 21.0 26.0±1 55±5% 4 2.00 6.5 3.42 3.61 1053 B53 294 Hi-Wall om 21.0 21.0 26.0±1 55±5% 4 2.00 4.1 1.45 1.31 516 392 84 Hi-Wall om 21.5 12.0 21.0 26.0±1 55±5% 9 2.00 2.0 1.14 0.98 409 292 84 Hi-Wall state 12.0 21.0 26.0±1 55±5% 9 2.00 2.0 2.15 2.24 655 503 199 Hi-Wall		Second Floor									199.7	95.4	76556.1	21894.6	7773.0		
oam 323 12.0 21.0 26.0±1 55±5% 14 2.00 0.5 3.42 3.61 1053 B53 294 Hi-Wall om 21.0 21.0 26.0±1 55±5% 4 2.00 4.1 1.45 1.31 518 392 84 Hi-Wall om 21.5 21.0 26.0±1 55±5% 9 2.00 2.0 1.14 0.98 409 292 63 Hi-Wall 32.3 12.0 21.0 26.0±1 55±5% 9 2.00 2.0 2.15 2.24 655 503 199 Hi-Wall		Associate Professor	312	12	21	26.0±1	55±5%	12	8	00	4.32	4.24	1533	1345	252	Hi-Wall	1.0×2=2.0
194 12.0 21.0 26.0±1 55±5% 4 2.00 6.5 3.42 3.61 1053 B53 294 Hi-Wall om 21.0 26.0±1 55±5% 4 2.00 4.1 1.45 1.31 516 392 84 Hi-Wall 32.3 12.0 21.0 26.0±1 55±5% 9 2.00 2.0 1.14 0.96 409 292 63 Hi-Wall 32.3 12.0 21.0 26.0±1 55±5% 9 2.00 2.0 2.15 2.24 655 503 199 Hi-Wall	_	Boys Common Room	323	12.0	210	75.04.7	0			1	T						1.5x2=3.0
ons 215 12.0 21.0 25.0±1 55±5% 4 2.00 4.1 1.45 1.31 518 392 84 Hi-Wall 32.3 12.0 21.0 26.0±1 55±5% 3 2.00 2.0 2.15 2.24 655 503 189 Hi-Wall	1	Clerical Room	194	12.0	21.0	1 E C C C C C C C C C C C C C C C C C C	05.0100	1.	2.00				1053	853	294	Hi-Wall	2.0x1=2.0 1.5x1=1.5
323 12,0 21,0 26.0±1 55±5% 9 2.00 2.0 2.15 2.24 655 503 189 Hi-Wall		Director's PA Room	215	12.0	210	36 0.4	20100	4	2.00	4.1	1.45	1.31	\$18	392	90	Hi-Wall	1501-15
2.00 2.15 2.24 655 503 189 H;Wall		Director's Room	323	12.0	21.0	250.027	204040	7	2.00	2,0	1.14	86.0	409	292	63	Hi-Wall	1501-15
					2011	TEO.OZ	0,0,00	~	2.00	2.0	2.15	2.24	655	203	189	Hi-Wall	2 Sele2 6

Cirls Common Room	410	17.0	21.0	70,041		41	2,00	TI	4,09	4.17	1350	1771	667	H1-IVER	Z.UEZ=4.D
Lecture Hall-01	998	12.0	17.0	26.0-1	55-5%	62	2.00	0.5	5.33	11.06	2239	1917	1054	Tower Unit	3.0x4=12.0
	581	12.0	17.0	26.0±1	5525%	38	2.00	0.1	3.39	6.48	1377	1211	265	TowerUnk	3.0x1=3.0 3.5x1=3.5
Professor Room-01	215	12.0	21.0	26.0±1	5545%	61	2.00	0.93	1.20	66.0	437	299	63	Hi-Wall	1.5x1=1.5
Professor Room-02	215	12.0	21.0	26.0±1	5545%	3	2.00	0.93	1.20	66.0	437	565	63	Hi-Wall	1.5x1=1.5
Professor Room-03	150	12.0	21.0	26.0+1	5545%		2.00	2.0	1.07	0,93	380	269	63	HI-Wall	1.0x1=1.0
Professor Room-04	168	12.0	21,0	26.0±1	55-5%	г	2.00	2.0	1,07	96'0	377	281	63	Hi-Wall	1.0x1=1.0
Research Lab-1	1140	12.0	21.0	26.0±1	5545%	18	2,00	2.00	95'9	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
Research Lab-2	1140	12.0	21.0	26,0±1	55.5%	18	2.00	2.00	6.56	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
Research Lab-3	1140	12.0	21.0	26.0±1	55.5%	100	2.00	2,00	6.56	6.10	2336	1881	378	Tower Unit	3.5xZ=7.0
Research Lab-4	1140	12.0	21.0	26.0±1	5515%	18	2.00	2.00	0.56	6.10	2338	1881	378	Tower Unit	3.5x2=7.0
Technician Room-01	98	12.0	21.0	26.0±1	55±5%	2	2,00	2.00	0.57	0.54	190	134	42	Hi-Wall	1.0x1=1.0
Technician Room-02	98	12.0	21.0	26.0±1	85±5%	7	2,00	2.00	0.82	0.68	300	209	42	Hi-Wall	1.0x1=1.0
Technician Room-03	108	12.0	21.0	26.0±1	55±5%	3	2.00	2,00	0.97	0.89	332	244	63	Hi-Wall	1,0x1=1.0
Technician Room-04	66	12.0	21.0	26.0±1	55±5%	3	2.00	2.00	0.82	0.76	267	176	63	Hi-Wall	1.0x1=1.0
Tintorial-01	425	12.0	17.0	26.0±1	55±5%	43	2.00	0.50	6.32	7.59	1557	1284	731	Hi-Wall	2.0x4=8.0
Tuturial-02	420	0.51	17.0	76,0€1	55±5%	82	2.00	1.00	4.33	5.10	1112	925	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5
Tutorial-03	420	12.0	17.0	26.0±1	55±5%	28	2.00	1.00	4.33	5.10	1112	925	476	Hi-VPall	2,0x2=4.0 1,5x1=1.5
DRY CANTEEN	08	12,0	21.0	26.0±1	5545%			W)						Hi-Wall	1.0x1=1.0
Sub Total	10356.0								0.08	63.0	24995.2	20234,6	6482,0		
Third Floor															
Tutorial-07	430	12.0	17.0	26.0±1	55,55%	30.00	2.00	1.0	5.29	6.03	1483	1295	510	Hi-Wall	2,0x3=6,0
Tutorial-08	430	12.0	17.0	26.0±1	55.5%	30.00	2.00	1.0	5.29	6.03	1483	1295	510	HI-Wall	2.0x3=6.0
Tutorial-09	265	12.0	17.00	26.0±1	55_5%	58.00	2.00	3.0	7.37	9.56	1576	1369	986	H-Wall	2.0x2=4.0 1.5x4=6.0
Tuorial-10	949	12.0	17.0	26.0±1	55.5%	30.00	2.00	1.0	5.14	5.77	1415	1155	510	Hi-Wall	1.5x4=6.0
Associate Professor-01	162	12.0	21.0	26.0±1	55±5%	3	2.00	1.23	1.52	1.40	581	250	63	Hi-Wall	1.5x1=1.5
Assistant Professor-01	801	12.0	21.0	26.0±1	55±5%	62	2,00	T.0	1.80	1.75	708	210	63	Hi-Wall	2.0x1=2.0
Assistant Professor-02	410	12.0	21.0	26.0=1	55.5%	12	2.00	2.0	3.08	3.12	696	744	252	Hi-Wall	1.0x4=4.0
Associate Professor-04	581	12.0	21.0	26.041	\$5=5%	12	2.00	2.0	3,74	3.85	1269	1134	252	Hi-Wall	1.0x4=4.0
Assistant Professor-03	108	12.0	21.0	26.0±1	\$5±5%	2	2.00	2.0	0.85	0.69	314	215	42	[fi-Wall	I.0x1=1.0
Assistant Professor-04	108	12.0	21.0	26,041	55±5%	2	2.00	2.0	0.85	69.0	31.4	215	42	Hi-Wall	1.0x1=1.0
Associate Professor-02	162	12.0	21.0	26.011	55±5%	3	2.00	2.0	1.34	1.11	502	363	63	Hi-Wall	1.5x1=1.5
Research Lab-1	1140	12.0	21.0	Z6.0±1	55.5%	119	2.00	2.0	95.9	6.10	2330	1881	378	Tower Unit	3.5x2=7.0
Research Lab-2	1140	12.0	21.0	26.0•1	55±5%	18	2.00	2.0	6.56	01.9	2338	1881	378	Tower Unit	3.5×2=7.0
Research Lab-3	1140	12.0	21.0	26.0±1	55±59%	18	2.00	2.0	6.56	6.10	2338	1881	378	Tower Unit	3.5×2×7.0
Clerical Room	194	12.0	21.0	26.0±1	55±5%	ক	2.00	4.12	1.45	1:31	518	392	84	H-Wall	1.5kl=1.5
Lecture Hall-01	968	12.0	170	94 AL	1000		0 0 1	-							

