Er. H.P. Singh
Executive Engineer

ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
PTU PUNJAB TECHNICAL UNIVERSITY
Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. I of 1997)

Ref. No. PTU/cc/356/26939 Daled 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 meeting 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,

HPS 16/05/11
(H. P. Singh)
Executive Engineer

Copy to :
i. Dr. R. S. Khandpur, DG, PGSC, SCO 60-61, Sector 34-A, Chandigarh.
ii. Sh. Rajiv Aggarwal, M/s Archigroup Architects, A-14, Sector-15, Noida -201301.

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 seminar hall of proposed PIT at main campus, Kapurthala.

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

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 & Bamala, 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.

1. DESIGN PHILOSOPHY

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

a) The work consists of two institute buildings, one library and one seminar hall. All are independent buildings.
b) the Bldg have overhead water tank on the terrace of all blocks.
c) The Bldg have lift facility & the lift machine room is on the terrace of all blocks.
d) The typical storey height in all the blocks is approx. 4 m, except for seminar hall which may be around 6m
e) The column to column spacing is as per plan.
f) The flooring system consists of slabs resting on beams.
g) All the internal partition walls shall be 115 mm thick brick wall, whereas the external walls, sunkwell walls and the lift core walls shall be 230 mm thick brick wall with stone cladding.
h) **The expansion/separation joint shall be provided as per IS:456, IS:1893, IS:4326**

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

1) Thickness of Slabs

a) Thickness of slabs: There will be three types of slab as per thickness requirement

i) Slab 1	100 mm	v) Slab 5	140 mm
ii) Slab 2	110 mm	vi) Slab 6	150 mm
iii) Slab 3	120 mm		
iv) Slab 4	125 mm		

2) Beams

i) Primary Beam	300 x 600/750/900 mm
ii) Secondary Beam	230/300 x 600/750 mm

3) Columns

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

2. MATERIALS

2.1 Grade of materials

a) **The grade of concrete shall be M25 for** beams,slabs **& columns above ground and Higher grade below ground for columns & Foundations.**
b) 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	25 kN/m³
b)	PCC	24 kN/m³
c)	Brick Masonry (230 thk with plaster)	22 kN/m³
d)	Brick Masonry (115 thk with plaster)	22 kN/m³
e)	Terracing (Brick Coba)	20 kN/m³
f)	Cinder/Brick coba Fill in sunken portion	16 kN/m³
g)	Glazing	2 kN/m²
h)	Stone cladding	1.5 kN/m²
I)	Soil	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 IS 875 (Part 1))**

a) The self weight of the beams and columns shall be input as SELFWEIGHT command in STAAD Pro

b) Self weight of normal slab

i) 100 mm thick slab	= 0.100 x 25	= 2.5 kN/sqm
ii) 110 mm thick slab	= 0.110 x 25	= 2.75 kN/sqm
iii) 120 mm thick slab	= 0.120X25	= 3.0 kN/sqm
iv) 125 mm thick slab	= 0.125x25	= 3.13 kN/sqm
iv) 140 mm thick slab	= 0.14x25	= 3.5 kN/sqm

c) Floor Finish (60 mm thk on floors) & Terrace (200mm thk.)

0.060 x 24	= 1.45 kN/sqm
0.150 x 20	= 3.00 kN/sqm

d) 230 thk masonry — as per unit weight given above

= 0.23 x (3.0-0.45) x 22

= 12.90 kN/m — on the basis of a 3.0 floor to floor height beam not less than 450mm depth envisaged for 230 thk walls.

e) 115 thk masonry

0.23 x (3-0.6) x 22

= 0.115 x (3.0-0.45) x 22

= 7.04 kN/m — on the basis of a 3.0 floor to floor height

0.115 x (3-0.6) x 22

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

a)	Class Room	= 3.00 kN/sqm
b)	Passage, Balconies	= 4.00 kN/sqm
c)	Toilet	= 2.00 kN/sqm
d)	Stairs	= 4.00 kN/sqm
f)	Lift M/C Room (Impact Loading)	= 10.00 kN/sqm
g)	Terrace	= 1.50 kN/sqm
k)	Over head water tank	as per size of Water Tank.
l)	office	= 3.00 kN/sqm
m)	laboratories	= 3.00 kN/sqm
n)	libraries	= 6.00 kN/sqm

iii) **Seismic Load (as per IS 1893: 2002)**

The following parameters would be considered for seismic loading as per IS 1893:2002, IS 13920:1993

Zone	IV
Zone Factor	0.24
Importance Factor	1.5
Response Reduction Factor	5*
Damping	5%

* The ductile deatailing of the structural elememts 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.