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5,24	5.23	5.22	5.21	5.20	5.19	5.10	5.17	5.16	5.15	5.14	5.13	5.12	5,11	5.10	5,9	S.B	5.7	5.6	Şn Sn	5,4	5.3	5.2	5.1	л		4.25	4.24	4.23	4.22	4.21	4.20	4.19	4.18	4,17
DRY CANTEEN	Tutorial-03	Tutorial-02	Tutorial-01	Technician Room-04	Technician Room-03	Technician Room-02	Technician Room-U.I.	Research Lab-4	Research Lab-3	Research Lab-2	Research Lab-1	Professor Room-04	Professor Room-03	Professor Room-02	Professor Room-01	Library	Lecture Hall-01	Girls Common Room	Director's Room	Director's PA Room	Cierical Room	Boys Common Room	Associate Professor	Fourth Floor	Sub Total	Assistant Professor-05	Professor Room-03	Professor Room-04	Technician Room-01	Technician Room-02	Technician Room-03	Tutorial-01	Tutorial-02	Tutorial-03
80	420	420	425	97	108	86	86	1140	1140	1140	1140	168	150	215	215	581	968	410	323	215	194	323	312		10582.0	400	150	168	86	86	108	425	420	420
12.0	12.0	12.0	12.0	12.0	12,0	12.0	12.0	12.0	12.0	12.0	12.0	12,0	12.0	12,0	12.0	12.0	12,0	12.0	12.0	12.0	12,0	12.0	12			12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
21.0	17.0	17.0	17.0	21.0	21.0	21.0	21,0	21.0	21.0	21.0	21.0	21.0	21,0	21.0	21.0	17.0	17.0	21.0	21.0	21.0	21.0	21.0	21			21.0	21.0	21.0	21.0	Z1.0	21.0	17.0	17.0	17.0
Z6.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0+1	26,0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0±1	26.0+1	26.0±1	26.0±1	26.0±1	26.0±1			26.0+1	26.0±1	26.0±1	26.0±1	26.0±1	26.0 1	26.0±1	26.0±1	26,0±1
55+59%	55±5%	55±5%	55±5%	55±5%	55±5%	55±5%	\$5±5%	SS±5%	55±5%	55±5%	55±5%	55±5%	5515%	55±5%	55+5%	\$5±5%	55±5%	55±5%	55±5%	55±5%	55±5%	55+5%	55±5%			965-55	55±5%	55±5%	55±5%	55±5%	55-5%	55±5%	55±5%	554546
	28	28	43	w	Lal	2	2	18	18	18	1.9	ω	3	3	3	35	62	14	9	u	4	14	12			12	ניו	J	2	2	u	43	28	B2
	2,00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	Z.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	88			2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	1.00	1.00	0.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.0	2.0	0.93	0.90	1.0	0.5	1.0	2.0	2.0	4.1	0.5	80			2.0	2.0	2.0	2.0	2.0	2.0	0.5	1.0	1.0
	4.33	4.33	6,32	0.82	0.97	0.82	0.57	6.56	6.56	6.56	6.56	1.07	1.07	1.20	1.20	5.39	9.11	4,09	2.15	1.14	1.45	3.42	4.32		88.7	2.73	1.07	1.07	0.57	0.82	0.97	6,32	4.33	4.53
	5.10	5.10	7.59	0.76	98.0	0.68	0.54	6.10	6.10	6,10	6.10	0.96	0.93	0,99	0.99	6.48	11.06	4.17	2.24	0.98	1.31	3.61	4.24		95.4	2.94	0.93	0.96	0.54	0.68	0.89	7.59	5.10	5,10
	1112	1112	1557	267	335	300	190	2336	2338	2338	2338	377	360	4.37	437	1377	2239	1356	655	409	518	1053	1533		26556.1	809	08¢	377	190	300	335	1557	1112	2117
	925	925	1284	176	244	209	134	1681	1881	1881	1881	281	268	299	299	1211	1917	1151	503	292	392	853	1345		21884.6	645	268	281	134	209	244	1284	925	925
	476	476	73L	63	63	42	42	378	370	378	376	63	63	63	63	595	1054	294	189	63	84	294	252		7773.0	252	63	63	42	42	63	731	476	476
Hi-Wall	HJ-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	H-Wall	Tower Unit	Tower Unit	Tower Unit	Tower Unit	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Tower Unit	Tower Unit	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-wati			Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall	Hi-Wall
1.0×1=1.0	2.0x2=4.0 1.5x1=1.5	2.0×2=4.0 1.5×1=1.5	2.0x4=8.0	1.0×1=1.0	1,0x1=1.0	L0x1=1.0	1.0x1=1.0	3.5x2=7.0	3.5x2=7.0	3.5x2=7.0	3.5x2=7.0	L0x1=L0	1.0x1=1.0	1.5x1=1.5	1.5x1=1.5	J.0x1=J.0 J.5x1=J.5	3.0×4=12.0	2.0x2=4.0	2.5x1=2.5	1.5x1=1.5	1.5×1=1.5	1.5xZ=3.0	1.0x2=2.0 1.5x2=3.0			1.0x3=3.0	1.031=1.0	1.0x1=1.0	1.0x1=1.0	1.0x1=1.0	1.0x1=1.0	2.0x4=8.0	2.0x2=4.0 1.5x1=1.5	1,5x1=1,5

8		10256.0							-	80.0	0.50	7.00447	0.50707	5		
Sub Total		10220.0													100000000000000000000000000000000000000	2 0×2=4.0
FUITH Floor				<	_	70,000	30.00	2.00	1.0	5.56	6.24	1608	1408	510	Hi-Wall	2.5x1=2.5
Tutorial-07		430	12.0	0/1		70 V 0 V 0 V 0 V 0 V 0 V 0 V 0 V 0 V 0 V	30.00	2.00	1,0	5.56	6.24	1608	1408	510	Hi-Wall	2.0x2=4.0 2.5x1=2.5
Tutorial-08		430	12.0	0./1	110.07	700	a u	0	-	7.7522	9.84568	1747.241	1524.08	986	H-Wall	2.0x2=4.0 1.5x4=6.0
Tutorial-09		592		11	140.dx	004000	3		4	22.6	6.00	1602	1325	510	Hi-Wall	1.5x4=6.0
1		646	12.0	17.0	26.0±1	55+5%	30.00	2.00	0.1	2.55	0.0	BCA	563	63	Hi-Wall	1.5x1=1.5
UTOTINI-TO	Free 0.1	167	12.0	21:0	26.0±1	55.5%	27	2.00	1.25	797	T-40	240	739	63	Hi-Wall	2.0x1=2.0
Associate Professor un	Olessor-u.	200	900	21.0	26.0+1	\$5±5%	E	2.00	F.0	1.86	1.80	740	000	250	Hi-Wall	1.0x4=4.0
Assistant Professor-01	Sessor-01	108	100	21.0	26,0+1	_	12	2.00	2.0	3.34	3.32	1087	200	252	Hi-Wall	1.0x4=4.0
Assistant Professor-uz	olessor-uz	075	120	21.0	26.0+1	55+59%	12	2.00	2.0	4.11	4,15	7697	244	62	Hiswall	1.0x1=1.0
Associate Professor-09	olessor-04	100	120	21.0	26.0+1	55+5%	7	2.00	2.0	0.92	0.74	242	667	45	Hi-Well	1.0x1=1.0
Assistant Professor-03	ofessor-03	100	12.0	21.0	26.0+1	_	2	2.00	2.0	0.92	0.74	345	467	75	Hi-Wall	1.5x1=1.5
Assistant Professor-04	ofessor-04	163	12.0	21.0	26.0±1	_	m	2.00	2.0	1.44	1.19	549	400	000	Hi-Wall	1.5x1=1.5
Associate Professor-02	ofessor-02	701	1200	0.00	14.040	_	18	2,00	2,0	7.29	99'9	2668	2181	373	Tower Unit	3.5x2=7.0
Research Lab-1	b-1	1140	15.0	F17	1000	_		2.00	2.0	7.29	6.66	2668	2181	378	Hi-Wall Tower Unit	1.5x1=1.5 3,5x2=7.0
Research Lab-2	h-2	1140	12.0	21.0	1En.02				00	7 30	4 66	2668	2181	378	Hi-Wall Tower Unit	1.5x1=1.5 3.5x2=7.0
Research Lab-3	P-3	1140	12,0	21.0	26.0±1	55+5%	18	2.00	2.0	77.7		7.00	CAL	0.4	Ni-Wall	1.5x1=1.5
			000	0.10	26.0+1	55+59%	4	2.00	4.12	1.58	1.40	4/6	200		Townson Inch	15
Clerical Room	un.	194	17.0	7	20.02	-	L	2.00	0.5	9.72	11.53	2519	2171	1054	10Wer Unit	+
6,16 Lecture Hall-01	10-1	896	12.0	12.0	76.0±1	22+270	1	2014		97.	100	1224	1035	476	Hi-Wall	7.012=4.0
-		420	12.0	17.0	26.0±1	55±5%	28	2.00	1.5	4.60	10.0	1421				2,0x2=4.0
-		007	000	17.0	26.0+1	55159%	26	2.00	1.0	4.60	5.31	1234	1035	476	Hi-Wall	1.5x1=1.5
6.18 Tutorial-02		450	T Eve			-	-	2.00	4	659	7.79	1680	1396	731	H-Wall	2.0x4=8.0
Turnial.01		425	12.0	17.0	26.0±1	-		2000	0 0	104	0.94	366	272	63	Hi-Wall	1,0x1=1.0
-	Down-D3	108	12.0	21.0	26.0±1	-	1	7.00	7.7	200	0.73	324	233	24	Hi-Wall	1.0x1=1.0
+	Poster 02	86	12.0	21.0	26.0±1	1 55+5%		2.00	2.0	10'0	2.0	215	156	42	H-Wall	1.0x1=1.0
-	Room-02	90	12.0	21.0	26.0±1	1 5515%		2.00	2.0	0.63	000	707	275	63	Hi-Wall	1.5x1=1.5
17.0	Koom-01	169	120	21.0	26.0±1	1 55±5%	63	2.00	2.0	1.17	5	074	Zuz	63	Hi-Wall	1.5x1=1.5
6.23 Prolessor Room-U4	toom-01	TOO	000	210	25.0+1	1 5515%		2.00	2.0	1.17	1.00	174	100	263	Hi-Mall	1.0x3=3.0
	Room-03	150	12.0	21.0	26.0±1			2.00	2.0	2.98	3.13	925	06/	707		
6.25 Assistant P	Assistant Professor-Up	400	16.0			_						0 00000	+	7773.0		
1		10593.0							-	95.5	100.5	0.91962	7.70DE7	+		
no.	Sub 10tal	ACAUTA TO							-	0.074	540.4	1877157	7 129135.2	2 42765.0		
										513.0	-	1017 101	н	-		

		3.1	co		0.5	2 23	4.5	1 N	2.2	2.1	12		1.5	-4	L	1.2	1.1	1			S, WO.	
Grand Total	Sub Total	LIBRARY	Second Floor	Sub Total	BACK Office	Teconical Stair	Server Room	MESTING	INDEXING	AUDIO VISUL ROOM	First Floor	5ub Total	PALibrarian	General Administration	Libratian	READING ROOM	CAFETERIA AREA	Ground Floor		(A)	CONDITIONED SPACE	
39398.0	19884.0	18684		9674.0	500	269	269	1028	5219	1453		10840.0	150	365	215	7910	2200		SQ.FT.	(B)	ACTUAL AIR CONDITIONED AREA	
		12.0			12.0	12.0	12.0	12.0	12.0	12,0			12.0	12.0	12.0	12,0	12.0		Ę	3	HEIGHT	BASIS
		21.0			21.0	21.0	0.0	17.0	17.0	17.0		200	21.0	21.0	17.0	17.0	17.0		VENTILATION RATE CFM/PERSON	(D)	INSIDE DESIGN CONDITION	BASIS OF DESIGN
		26.0.1											26.0+1	26.0±1	26.0+1	26.0•1	26.0±1		(C)	(E)	IGN CON	
		25±5%											55±5%	55+5%	55±5%	55±5%	55±5%		2	(F)	NOLLIG	
		250.00			10	12	0	24	116	56			Ç.s	5.00	9.00	140,00	136.00		NOS.	ତ	OCCUPANCY	
		2.00			2.00	2.00	2.00	2,00	2.00	2.00			2.00	2.00	2,00	2.00	2.00		w/sq.FT.	(H)	LIGHT LOAD	
		0.5			2.0	2.0	18.6	1.0	1.0	1.0			2.0	2.0	0.93	T.0	1,0		KW.	3	EQFT LOAD	
212.1	65.3	85.31		55.9	2.76	2,54	3.03	6.04	27.62	13.91		70.9	1.13	2.54	1.74	47.26	18.21		ŤR	(L)	SUMMER LOAD	
217 1	83.9	83.89		57.2	2,73	2.81	2.39	6.09	28.33	14.84		72.0	1,08	2.25	1.94	43.12	23.34		Ħ	0)	MONSOON LOAD	DESIGN D.
77615.7	29010.5	29811		18605.8	996	723	1375	2011	9995	4606		23198.9	417	974	515	17178	4114		CPM	R	SUMMER DEHUMIDIFIED CFM	DESIGN DATA SUMMARY
616979	25672.1	25672		16320,8	690	575	1290	1717	7709	4347		19676.4	362	823	458	14282	3712		Mad	2	MONSOON DEHUMIDIFIED CFM	RY
140570	5250.0	5250		3794.0	210	252	0.0	408	1972	952		5013.0	63	105	153	2380	2312		СЕМ	3	REQUIRED FRESH AIR QTY	
		Package Unit Hi-wall			Hi-wall	Hi-wall	Hi-wall	Tower Unit	Package Unit	Tower Unit			Hi-wall	Hi-wall	Hi-wall	Package Unit Tower Unit	Tower Unit			TYPE	ND AOOUNE	
		17.0x5=85.0 1.0x4=4.0			1.5x2=3.0	1.5x2=3.0	1.5x2=3.0	3.0x2=6.0	17.0xZ=34.0	4.0m4=16.0			1.5x1=1.5	1.5x2=3.0	2:0x1=2.0	11.0x2=22.0 4.0x6=24.0	3.0x8=24.0			CTRACTO	INDOOR UNIT SELECTED	

	1.2 En	-	1.1	4	- G			5, NO. CO	
	Entrance Lobby		Selliller Trans	minar Uall	Grnund Floor		(A)	CONDITIONED SPACE	
	695		1,00	1700		SQ.FT.	(B)	ACTUAL AIR CONDITIONED AREA	
	0.71		44.00	12.0		Ę	(3)	HEIGHT BASIS	
	17.00	447		17.0		MIN VENTILATION RATE CFM/PERSON	(0)	HEIGHT INSIDE DESIGN CONDITION	HEAT LUAU
	740.07	360.1		26.0±1		TEMP	(E)	GN COND	SUMM
	207070	55.50		55+5%		EA.	(F)	NOLION	HEAT LOAD SUMMARY FOR SEMINAR HALL F DESIGN
	10,00	20.00		150.00		NOS.	(6)	OCCUPANCY	
	Live	200		1.50		W/SQ.FT.	(H)	LIGHT LOAD	ARU DAL
		0.5		5.0		KW	3	EQPT LOAD	F
364		13.75		22.66		TR	[]	SUMMER LOAD	
42.7		17.10		25.04	-	TR	9	MONSOON SO	
9866.2		3745		1710		CFM	Œ	MONSOON LOAD DATA SUMMER DEHUMIDIFIED CFM	
9135.4		3743		7000	6303	CPM	5	MONSOON	
4020.0		1470		0000	7550	CFM	(90)	REQUIRED FRESH AIR QTY	
		Ductable	Hiwall	THEORY	Ductable		3411	INDOOR	-
		8.5 X 1 + 5.5 X 1	1.5%2		5.5 X4		(TRXQTY)	INDOOR UNIT SELECTED	

EQUIPMENT SELECTION

Based on the above environmental conditions, the air conditioning load is designed independently for

- 1. College Building I
- 2. College Building II
- 3. Library Building
- 4. Seminar Hall

To meet the above referred load, we have following options:

Water-cooled water chilling machines with Screw Compressors

In this system the main plant is located in the plant room within the building or outside the building. The cooling towers are located on a well-ventilated place, external of the building and the AHUs are housed in the AHU Rooms or are ceiling suspended. This system can sustain the high ambient temperature. Suitable for any configuration using machines from 100TR to 400 TR. Depending on various capacities IKW /TR is 0.65 to 0.8 for compressor and will be more with other equipment such as AHU, condenser pump, chill water pump and cooling tower etc.

The disadvantage with the system is the high requirement of soft water. The cost for water and softening plant for such a high requirement of water is very high. As such there is a crisis of water. Hence due to the water requirement the capital cost and running cost increase for this scheme.

2. Air-cooled water chilling machines with Screw Compressors

In this system the main plant is located on the terrace of the building or outside of the building. There are NO cooling towers in the system. Suitable for any configuration using machines from 100Tr to 400Tr. IKW /TR are 1.2 to 1.5. IKW will be more with other equipment such as AHU, chill water pump etc. IKW per TR will increase as per the increased ambient temperature.

The disadvantage with this system is to select a higher nominal capacity equipment to meet the derating factor due to ambient. Hence the running cost is high.

3. Air-cooled Split Units

In this system each indoor unit has individual outdoor unit with single or multi compressors, depending on the capacity. The indoor unit can be of different types such as Hi-wall, Floor standing tower, cassette, and ductable units.

The non-ductable split units are available with rotary compressors or scroll compressors. Ductable split units are available with scroll compressor.

- A. <u>Non-ductable split unit with rotary compressor</u> These units has one to one connection of indoor to outdoor units. The refrigerant pipe circuits are separate for each compressor. The biggest limitation of this type unit is the refrigerant pipe length. The most of the time the permissible refrigerant pipe length is 7 meters. Exceeding this permissible length, the unit will attract denalion factor. The denaling factor can be more than 25% upto the pipe length of 12 meters. This results in an excessive wastage of energy which is such a precious commodity and thereby excessive electricity bills.
- B. Non-ductable split unit with scroll compressor These types of compressors are popular due to its efficiency and versalility. These units also have one to one connection of indoor to outdoor units. In this case the refrigerant pipes are separate for each compressor. The biggest advantage of this unit is the refrigerant pipe length. The permissible refrigerant pipe length is 50 meters (70 meters equivalent length). Due to the scroll technology the refrigerant can be pump in to the refrigerant pipe effectively such a high length.

4. Variable Refrigerant Volume/Flow Air Cooled System

Variable Retrigerant Volume / Flow Systems were introduced in Japan more than 20 years ago, have become popular in many countries including India. VRV/VRF systems are used in approximately 50% of medium sized commercial buildings and one-third of large commercial buildings.

The following advantages are there:

 The units will consist of high efficiency air-cooled scroll microprocessor controlled compressors with all the latest materials and technology.

- VRV/VRF systems are flexible and diverse with a single condensing unit connected to up to 32 indoor units thus combining multiple condensing units for up to several hundred tons. Overall COP and SEER remain high due to effective zone control.
- VRV/VRF systems use Hydro fluorocarbon (HFC), non-CFC containing refrigerant with Zero Ozone Depletion Potential (ODP) and are 15% more efficient than R-22 systems.
- Saving in electric energy even on part load.
- . IKW /TR is 1.1 including indoor. IKW per tone decreases on the part load.
- Pipe length from indoor to outdoor units is approx, 150 m.

The different aspects for this project considering different HVAC schemes are summarized as below.

S. Area	HVAC Schemes			
No	Split unit Rolary Comp	Spllt unit Scroll comp	VRV/VRF	
1 College Building -I & II	Advantage: Individual control of the units. Flexibility in the installation of the indoor units. In case of breakdown of compressor particular units will be non operational. Hence rest of the units can be operational. However, no diversity available. Floor standing tower type indoor units are available. Permissible length of the refrigerant pipe is only 8mt. after which the de-rating starts in account of pipe length. The units are available with almost all manufacturers The installation cost is low Disadvantage: Permissible refrigerant piping is upto 8 mtr. More number of outdoor	Advantage: Individual control of the units. Flexibility in the installation of the indoor units. In case of breakdown of compressor particular units will be non operational. Hence rest of the units can be operational. However, no diversity available. The permissible refrigerant pipe is 50 rmtr (Effective length 70rmt) Derating factor is low. Floor standing lower type indoor units are available. Units are available with Daikin, Mitsubishi, LG, manufacturers in India.	Advantage: Almost negligible derating lactor. Long length of refrigerant pipe permissible Eco friendly refrigerant. Less number of outdoor units, hence less requirement of space. Saving in energy a part load. Diversity in the load possible. The units are available with almost all manufacturers Individual control of the units. Flexibility in the installation of the indoor units. Disadvantage:	

- requirement.
- High derating in the cooling capacity.
- CFC base refrigerant.
- More point of operation & maintenance
- Handling of condensate drain pipe in case of floor standing tower type indoor units is difficult because the pipe has to run at lower then floor level.

Looking at the building the indoor & outdoor units can be located at distances of 15 mtr to 50 mtr, depending on the different areas of the floor. These lengths of piping are calculated in view of different locations available to place the outdoor units. Please refer the scheme drawing no SUR-01.

The number of outdoor units shall be approximately 632 nos both the building.

- More number of outdoor units hence more space requirement.
- © CFC best refrigerant.
- More point of operation
 maintenance
- These units are available with some manufacturer
- The installation cost is comparatively high then relary compressor

These units take care of refrigerant piping considering the three available locations to place the outdoor units. The scheme is explain in the drawing no. SUS-01.

The number of outdoor units shall be approximately 632 nos both the building.

There will be approximately 52 nos outdoor units on each (toor.