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 less 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 Loads on floors depending up on the type of use are as follows

I) Room (125 thick slab)

a)	Self wt. of slab		= 3.13 kN/sqm
b)	FF		= 1.45 kN/sqm
		Total DL	= 4.58 kN/sqm
c)	LL		= 3.00 kN/sqm
		Total	= 7.58 kN/sqm

II) Pantry(100 thick slab)

a)	Self wt. of slab		= 2.5 kN/sqm
b)	FF		= 1.45 kN/sqm
c)	Filling of 150 mm (brick coba)		= 2.40 kN/sqm
		Total DL	= 6.35 kN/sqm
c)	LL		= 3.00 kN/sqm
		Total	= 9.35 kN/sqm

iv) Passages (100mm thick slab)

a) Self wt. of slab		= 2.5 kN/sqm
b) FF		= 1.45 kN/sqm
	Total DL	= 3.95 kN/sqm
c) LL		= 4.00 kN/sqm
	Total	= 7.95 kN/sqm

v) Stairs

a) Self wt. of slab (175THK.)		= 5.27 kN/sqm
b) Wt. of Steps (165mm Riser)		= 2.45 kN/sqm
c) FF		= 1.65 kN/sqm
d) CP		= .15 kN/sqm
	Total DL	= 9.46 kN/sqm
e) LL		= 4.0 kN/sqm
	Total	= 14.46 kN/sqm

vi) Lift M/C Room

a) Self wt. of slab (150 Thk)		= 3.75 kN/sqm
b) FF		= 1.45 kN/sqm
	Total DL	= 5.2 kN/sqm
c) LL*		= 10.00 kN/sqm
	Total	= 15.20 kN/sqm

*LL on lift m/c room accounts for 50% impact, i.e., full load of the m/c

vii) Terrace

a) Self wt. of slab		= 3.5 kN/sqm	
c) Brick tile + Brick coba (250 thk)		= 5.00 kN/sqm	
	Total DL	= 8.50 kN/sqm	As per unit weight
e) LL		= 1.50 kN/sqm	given above
	Total	= 10.00 kN/sqm	

viii) office (125 thick slab)

a) Self wt. of slab	= 3.13	kN/sqm
b) FF	= 1.45	kN/sqm
Total DL	= 4.58	kN/sqm
e) LL	= 3.00	kN/sqm
Total	= 7.58	kN/sqm

ix) laboratory(125 thick slab)

a) Self wt. of slab	= 3.13	kN/sqm
b) FF	= 1.45	kN/sqm
Total DL	= 4.58	kN/sqm
e) LL	= 3.00	kN/sqm
Total	= 7.58	kN/sqm

x) libraries (140 thick slab)

a) Self wt. of slab	= 3.5	kN/sqm
b) FF	= 1.45	kN/sqm
Total DL	= 4.95	kN/sqm
e) LL	= 6.00	kN/sqm
Total	= 10.95	kN/sqm

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(DL-EQX)
4	1.5(DL+EQZ)
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)

C	Serviceability Limit State
1	DL+LL
2	DL+EQX
3	DL-EQX
4	DL+EQZ
5	DL-EQZ
6	DL+LL+EQX
7	DL+LL-EQX
8	DL+LL+EQZ
9	DL+LL-EQZ

Note:

DL: Dead Load

LL: Live Load

EQX: Seismic Load in X Direction

EQZ: Seismic Load in Z Direction

5. DEFLECTIONS

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

a) **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 occuring 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

7. COVER FOR STRUCTURAL ELEMENTS

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

a) Slabs	20 mm	Walls	25 mm
b) Beams	25 mm	Fdn.	50 mm
c) Columns	40 mm		

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
2) IS 875 (Part 1 to 5): 1987 - Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures
3) IS 1893 (Part1) : 2002 - Criteria for Earthquake Resistant Design of Structures
4) 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
6) SP 34 : Handbook on Concrete Reinforcement and Detailing
7) Reinforced Concrete Designer's Handbook by Reynolds 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.