- lower type indoor units are not available.
- Better skill requirement for maintenance.
- The installation cost is higher than both type spill unit

All the outdoor units can be located at terrace of the respective buildings. This will facilitate a single point operation & maintenance of the compressors. The scheme has been explained in the drawing no. VRF-01.

The number of outdoor units shall be approximately 16 nos both the building.

S.	Area		HVAC Schemes		
No		Spilt unit Rotary Comp	Spilt unit Scroll comp	VHV/VRF	
2	Library Block Scheme drawing	Advantage & Disadvantage:	Advantage & Disadvantage:	Advantage & Disadvantage:	
	no. LIB-	o Same as above	o Same as above	□ Same as above	
		The library is a large indoor volume and indoor ductable units and floor towers are possible, this may be a feasible system. Numbers of outdoor units	Ductable spilt units are considered for bigger areas. Looking at the distance between in the indoor & outdoor units this scheme can be considered.	Number of outdoor units are approximately 6 nos.	
		are approximately 28 nos.	No.of outdoor units are approximately 28 nos.		
3	Seminar Hall Scheme	Advantage: O Same as that above.	Advantage: D Same as that above.	Advantage: O Same as that above Disadvantage:	
	drawing no. SCM- 01	Disadvantage:	Disadvantage: Same as that above.	o Same as that above Floor standing towers	
		Only few units can be used.	Ductable units can be used.	units are not in use in this scheme. So VAF/VRV system can be used.	
		Number of outdoor units are approximately 8 nos.	Number of outdoor units is approximately 8 nos.	Number of outdoor units are approximately 2 nos.	

Recommendation of schemes:

Keeping all the above factors in mind our recommendation of air-conditioning schemes for various buildings are as follow:

1. College Building & &ll

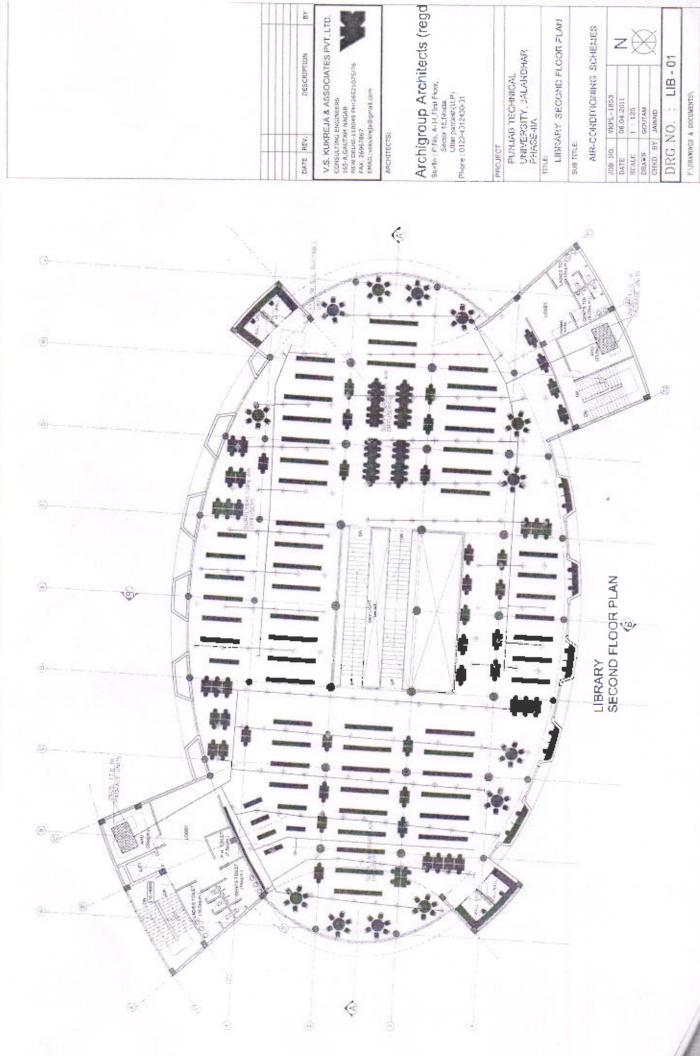
A first preference, Air Cooled Variable Retrigerant Volume/Flow machines may be installed for these buildings. As a alternative spilt units with scroll compressor may be installed.

2. Library Bullding

Non ductable and Ductable spilt /air cooled package units with scroll compressor. The spill units with rotary compressor are not suitable since the volume for air-conditioning is large.

Seminar Hall

Non ductable and Ductable spilt /air cooled package units with scroll compressor.



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PUNJAIS TECHNICAL UNIVERSITY, JALANDHAR PHASE-IIA

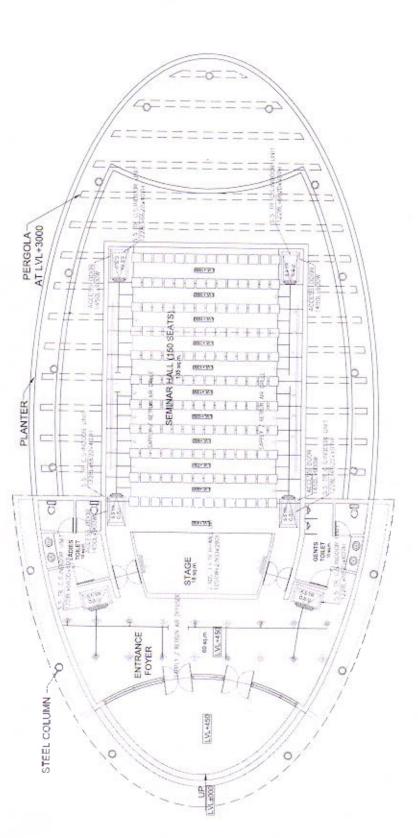
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SUB TITLE: UNIVERSITY, JALANDHAR PUNJAB TECHNICAL PROJECT

Archigroup Architects (regd.)

V.S. KUKREJA & ASSOCIATES PAT LITE

Studio: P.Ne. A-14, First Floor, Sector 15, Notide, Utter perdesh(U.P) Phone: 0120-4312430-31

AIR-CONDITIONING SCHEMES

SEMINAR HALL

DRG.NO.: SEM - 01 1 : 100 GOUTAM SCALE 1 : 100
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CHKD. BY JAVED

JOB NO.

TITLE

Philosophy and a personal

PTU, Phase III

Electrical Design Basis Report

April 27, 2011

Client:
PUNJAB TECHNICAL UNIVERSITY
JALANDHAR

Architect:
ARCHIGROUP ARCHITECTS (REGD.)
A-14, First Floor, Sector 15, Noida
Tel: 0120- 4312431

Consultant; Lirio Lopez Electrical + lighting Design Consultants B 17/4 N.E.A. Rajinder Nagar, New Delhi 110 060 Tel: 011-25745147

[This report covers the Electrical design basis for construction of two colleges, one seminar block, a library and an open air theatre, in phase III of Punjab Technical University, Jalandhar]

DESIGN BASIS REPORT FOR PHASE III ELECTRICAL INSTALLATION WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

OBJECTIVES

The **objective of this report** is to present the design considerations for various elements of the electrical systems and low voltage systems like Electronic Fire Detection, provisions only for Voice & Data Networks, Public Address and Electronic Security systems. This will form a basis for the process of development and approval of the final design for electrical systems to suit Schedules of Quantities.

The **objective of the design** will be to provide a robust, reliable and safe electrical power distribution system based on principles of ready-to-use energy efficient practices and clean energy technologies wherever feasible, and to ensure an easy-to-maintain, cost effective and flexible system in line with the best available in local and international markets.

STANDARDS + CODES

All aspects of design shall conform to relevant portions of the following:

- National Building Code of India 2005
- Energy Conservation Building Code 2007
- Bureau of Indian Standards
- International Electrotechnical Commission
- CPWD General Specifications for Electrical Works (Internal) 2005

ELECTRICAL LOAD ANALYSIS

The electrical load requirement for lighting and small power (e.g. computers, servers, photocopiers, scanners, faxes and other lab equipments), UPS load and HVAC have been estimated empirically based on the areas proposed and considering the approximate load for External Lighting & Plumbing. The conclusions have been tabulated below, while the details for individual buildings are listed later.

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

PRELIMINARY ELECTRICAL LOAD CALCULATION (PHASE III)

S.NO.	DESCRIPTION	Area (Sq.ft)	Emergency load	Total Connected	Diversity	Max. Demand
			In kW	In kW		In kW
1	College Building 1	137,190.00	145.74	1,322.90	0.70	926.0
2	College Building 2	136,275,40	145.17	1,317,90	0.70	922.5
3	Library	49,227.00	506.90	506.90	0.70	354.83
4	Seminar Hall-1	2,853.55	1.78	22.02	0.70	15.42
	OTHER LOADS					
5	External Lighting (Assumed)		35.00			
6	Plumbing Load (Assumed)		80.00			
	Total Load		914.59	3,169.72		2,218.80
	FUTURE PHASE					212 10.00
7	College Building 3	129568,48	137.65	1,249.40	0.70	874.58
θ	College Building 4	132118.92	140.36	1,274.00	0.70	891.60
9	College Building 5	134420.16	142.80	1,296,19	0.70	907.33
10	Seminar Hall-2	4196.40	2.62	32.39	0.70	22.67
11	Seminar Hall-3	2853.55	1.78	22.02	0.70	15.42
12	Plumbing Load (Future)		100.00			
	Grand Total Load		1,439.81	7,043.72		4,930.60
	Simultaneous Utilization Coe	Miclent		,	0.80	3,944.48

The following assumptions have been made in the calculations:

Light and small power load:

2.5w per sft.

AC load (for certain designated areas):

8.0w per sft.

Entire Library load is being considered on generator back-up

For other buildings, 25% of lighting, fans and small power is being considered on generator back up

All lifts in all blocks are considered on generator

Connected Load in Kw Demand Load in kW Connected Load in kVA Demand Load in kVA Taking 85% efficiency		7043.72 3944.48 8804.65 4930.60 5800.71	Emergency Connected Load in kW Emergency Demand Load in kW Emergency Connected Load in kVA Emergency Demand Load in kVA Taking 85% efficiency		1439.81 1007.86 1799.76 1259.83 1482.15
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Recommended Ratings & Configuration:

Transformers 4nos x 1600KVA

DG Sets :

DETAILED BUILDING WISE LOADS

COLLEGE BUILDING-1

S.No	Description	Light & Small Power	A/C Lond	Emer- gency	Leb Equipment	Total Connected	Diversit	Max. Demand
	200	kW	kW	kW	kW	kW		
1	Ground Floor	57.84	95.72	14.46	100.00			kW
2	First Floor	56.49	87.59		700.00	253.56	0.7	177.49
3	Second floor		67,59	14.12	60.00	204.08	0.7	142.65
		56.49	87.59	14.12	60.00	204.08	0.7	
4	Thired floor	56.49	87.59	14.12	45.00			142.85
5	Fourth floor	57.84	06.70		45.00	189.08	0.7	132,35
6	Eifth the	200	95.72	14.46	60.00	213.56	0.7	149.49
u	Fifth floor	57.84	95.72	14.46	45.00	199.56	0.7	
	Other Loads						0,7	138.99
	Lift Load 4nos							
7	(4@15kW)			60.00		60.00	0.7	40 =
	Grand Total					00.00	0.7	42.0
	Load	342.98	454.20	145.74	370.00	1,322.90		926.03

^{*}Provision for Electrical loads- 25 kW per lab For Ground floor, 20kw per lab for first floor and 15kW per lab for all subsequent floors be kept as PTU recommendation.

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

COLLEGE BUILDING-2

S.No	Description	Light & Small Power	A/C Load	Emer- gency	Lab Equipment*	Total Connected	Diversit	Мех. Demand
700		kW	kW	kW	kW	kW		
1	Ground Floor	61.20	101,49	15.30	100.00			kW
2	First Floor			70.00	100.00	262.69	0.7	183.88
		55.15	90.81	13.79	60.00	205.96	0.7	144.17
3	Second floor	55.82	86.60	13.95	60.00	202.41		
4	Thired floor	55.15	90.81	10.70		202.41	0.7	141.69
5	Fourth fla		30.01	13.79	45.00	190.96	0.7	133,67
	Fourth floor	56.89	92.71	14.22	60.00	209.60	0.7	
6	Fifth floor	56.49	84.79	14.12	45.00			146.72
-		-			10.00	186.28	0.7	130,40
	Other Loads					-		
7	Lift Load 4nos (4@15kW)			- 17-				222
				60.00		60.00	0.7	40 -
	Grand Total					00.00	U, /	42.0
	Load	340.69	445.72	145.17	370.00	1,317.90		922.53

[&]quot;Provision for Electrical loads 25 kW per lab For Ground floor, 20kw per lab for first floor and 15kW per lab for all subsequent floors be kept as PTU recommendation.

SEMINAR HALL

S.No	Description	Light & Small Power	A/C Load	Emer-gency	Total Connected	Diversit-	Max. Demand
		kW	kW	kW			
1	Ground Floor	The state of the s		KVV	kW		kW
-	CLORING LIBOX	7.13	14.89	1.78	22.02	0.7	15.42
	Grand Total Load	7.10					10.42
	Grand Total Load	7.13	14.89	1.78	22.02		15.42

PHASE (II WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

LIBRARY

S.No	Description	Light & Small Power	A/C Load	Emer-gency	Total Connected	Diversit-	Max. Demand
		kW	kW	kW	kW		kW
1	Ground Floor	34.30	102,84	137.14	137.14	0.7	96.00
2	First Floor	34.97	99.94	134.91	134.91	0.7	94.44
3	Second floor	53.80	166.05	219.85	219.85	0.7	153.89
	Other Loads					0.1	100.00
4	Lift Load1nos (1@15kW)			15.00	15.00	0.7	10.5
	Grand Total Load	123.07	265.99	506,90	506.90	0.7	10.5 354.83

DESIGN CONSIDERATIONS

This is covered under the following subheads:

Subhead A :

Substation & Power Distribution Plan,

Subhead B Subhead C

Point Wiring Lighting & Fan

Subhead D

Fire Detection & Voice Evacuation System;

Subhead E

UPS System

Subhead F

LV Services: Voice, Data, & Security System

Subhead G

External Development (Electrical)

A <u>SUBSTATION & POWER DISTRIBUTION</u>

A.1 SEB Power

In Phase I, the meter for 11kV HT supply was installed and commissioned at the North East corner of the site. From there the main HT cable was taken to the Administration Block substation (at the centre of the site) and terminated at a Ring Main Unit. Now for the Phase III substation it is proposed to have this HT line tapped from the existing RMU in the Admin Substation and carried to a new substation in the Academic section of the site.

All 11KV supply - from HT RMU in Admin Substation to HT RMU in Academic Substation, and from HT VCB to HT side of the transformer will be carried with 11kV grade XLPE Cables.

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

Transformers: As per load calculation, keeping transformer losses in mind and assuming working efficiency of 85%, the following transformer configuration and rating is proposed:

Total estimated connected load Total expected diversified load

7050 kW or 8800 kVA 3950 kW or 4950 kVA

Total capacity required (@85% efficiency)

5800 kVA

Configuration proposed

4no. 1600kVA

Given the estimated load it is suggested that for the complete Academic Section a total of 4nos transformers of 1600kVA capacity each be taken and these will be designed to operate under parallel operation if required. However, for the first few designated buildings, we are considering two Transformers of 1600kVA. These will be Oil cooled and naturally aspirated (ONAN) type but must be with copper windings and should preferably have an On-Load Tap Changer (OLTC) of nominal rating -15% to +5% on the HT side of the transformer.

A.2 D.G.Sets and Power Back-up Facilities

It is proposed to back-up power for generators for the following:

- Entire Library load is being considered on generator back-up
- For other buildings, 25% of lighting, (ans and small power is being considered on generator back up

This would be made available by equally sized diesel generator sets. It is also proposed to have modularity for DG Sets which allows for better loading, performance flexibility and ease in spares and maintenance.

It is therefore proposed to have a final configuration of 3 nos. 500kVA D.G. Sets. For Phase -Il now we would suggest 2nos 500kVA D.G. Sets be installed and the remaining one be installed later. The two D.G. Sets would be connected onto a common bus but with bus coupler. These sets will be provided with individual AMF panels for automatic starting in case of power failure. It is not intended to either synchronise the sets or share the loads. There will be a manual selection of sets to run for various load conditions. The AMF panels will also be supplied with manual override facilities.

It is proposed to locate the sets on ground floor level so that servicing, operation and maintenance is consolidated for more efficiency. The sets would be located in open area and based on sound attenuated acoustically treated all-weather containers to conform to CPCB norms and mounted on independent foundations to minimize the transfer of vibrations to the main structure.

The exact location of the DG Sets would have to be determined on the basis of overall planned capacities and locations of other services.

Power Distribution A.3

LT supply from the transformers and the DG Sets would be carried by LT XLPE aluminum Armoured cable to the Main LT panel.

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

LT Panels will be factory fabricated, cubicle type, Form 3, indoor duty floor standing units with provisions for cable entries from top and bottom as required. Bus-bar chambers will be bolted type with louvers for heat dissipation, while cable alleys would be hinged type with half turn knobs for easy access. The location of main LT Panel is proposed on Ground floor of the Academic Substation.

All switchgear would be fuseless with breaking capacities calculated at each level of protection. All **Air Circuit Breakers (ACBs)** would be draw-out type and motor operated in case of transformer and DG Set incomers and bus-couplers for integration with the automation system.

All MCCBs would have rotary operating handle. Protection for the larger ratings of ACBs and MCCBs will be with solid state relays with variable settings for pick-up currents and delay times.

Multi-parametric **metering** (voltage, current, frequency, power factor, power, energy – active and reactive) shall be provided for all incoming equipment breakers. All outgoing feeders shall have ammeters for monitoring output loads.

All cabling will be XLPE insulated steel armoured cable with aluminium conductors for sizes above 16sq.mm and with copper conductors for sizes of 16sq.mm and below. The cabling design will take into account the RLC losses through appropriate sizing and application of recommended derating factors.

Control of **power factor** has also been considered on the LV side, and appropriate locations and sizing of reactive power banks will be worked out at the detailed engineering stage, taking into account both linear and non-linear loads. The design will attempt to maintain power factor at the main panel at 0.95, using automatic correction relays and fixed capacitors.

A.4 Earthing

Earthing would be carried out using copper conductors for all equipments' neutral earthing point. Earth mat would be created to ensure path of minimum resistance. Pipe earthing would be used for equipotential bonding of Feeder Pillars for external lighting and for far flung smaller load centres.

A.5 Ring Main

Power will be carried to the floors by means of Rising Mains with sandwich type busducts with aluminium conductors. There would be tap-off points at each floor. There would be two rising mains in the electrical shaft, each rated for 75% of the total required capacity for "limited redundancy" – i.e. in the event of failure or maintenance of one of the Rising Mains at least 75% "Main Board" on the floor would receive supply from both Rising Mains. On any floor the switch. This would ensure that even in the event of maintenance or break-down of any one Rising Main the individual floors would still receive power.

B POINT WIRING:

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

Point wiring shall be carried out using Fire Resistant (FR) grade PVC insulated wire with multistranded copper conductors carried in MS pipe. Switches proposed to be used are contemporary modular type switches with screwless cover plates.

There shall be separate DBs for "Normal" power (which will feed the power outlets and some lights), for "Emergency" power (which will feed all fans and some lights) and "UPS" power (which will have the provision to be connected to either a centralized UPS or a zonal UPS or directly from the "Emergency" panel depending on the importance of the load at that particular point in time).

C LIGHTING & FANS:

Lighting levels have been designed for in adherence to the BIS. For some typical areas the following levels are being followed;

AREA	LUX LEVEL	AREA	LUX LEVEL	
Labs & Classrooms	300 - 350	Staff, Common Rooms	200 - 250	
Corridors, Lobbies, Stairs		Reading Rooms & Offices	300 - 350	

For certain key areas computerized simulation of the lighting levels have been adopted to ensure that appropriate lighting levels would be maintained even after ageing and deterioration of lamp output or fitting fatigue.

However, it must also be clearly understood that since the utilization of this building is predominantly during daytime, suitable energy conservation methods have been adopted to optimize the lighting levels. Areas away from windows have been given higher lumen packages while those nearer natural sources of light have lower lumen packages. In areas like the library and the computer centres which are likely to have evening and night time operational hours, uniform lighting in all areas will be considered.

Also keeping in mind the flexibility of usage of internal spaces, we have made special provisions to make the lighting and fans layout as modular as possible.

Fluorescent light will be the preferred source of light for maximum lumen/ watt package. Fittings with conversion efficiencies of 65% and above are selected for areas requiring 300 lux and above. Suitable mirror optic louvers have considered minimizing the cut-off angle of direct light incident on the screens. Compact fluorescent light has been selected for corridors and lobbies as they are the highest usage areas.