i) 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%
Fresh Air	-	21 CFM/ Person

c) Design Criteria

Fresh Air	Lecture Hall, Tutorial, Library, Seminar Hall etc – 17 CFM/Person Laboratory, Common Room, Cafeteria etc – 21 CFM/Person
Lighting Load	2.0 watt/sft (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 level
- 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:

HEAT LOAD SUMMARY FOR COLLEGE BUILDING-1

		BASES OF DESIGN					DESIGN DATA SUMMARY									
S. NO.	CONDITIONED SPACE	ACTUAL AIR CONDITIONED AREA	HEIGHT	INSIDE DESIGN CONDITION			OCCUPANCY	LIGHT LOAD	EQPT LOAD	SUMMER LOAD	MONSOON LOAD	SUMMER DEHUMIDIFIED CFM	MONSOON DEHUMIDIFIED CFM	REQUIRED FRESH AIR QTY	INDOOR UNIT SELECTED	
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(J)	(K)	(L)	(M)	TYPE	(TRxQTY)
		SQ.FT.	FT.	MIN VENTILATION RATE CFM/PERSON	TEMP (°C)	RH	NOS.	W/SQ.FT.	KW	TR	TR	CFM	CFM	CFM		
1	**Ground Floor**															
1.1	Associate Professor	328	12.0	21.0	26.0±1	55±5%	12	8	7.2	4.44	4.62	1589	1555	252	Hi-Wall	1.5x3=4.50 1.0x1=1.0
1.2	Boy Common Room	315	12.0	21.0	26.0±1	55±5%	14	2.00	1.0	2.93	3.25	831	656	294	Hi-Wall	2.0x1=2.0 1.5x1=1.5
1.3	Clerical	172	12.0	21.0	26.0±1	55±5%	4	2.00	5.0	1.40	1.35	492	416	84	Hi-Wall	1.5x1=1.5
1.4	Director PA Room	192	12.0	21.0	26.0±1	55±5%	2	2.00	1.8	0.95	0.75	359	247	42	Hi-Wall	1.0x1=1.0
1.5	Director's Room	288	12.0	17.0	26.0±1	55±5%	9	2.00	1.8	2.11	2.11	683	551	153	Hi-Wall	2.0x1=2.0
1.6	Girls Common Room	372	12.0	21.0	26.0±1	55±5%	13	2.00	1.0	3.27	3.29	1023	759	273	Hi-Wall	2.0x2=4.0
1.7	Library	584	12.0	17.0	26.0±1	55±5%	35	2.00	1.0	5.90	6.81	1607	1386	595	Tower Unit	3.5x2=7.0
1.8	Professor Room-3	200	12.0	21.0	26.0±1	55±5%	5	2.00	1.0	1.31	1.32	418	318	105	Hi-Wall	1.5x1=1.5
1.9	Professor Room-4	174	12.0	21.0	26.0±1	55±5%	3	2.00	1.0	1.06	0.94	376	271	63	Hi-Wall	1.5x1=1.5
1.10	Professor Room-1	190	12.0	21.0	26.0±1	55±5%	5	2.00	2.70	1.55	1.45	526	393	105	Hi-Wall	1.5x1=1.5
1.11	Professor Room-2	190	12.0	21.0	26.0±1	55±5%	5	2.00	2.70	1.55	1.45	526	393	105	Hi-Wall	1.5x1=1.5
1.12	Research Lab-1	1292	12.0	21.0	26.0±1	55±5%	18	2.00	2.00	7.33	6.75	2687	2231	378	Tower Unit Hi-Wall	3.5x2=7.0 1.0x1=1.0
1.13	Research Lab-2	1292	12.0	21.0	26.0±1	55±5%	18	2.00	2.00	7.33	6.75	2687	2231	378	Tower Unit Hi-Wall	3.5x2=7.0 1.0x1=1.0
1.14	Research Lab-3	1292	12.0	21.0	26.0±1	55±5%	18	2.00	2.00	7.33	6.75	2687	2231	378	Tower Unit Hi-Wall	3.5x2=7.0 1.0x1=1.0
1.15	Research lab-4	1355	12.0	21.0	26.0±1	55±5%	20	2.00	2.00	6.51	6.44	2241	1906	420	Tower Unit Hi-Wall	3.5x2=7.0 1.0x1=1.0
1.16	Tutorial-3	420	12.0	17.0	26.0±1	55±5%	28	2.00	1.00	5.05	5.27	1438	1014	476	Hi-Wall	2.0x2=4.0 1.5x1=1.5