Fans will be provided for all rooms - including rooms with AC.

D FIRE DETECTION & VOICE EVACUATION SYSTEM:

K

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report – ELECTRICAL INSTALLATION WORKS

Addressable type of fire detection system is proposed to be used to give the highest grade of fire detection facility. Locations of all detectors and alarm sounders shall be as per NFPA 72 and would be worked out in coordination with the proposed reflected ceiling plans of the common areas.

Optical type smoke detectors shall be used in most areas (lonization type detectors shall not be used anywhere due to international consensus on the reduction of radioactive material disposal.)

Rate of rise heat detectors shall be planned for all potentially smoky areas.

Hybrid system – conventional detectors (without individual addresses) addressed in zones through addressable Monitor Modules – shall be used in common areas and corridors to optimize cost. Addressable **Manual Call Points** titted with "Break-Glass" units shall be strategically located near all exit points.

Audio-visual alarm, in the event of fire, shall be provided by means of piezo electric sounders and strobe lights.

The Main Fire Alarm Panel shall be located in the **Fire Control Room** preferably at the Ground Floor.

Additional **addressable control modules** will be provided per licor for the control of AHU dampers, pressurizing lans, etc.

All exit staircases will have the Fireman's telephone jack.

E UPS SYSTEM / INVERTER SYSTEM

Before determining the capacity of UPS system to be used, inputs on number of computers and server load requirements and AV power needs to be quantified. The basic systems to be covered by the UPS would be computer load, server racks, the projectors, audio equipment, Fire Alarm Panel and public address system.

UPS size will depend upon the computer load, load requirement for server racks, requirement of back up for projectors, audio equipment load and public address system. After complete information of these inputs we will be work out the size of UPS.

For emergency lighting Invertors will be provided for only library to have some lights...

F LV SERVICES

F.1. Data and Voice System Provisions

The scope of design and execution would consider only the provision of Mild Steel (MS) conduiting for the Data & Voice Networks i.e. we would not be considering the actual cabling and

PHASE III WORKS FOR PUNJAB TECHNICAL UNIVERSITY, JALANDHAR Preliminary Design Report - ELECTRICAL INSTALLATION WORKS

the outlets for the computer system. Inputs of locations of Data & Voice points would be marked on the layout drawings and given to the University for approval.

F.2 SECURITY / PA SYSTEM

Provision for installing a CCTV system would be made to monitor the Main Entries & Exits of the building. The system itself – the cameras, monitors and cabling - will not be included in the scope of design and execution as it would be best to be integrated at the time of commissioning and handing over.

PA system provisions will be made for seminar hall, Library, corridor. Wiring, outlets & hardware is not being considered.

G EXTERNAL DEVELOPMENT (ELECTRICAL)

External lighting would be designed for in a manner to ensure the security of people at various hours on all roads, pedestrian paths. In addition lighting for the landscaped areas would be integrated so that the luminaries blend and contribute to the aesthetic nature of the landscape design. Particular care would be taken to minimize upward spill of light to ensure compliance with "Night Sky" criterion.

Lamp sources with maximum efficiency and high colour rendering index would be selected. For larger lumen packages Metal Halide (MH) lamps would be used, for medium level requirements CFLs would be used and LEDs would be used for steps, contours and effect lighting.

PTU, PHASE III

Plumbing & Fire Fighting Design Basis Report

April 25, 2011

Client:

PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Architect:

ARCHIGROUP ARCHITECTS (REGD.)

A-14, First Floor, Sector 15, Noida Tel: 0120-4312431

Consultant:

V.S. Kukreja & Associates (P) Ltd.
165-A, Gautam Nagar, Adjoining Gulmohar Commercial Complex, New Delhi-49
Tel: 011-26520175

[This report covers the Plumbing & firefighting design basis for construction of two colleges, one seminar block, a library and an open air theatre, in phase III of Punjab Technical University, Jalandhar]



SANITARY ENGINEERING AND FIRE FIGHTING SERVICES

GENERAL

The project consists of developing various buildings in the existing Punjab Technical University Campus.

The Buildings to be developed are 2 nos. College buildings, library building and a Seminar hall.

1.0 INTRODUCTION

- 1.1 Water supply and wastewater disposal constitute a very important part of the services in a building. Maintenance of hygiene and cleanliness are indispensable to the well being of the occupants as a whole.
- 1.2 This report intends to highlight the details of the following proposed services, which are to be provided from the point view of Sanitary Engineering, Fire Fighting and other allied services.
 - Water Supply System
 - Wastewater Disposal System
 - Sewerage and drainage system including disposal
 - Sewage Treatment Plant and Recycling of Waste Water
 - Rain Water Harvesting
 - Fire fighting system.
- 1.3 It is proposed to design the services, storage capacities and piping network of the buildings in totality.

2.0 WATER SUPPLY SYSTEM

2.1 Total Water Requirement Calculation: The consolidated and distributed water requirement as per I.S. specifications and Govt. manuals shall be as below:

S. No.	Type of Building	Population	Water Requirement (LPCD)	Total Water Requirement (Liters per Day
A)	COLLEGE BUILDING - 1			
1	Students			
	O (LOCO) (ILS	360	45	16200
2	Teachers	78	45	3510
3	Technical Staff	21	45	
4	Support Staff			945
		36	45	1620
5	IV class staff	36	45	1620
6	Laboratory requirement			5000
B)	COLLEGE BUILDING - 2			0000
1	Students	360		
		360	45	16200
2	Teachers	78	45	3510
3	Technical Staff	21	45	945
4	Support Staff	36	45	
5	IV class staff			1620
		36	45	1620
6	Laboratory requirement			5000
C)	SEMINAL HALL	150	15	2250
D)	I) LIBRARY	450	45	
	ii) STAFF		45	20250
		10	45	450
-)	Caleteria	L.S		5000
	BACK WASH FOR FILTER, etc.	L,S		5000
1	TOTAL.			90740
			Or, say	95000

TOTAL WATER REQUIREMENT = 90,740 LITERS PER DAY

OR SAY

= 95,000 LITERS PER DAY

Hortlculture water requirement to be calculated at the rate of 5 liters per sqm per day.

Green area coverage = 13,890 sq.m @ 5 l/sq.m = $13890 \times 5 \text{ l/sqm}$ = 69,450 Liters per day

Or Say Total = 70 KL

Quantity of Water Available after Sewage Treatment:

Waste water available = 80% of 95000 (pd.)

= 76, 000 lpd

Treated water available after

Trealment = 90% of 76,000 lpd

= 68,400 lpd

2.2 Source of Water

- 2.2.1 Since municipal water supply not exist in the vicinity of project site it will be necessary to develop own infrastructure to fulfill the entire requirement. It is proposed to meet the total water requirement for the campus by other source / external supply such as bore wells etc. Although there are two tube wells existing on site, one near Academic area and another near residential area. Both tube wells are inter-connected by water supply line for domestic as well horticulture purposes. Minimum one no. bore well also proposed having a discharge of 15000 lph will be required to fulfill the requirement.
- 2.2.2 However, it is also proposed to design a sewage treatment plant in such a way that effluent will be recycled for flushing and horticulture.

2.3 Storage

Considering minimum requirement of storage for one day (excluding for horticulture purpose), the capacity in underground tanks and overhead tanks shall be as follows:

Water Tanks

-	(a) Raw water lank (Compartment No -1)	35 Cu.m
		00 (0.1)
	(b) Treated water tank (Compartment No-2)	35 Cu.m
	(c) Recycled waste water tank	30 Cu.m
Overl	(a) For fire fighting (Static) (On educational building terraces)	25 Cu.m
	(b) For fire fighting (Static) (On Library building terrace)	5 Cu.m
	(c) For Treated Water tank	15 Cu.m
	(d) For Flushing Water lank	

2.4 Quality of Water Supply

Since, the water will be required for different purposes i.e. for drinking, cooking, in laboratories in the toilets etc., it has to be of a required standard quality. The exact treatment of water will be suggested after getting the bore well water test report for potability.

However, as a standard, the water shall be passed through a multi grade filter and disinfected with UV Sterilizer prior to the supply to the buildings.

It is also advisable to maintain a strict monitoring system on the quality of the water during the operation of the system.

It is proposed to locate all the pumps and equipments in the underground pump room which shall accommodate all major pumps and equipments and electrical panels etc.

2.5 Water Supply System

2.5.1 The water from the sources will be brought into compartment No. 1, which will serve as a raw water storage tank. The water from raw water tank shall be pump by centrifugal pump of respective discharge and head for treatment

through filtration and disinfected with UV Sterilizer and then stored in Treated water tank compartment No. 2.

- 2.5.2 The compartment No. 2 termed as treated water tank shall supply the water through a hydro-pneumatic pumping system from the under ground domestic water tanks to overhead tank. Water shall be distributed to various user points for consumption by gravity from the overhead tanks. In this scheme, automatic electronic level controllers will be installed in the terrace tank of each building and also a solenoid valve will be installed in the water supply pipe for filling of the over head tank. As soon as the over head tank will be full, the level controller will automatically close the solenoid valve. This would have the following advantages:
 - a) The over head water tanks will be refilled automatically.
 - b) Closing of valves in this way would help in increasing the pressure in the main water supply ring mains. Due to this increase in the pressure, the blocks at the farther end would also be able to get optimum amount of water to fill up their over head water tanks in shorter time period.
 - c) It would also help to reduce the nuisance of water over flowing from the over head tanks as the water supply pipe line for each block would be closed after the over head tank has been filled. This would be a very important step in the conservation of water, which is such a precious resource today.

After the above process, the level controller will automatically open the solenoid valve after the tank is half empty so that water can enter the tanks again on resumption of water supply in the ring mains.

- 2.5.3 An under ground ring main shall be provided along the building periphery / boundary of the academic zone which will be connected directly to the bore well and Sewage Treatment Plant. Water will be pump by centrifugal pumping system arrangement for horticulture. Garden hydrants will be provided on the ring main.
- 2.5.4 Pump room of approximately size = 8 x 5 m shall be proposed nearby Underground Water tank. All pump and equipment for water treatment and supply system will be placed inside the pump room.

3. HOT WATER SYSTEM

It is suggested that a 1000 litres per day solar water heating system with an electrical backup may be provided on top of each college building to supply hol water to the laboratories.

4. MATERIALS FOR WATER SUPPLY

- All the external pipes to be used for water supply shall be Cl LA / Galvanized 4.1. steel tubes confirming to I.S.1239 medium class of superior quality. Fittings shall be malleable iron/brass as applicable.
- 4.2. For internal works, the pipes running on the terrace, shalt are proposed to be G.I pipe and in the wall chases to the various fixtures of CPVC pipes.
- 4.3 Valves on branches, main line and pumps shall have ball valve / butterfly valve of good approved quality, as per requirement.
- 5. Soil, Waste, Vent & Rain Water Disposal Pipe System
- 5.1 The system will be designed based on two pipes (stack) system as recommended in code of practice for soil and waste pipes above ground (I.S. 5329 - 1964).
- 5.2 Minimum diameter of pipes shall be adopted as:

•	All main soil pipes	 100mm
•	All branch soil pipes	 100mm
•	All main waste pipes	 100mm
•	All branch waste pipes	 50mm
•	All main soil and waste pipes stack	 150mm
٠	Wash basin/Sink waste connection to floor trap	 32/40/50mm

- 5.3 All soil, waste, vent & rain water pipes running vertically, shall be exposed and approachable, in vertical shafts as per architectural design.
- 5.4 Each connection from the lixtures shall be provided with access doors for cleaning (door junctions).
- 5.5 Where two or three fixtures are connected to a single horizontal pipe leading to a vertical stack (in toilets), clean-out plugs are provided at starting point. The clean-out plugs shall be flush with the top of floor.
- 5.6 All traps shall be with a minimum water seal of 50mm.
- 5.7 Materials
 - (a) All soil, waste, vent and anti-syphonage pipes and fittings 50mm and above shall be CI centrifugally cast.

6. SEWERAGE SYSTEM

Soil waste from water closets and urinals etc. will be collected by horizontal and vertical soil pipes and discharged directly to the manholes. Waste water

32/40/50mm

from wash basins, sinks, and from other waste fixtures shall be collected separately by waste pipes and be discharged through gully traps into the manhole of the external sewerage system.

The external sewerage system shall be running around the building periphery having manholes in front of each shaft. The main sewer line will carry the whole sewage by gravity up to the Sewage Treatment Plant.

6.2 Design Parameters

The following parameters shall be considered for design of sewerage system:

(i) Flow of sewage = 0.8 of water supply)

(ii) Peak Flow = 3 x average flow

(iii) Min. velocity of flow in = 0.75 m/sec pipes flowing half full

Max Velocity of flow = 2.0 m/sec.

(iv) Min. depth for sewers = 0.9m (v) Infiltration Factor = Add 8.33% of average discharge

(For surface run off, subsoil water conditions etc.)

(vii) Formula for calculation for design of sewer lines shall be by Manning's formula:

Where,

V = Velocity in m/sec.

R = Hydraulic radius in m

S = Slope or hydraulic gradient in m/m

n = Manning's co-efficient

(viii) Manning's co-efficient n = 0.015

6.3 Appurtenances & Materials' Specifications

6.3.1 Pipes

(a) S.W. Pipes

For dia 150mm to 250mm Grade 'A' as per IS: 651 depending on site conditions with laying and jointing and bedding as per IS: 4127-1983

(b) R.C.C. Pipes Class NP2 For dia 250mm and above as per IS: 458, for normal slopes and general site conditions.

(c) R.C.C. Pipes Class NP3

For road crossings, for heavy loading conditions as per IS:458.

All R.C.C. pipes shall be laid as per iS: 873 - 1985 and as per "Manual on Sewerage and Sewage Treatment" by Ministry of Urban Development, New Delhi.

(d) C.I. Pipes Class LA

For sleep slopes and exposed pipe as per IS: 1536.

6.3.2 Manholes

- (a) The manholes shall be constructed of brick masonry as per standard specifications of National Building Code.
- (b) Minimum Depths of Manhole 0.9m

(c) Specing

- Manholes shall be provided at all junctions, change of directions, and change in diameters, as per connection requirement.
- (ii) A distance of 30 metres on the main trunk sewer lines, depending on dia, of pipe and local conditions.

(d) Manhole Covers

(i) Medium/heavy duty for manholes.

7. Sewage Treatment Plant

It is proposed to treat the domestic sewage in a scientific manner through a properly planned sewage treatment plant. The objective is to stabilize the decomposable organic matters present in sewage so as to get an effluent and sludge having characteristics which are within safe limits, and which can be recycled and re-utilized for various purposes to help in maintaining the ecology of nature and save energy resources. The treatment process for sewage/effluent and the location of the final waste water disposal shall be based on the following considerations:



- Use of Treated Sewage.
- Aesthetics of the area and nearby inhabitation.
- Wind direction
- Availability of suitable land.
- Initial Cost of the system
- Recurring Cost of the system.

7.1 Salient Features of STP

- (A) Characteristics of Influent
 - B.O.D (5 days at 20 °C) (mg/lit)
 Suspended solids (mg/lit)
 PH
 250 ~300
 400 ~ 600
 6.5 ~ 8.5
- (B) Characteristic of Effluent (after treatment)
 - B.O.D (5 days 20 ℃) (mg/lit) less than 20mg/lit.
 - Suspended solids mg/lit less than 30mg/lit.

The technology suggested to be used for Sewage treatment will be FAB.

7.2 PROCESS DESCRIPTION: FAB Process

Sewage generated from the buildings will reach the last manhole of trunk sewer line from where it shall be passed through a bar screen of suitable size before entering the equalization cum collection tank. There shall be suitable arrangement for cleaning and tifting the coarse material from the platform near the screen chamber.

From equalization tank the sewage shall be lifted through submersible automatic control pumps into adjoining FAB aeration tank. The equalization tank shall also have provision of the aeration system to keep the sewage in the homogeneous condition.

In the FAB aeration tank of required capacity wastewater will be mixed with microorganisms in presence of dissolved oxygen. Microorganisms will assimilate organic impurities. The FAB aeration tank will be supplied through two positive displacement (roots type) air blowers (1 working + 1 standby) located out side the tank. Submerged air diffusers will provide mixing and oxygen for the needs of microorganisms. The blowers will be sized to

maintain dissolved oxygen level in the aeration tank of approximately 2 mg/lit.

From the FAB aeration tank mixed tiquor will flow by gravity into adjoining Plate Settler of required capacity. The solids will settle in the plate settler tank. A sludge return pump will be provided for pumping the settled sludge from the plate settler tank back to the aeration tank. Plate settler tank will also be provided with skimmer system to pump floating scum back to the aeration tank to keep the plate settler surface clean.

An overflow weir with scum baffle will be provided in plate settler to take treated wastewater out of the plate settler.

From the plate settler, treated wastewater will flow by gravity into adjoining clarified water tank. From this tank the water will be lifted with a submersible pump and passed through a pressure sand filter, an activated carbon filter and softener and stored in a soft water tank. Water from this tank will be lifted with suitable submersible pumps for further use for Air Conditioning purpose. In case of extra effluent the arrangement shall be made to dispose off into municipal sewer.

Excess sludge from the plate settler tank will be taken periodically into sludge holding tank. In this tank sludge will be aerated for self-stabilization. Air will be shut off periodically and superannuate water will be transferred to the aeration tank creating stabilized sludge. This stabilized sludge shall be dried in filter presses and the stabilized sludge shall be lifted from tank into the tanker for outside transportation / disposal for further use for agriculture / horticulture purposes.

8. RAIN WATER DISPOSAL

8.1 Roof Drainage:

Vertical rain water pipes provided as per requirement and will collect the rainwater pipe through khurrahs and this will discharge into masonry storm water drains with SFRC Covers or Piping cum manhole storm water drainage system.

Drainage system shall be designed on the parameters setup by the metrology department and various statutory codes. Rooftop rainwater is generally clean does not require any pretreatment before discharging into Rain water Harvesting wells. Rain water from roof shall first be discharged into the harvesting wells and excess water from the wells shall be overflow into the surface drain.

8.2 Surface Drainage:

Surface drainage consisting of surface drains and underground storm water disposal pipes will be provided so that there is no accumulation of rain water. Before discharging into rain water harvesting wells bar screens and silt traps have been

incorporated to remove the silt, heavier particles and other objectionable material which can cause the choking of the percolation well. Surface rain water separately collected in the external masonry storm water drains with SFRC Covers or Piping cum manhole storm water drainage system and discharge into the rain water harvesting chamber.

The final disposal of the rain water collected from the overflow of the rain water harvesting system will be in the proposed retention pond in Phase I

8.3 Design/Technical Parameters

8.3.1

Min. velocity of flow in pipes = 0.6 m/sec or as per site = 2.0 m/sec.

Min. Free board

a. For drains upto 300 mm width = 75 mm b. For drains upto 900 mm width = 150 mm

- 8.3.2 The run off for designing of drainage = As per Metrological Data
- 8.3.3 The design of drains is based on Manning's formula, for flow due to gravity

$$V = -\frac{1}{n} \cdot R^{2/3} S^{1/2}$$

Where V = Velocity in m/sec.

R = Hydraulic mean radius in m

S = Hydraulic gradiant in m/metre

n = Manning's co-efficient

8.3.4 Manning's Co-efficient

- (a) For R.C.C. pipes n = 0.015
- (b) For brick masonry channel with neat coat of cement plaster n = 0.013

9. RAIN WATER HARVESTING

The main emphasis given in the planning of the storm water drainage system is on recharging the underground aquifer of the area while having the safe disposal of storm water without flooding the campus. A network of storm water disposal drains will be planned which will finally dispose off into a percolation well for direct injection of collected storm water into the ground water. Bar screens and sill traps have been incorporated before the

percolation wells to remove the silt, heavier particles and other objectionable material which can cause the choking of the percolation well. Type of percolation wells etc. will be decided after detailed hydrological and geological survey analysis results are obtained.

WHY DO WE REQUIRE RAIN WATER HARVESTING AND GROUND WATER RECHARGE?

- To meet ever increasing demand for water in urban areas.
- To reduce the runoff that is choking the storm drains.
- To avoid the flooding of roads.
- To augment the ground water storage and control decline of water levels.
- To improve the quality of ground water.

THE ADVANTAGES OF RAIN WATER HARVESTING AND GROUND WATER RECHARGE

- This is an ideal solution of water problem where there is inadequate ground water supply or surface resources are either lacking or insignificant.
- To utilize the rainfall runoif, which is going to sewer or storm drains.
- Rainwater is pure, free from organic matter and soft in nature.
- It will help in reducing the flood hazard.
- To improve the quality of existing ground water through dilution.
- Rainwater may be harnessed at place of need and may be utilized at time of need.
- The structures required for harvesting the rainwater are simple, economical and eco-friendly.

The drainage system shall be led to various percolation wells catering to different parts of the catchments area. Sift traps will be provided at intel to each percolation well. The overflow from percolation wells will be inter-connected and the overflow will be in the river flowing along the plot.



IMPORTANT INDIAN STANDARDS PLUMBING & SANITARY WORK

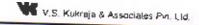
	TANDANDS PLUMBING & SANITARY WORK
	TITLE
IS 651-1965	Specification for salt Glazed stoneware pipes and fittings
IS 782-1978	Specification for caulking lead.
IS 1172-1971	Code of basic requirements for water supply, drainage and sanitation (revised).
IS 1239-1966 (Part-I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1239-1968 (Part-II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
JS 1537-1976	Specification for vertically cast iron pressure pipes for water, gas and sewage.
IS 1536-1976	Specification for centrifugally Cast (Spun) from pressure pipes for water, gas and sewage.
IS 1538 (Part 1 to 23)	Specification for Cast Iron fittings for pressure pipes for water, gas and sewage.
IS 1626-1960	AC building pipes, gutters and fittings (Spigot and socket type).
IS 1726-1960	Code for cast iron manhole frame and cover.
IS 1729-1979	Specification for Sand cast iron Spigot and Ventilating pipes, fittings and accessories.
IS 1742-1960	Code of practice for building drainage.
IS 2064-1962	Code of practice for selection, installation and maintenance of sanilary appliances.
IS 2065-1963	Code of practice for water supply to buildings.
IS 3114-1965	Code of practice for laying of C.I. Pipes.
IS 3589-1981	Specification for electrically welded steel pipes for water, gas and sewage.
IS 3989-1970	Centrifugally cast spun iron and socket soil and ventilating pipe, fittings and accessories.
IS 4111-1967	Code of practice for Ancillary structure in sewerage system.



	Takreja & Associales Pri, Cld.
IS 4127-1967	Code of Practice for laying glazed stone ware pipe.
IS 4515	Specification for unplasticized PVC pipe fittings.
IS 4985-1981	Specification for unplasticized PVC pipes for portable water supplies.
IS 1703-1984	Ball Valves
IS 2548-1970	Toilet Seat Cover
IS 4736-1986	Galvanizing G.I. Pipes
IS 780-1984	Cast iron stuice valves
IS 778-1984	Full way valves
IS 2692-1978	Brass ferrule
IS 458-1971	R.C.C. pipes
100	

National building code for water supply, drainage and sanitation Part IX Plumbing services section 1 & 2.

The installation shall also be in conformity with the bye-laws and requirements of the local authority is so far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship then those required by any of the above regulations and standards, hence these specification shall take precedence over the said regulations and standards. Wherever drawings and specifications require something that may violate the regulations, the regulation shall govern.



FIRE FIGHTING SERVICES

1.0 PREAMBLE

Most accidental fires have a small, insignificant beginning, but a terrible ending. They advance rapidly from the incipient stage to a devastating stage and soon go out of control. And fire is no sojourner and travels rapidly to engulf large areas with least delay. The end result is always horrible and needs no further description.

1.1 AIM

The present objective is to put forth a Fire Protection and Safety Scheme for the campus in conformity with existing standards and practices.

2.0 Details of the building

2.1 The fire fighting will be designed as per the recommendations of the National Building Code of India-Part IV, 2005. The Occupancy wise classification will be as under:

Group-A: Educational Buildings (15 m and above but not exceeding 30 m in height)

Subdivision: All others / training institutions

Group-B: Business buildings (Above 10 m but not exceeding 15m in height)

Subdivision: Library

- 2.2 Considering that the purpose of the buildings, as well as the height of the structure and mixed occupancy, it will be necessary to provide a proper and adequate fire fighting system based on the requirements of the National Building Code 2005.
- 2.3 The proposed fire fighting shall be consisting of static U.G water storage tank of capacity 50 KL, with a provision of fire brigade inlet and suction connections with pump capacity 2280 l/m electrical as well diesel driven pump which have met from the existing static underground water storage tank of capacity = 100 KL and Pumps from Pump room made in Phase I.



Minimum Requirement for Fire Fighting System as per NBC – 2005 (Table No.-23)

S.No.	Description	As Per (NBC)	
1	Fire Extinguisher	Required	Provided
2	Hose Reel	Required	Provided
3	Dry Riser	Not Required	Not Provided
4	Wet Riser	Required	Provided
5	Down Comer	Required	Provided
6	Yard Hydrant	Not Required	Not Provided
7	Automatic Sprinkler System	Not Required	Provided only in Library building.
8	Manually Operated Electric Fire Alarm System	Required	Provided
9	Automatic Detection Alarm System	Required	Provided
10	Underground Static Water Storage Tank	Required (50 KL)	Will be met from existing 100 KI U.G tank
11	Terrace Tank	Required	Provided
12	Pump Near UG Tank	Required	Will be met from existing Pump.
13	Pump at Terrace	Required	Provided

- 2.4 Vertical wet riser cum down comer of 100mm dia M.S. pipes will be taken to provide pressurized water to the single outlet hydrant landing valve on each floor as per requirement and then connected commonly to an over head tank and pump. Along with wet riser system, portable fire extinguishers are to be provided at all accessible positions.
- 2.5 An over head tank of 25000 I capacity and pump of 900 lpm @ 45 m head will also be provided for the building which come under educational building while



the building coming under business building will be provided with over head tank of 5000 I capacity and pump of 450 lpm @ 40 m head for firefighting system will be connected to the risers through a non-return valve and also connected to the suction of the pumps in the under ground pump room.

- 2.6 A fire hose cabinet with complete fire lighting accessories shall be provided with following specifications:
 - 2 nos., 63mm dia and 15m long rubberized fabric lined hose pipe as per I.S:636 type-II.
 - Gunmetal mate and female instantaneous type coupling as per I.S:903 with I.S. specifications.
 - Gunmetal branch pipe with nozzle as per I.S:903
 - First-aid fire hose reels with 20mm dia 30m long with 5mm bore gunmetal nozzle as per I.S:884 - 1969.
 - Fireman's axe.
- 2.7 Also it has been proposed to provide following portable type fire extinguishers.
 - 9 lit, water expelling type.
 - 4.5 lt. CO₂ Type.
 - 5 kg ABC type.
 - Dry chemical powder type of 10kg/5kg capacity.
- 2.8 Sprinkler system although not specified by NBC, we recommend sprinkler should be provided in Library building for the safety of documents and casualty.
- 2.9 Sprinklers shall be provided in all the floors of the fibrary building, each sprinkler covering an area of upto 100-120 sqft, & connected to the same pressurized system with provision for an automatic alarm system in case of activation. The sprinkler shall be automatically activated at a temperature of 57°C-68°C.
- 2.10 Also, upright sprinkler pendant shall be provided in the areas where the depth between the soffit of the main slab and the false ceiling is more than 750mm.



2.11 The delivery pipes for the sprinkler pumps and main fire pumps shall be interconnected.

IMPORTANT INDIAN STANDARDS FOR FIRE FIGHTING WORK TITLE

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IS 1239-1968 (Part-I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
JS 1239-1968 (Part-II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1536-1976	Specification for centrifugally Cast (Spun) Iron pressure pipes with flanges for water, gas and sewage.
IS 1538 (Part 1 to 23)	Specification for Cast Iron fittings for pressure pipes for water, gas and sewage.
IS 1726-1960	Code for cast iron manhole frame and cover.
IS 3589-1981	Specification for electrically welded steel pipes for water, gas and sewage.
IS 4736-1986	Galvanizing G.I. Pipes
IS 636-1988	Non percolating llexible fire lighting delivery hose (third revision)
IS 694-1990	PVC insulated cables for working voltages upto and including 1.100 volts (third revision)
IS 778-1984	Copper alloy gate, globe and check valves for water works purposes (fourth revision) (Amendment 2)
IS 780-1984	Sluice valves for water works purposes (50 to 300 mm) size (sixth revision) (amendment 3)
IS 884-1985	Specification for tirst-aid hose-real for fire fighting (for fixed installations) (first revision) (with amendment No.1)
IS 900-1992	Code of practice for installation and maintenance of induction motors (second revision)
IS 901-1988	Specification for couplings, double male and double female, instantaneous pattern for fire fighting (third revision)
IS 902-1992	Suction hose coupling for fire lighting of purposes (third revision)
IS 903-1984	Specification of fire hose delivery couplings branch pipe, nozzles and nozzle spanner (third revision) (Amendment 5)

	The Transplaces FVI. Etc.	
IS 937-1981	Specification for washers for water littings for fire fighting purposes (revised) (with amendment No. 1)	
IS 1520-1980	Horizontal centrifugal pumps for clear cold, fresh water	
IS 1536-1976	(second revision) Horizontally cast iron pressure pipes for water, gas & sewage (first revision) (with Amendments No. 1 to 4)	
IS 1554-1988 Part I	PVC insulated (heavy duty) electric cables (working voltage upto and including 1100 volts (third revision)	
IS 1554-1988 Part II	PVC insulated (heavy duty) electric cables (working voltage from 3.3 KV upto and including 11 KV (second revision)	
IS 1648-1961	Code of practice for fire safety of buildings (General) Fire fighting equipment and its maintenance (with amendment No.1)	
IS 3624-1987	Pressure and vacuum gauges (Second revision)	
IS 4736-1968	Hot-dip zinc coatings on steel tubes (with Amendment No.1)	
IS 5290-1983	Specification for landing valves (second revision) (with Amendments No.6)	
IS 5312- 1984 Part I	Swing check type reflux (non return) valves Part I-single door pattern (with amendments nos. 1 & 2)	
IS 5312- 1986 Part II	Swing check type reflux (non return) valves Part II-Multi door pattern (with amendments nos. 1 & 2)	
IS 72 8 5	Seamless cylinders for storage of gas at high pressure.	
IS 2189-1962	Code of practice for Automatic Fire alarm system	
IS 2195-1962	Specification for heat sensitive fire detectors	
IS 732-1973	Code of practice for electrical wiring installation	
	UL 168 Underwriters Laboratory specification for smoke detector.	