Er. H.P. Singh
Executive Engineer

ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
PTU PUNJAB TECHNICAL UNIVERSITY
Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref No PTU/CC/972

Dated 01/08/12

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

Sh. Amrit Sagar Mittal
CMD,
Sonalika Tractors Ltd, Hoshiarpur.

Dr. Nachhattar Singh,
Dean (P&D),
Punjab Technical University, Jalandhar.

Dr. Buta Singh (Special Invitee),
Dean (Academics),
Punjab Technical University, Jalandhar.

Dr. Prabhjot Kaur (Special Invitee),
In-charge PTU's Mohali Campus,
C102B, Phase VII Industrial Area,
Mohali.

Sh. S.L. Kaushal,
Chief Architect, Punjab (Retd),
2865, Sector 42-C,
Chandigarh.

Sh. Deepak Mittal, Chairman, CII,
Managing Director,
Sonalika Tractors Ltd, Hoshiarpur.

Dr. H. S. Bains,
Registrar,
Punjab Technical University, Jalandhar.

Sh. S. K. Mishra,
Director/Finance,
Punjab Technical University, Jalandhar.

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

Sub : Construction of new campuses of Punjab Technical University – 35th meeting of the Standing Building Construction Committee.

Dear Sir/Madam,

35th meeting of the Standing Building Construction Committee shall be held under the Chairmanship of Dr. R. S. Khandpur, Director General, PGSC at 1100 hours on 13.08.2012 in his office at SCO 60-61 (3rd floor), 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,

01/08/12

(H. P. Singh)
Executive Engineer

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

Er. H.P. Singh
Executive Engineer

ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
PTU PUNJAB TECHNICAL UNIVERSITY
Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. PTU/EC/973

Daled 01/08/12.

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. Inderjit Kumar (Special Invitee),
House No. 116,
Phase 3B/1,
S.A.S. Nagar, Mohali.

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 campuses of Punjab Technical University – 35th meeting of the Standing Building Construction Committee.

Dear Sir/Madam,

35th meeting of the Standing Building Construction Committee shall be held under the Chairmanship of Dr. R. S. Khandpur, Director General, PGSC at 1100 hours on 13.08.2012 in his office at SCO 60-61 (3rd floor), 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,

01/08/12
(H. P. Singh)
Executive Engineer

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

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

Sub : Agenda for the 35th meeting of the Standing Building Construction Committee.

Item No. 35.1 : To confirm the Minutes of 34th meeting of Standing Building Construction Committee held on 06.06.2012.

Item No. 35.2 : Action taken on various items discussed during previous meetings of Standing Building Construction Committee.

Item No. 35.3 : To discuss and finalize the appointment of Consultant for Project Management Consultancy Services/Executing agency for construction of proposed new buildings at University's main campus at Jalandhar-Kapurthala Road, Kapurthala.

Item No. 35.4 : To discuss and approve the rough cost estimate based plinth area rates of CPWD in respect of buildings (Science Block, Workshops and Boys/Girls hostel) proposed to be constructed at Punjab Institute of Technology at Mansa under Phase-I.

Item No. 35.5 : 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 Science Block, Workshops and Boys/Girls hostel of proposed PIT at Mansa.

Item No. 35.6 : To discuss and finalize the requirements (Design brief) of Punjab Institute of Technical Teachers Training and Research proposed to be established at Ladowali Road, Jalandhar.

Item No. 35.7 : Any other point with the permission of the Chair.

PUNJAB TECHNICAL UNIVERSITY, JALANDHAR

Agenda Note for the 35th meeting of the Standing Building Construction Committee.

Item No. 35.1 : To confirm the Minutes of 34th meeting of Standing Building Construction Committee held on 06.06.2012.

The minutes of 34th meeting of Standing Building Construction Committee held on 06.06.2012 were circulated on 11.06.2012. The minutes circulated are to be confirmed.

Item No. 35.2 : 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:

- Based upon the decisions taken in 34th meeting of the Building Committee regarding master plan of PIT Mansa, the Architect has made the suggested modifications and the revised the master plan and the same is being presented in this meeting.

- Punjab Technical University has taken up the matter with Punjab PWD for getting the construction works done from them. The case is being discussed in the present meeting as an agenda item.

- The Architect has taken up detailed designing for the buildings (Science Block, Workshops and Boys/Girls hostel) proposed to be constructed at Punjab Institute of Technology at Mansa under Phase-I. Design basis reports submitted by the Architect in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems for these buildings are being discussed as an agenda item.

Item No. 35.3 : To discuss and finalize the appointment of Consultant for Project Management Consultancy Services/Executing agency for construction of proposed new buildings at University's main campus at Jalandhar-Kapurthala Road, Kapurthala.

In 34th meeting of the Building Committee, it was informed that Technical Bids submitted by the following agencies for appointment of 'Project Management Consultant' were opened on 20.04.2012:

i) M/s Rites Ltd., Gurgaon.
ii) M/s Hindustan Steel Works Construction Ltd, New Delhi.
iii) M/s HLL Life care Ltd., Noida.
iv) M/s Telecommunication Consultants India Ltd, New Delhi.
v) M/s Life Insurance Corporation of India Ltd, Lucknow.
vi) M/s National Buildings Construction Corporation Ltd, New Delhi.

After evaluation of technical bids, financial bids of three pre-qualified bidders have been opened and the rates quoted by these three agencies are as under:

1. M/s HLL Life care Ltd., Noida. — 3.89% of cost of works
2. M/s Hindustan Steel Works Construction Ltd, New Delhi. — 4.49% of cost of works
3. M/s National Buildings Construction Corporation Ltd, New Delhi. — 4.99% of cost of works

While discussing on the above, it was decided that possibility of entrusting the work to Punjab PWD may also be explored.

Accordingly, PTU has taken up the matter with Punjab PWD vide letter No. PTU/DP&D/SPL/16 dated 25.06.2012. In response to the same, PWD vide their letter No. 2389 dated 26.07.2012 has refused to construct buildings without levying departmental charges and for waiving off departmental charges, permission is required from Hon'ble Chief Minister, Punjab. Copies of the letters issued by PTU and received from PWD are enclosed at Annexure-A.

The matter is placed before the Committee for taking appropriate decision in this regard.

Item No. 35.4 : **To discuss and approve the rough cost estimate based plinth area rates of CPWD in respect of buildings (Science Block, Workshops and Boys/Girls hostel) proposed to be constructed at Punjab Institute of Technology at Mansa under Phase-I.**

The Architect has submitted preliminary estimated cost based upon the Plinth Area Rates of CPWD for the proposed buildings to be taken up in Phase-I at Punjab Institute of Technology at Mansa, as under:

S. No.	Building	Plinth Area (Sqm.)	Estimated Cost (In Crores of Rs)	Remraks
1	Science Block (initially to accommodate Administration and Library)	18996.0	55.31	
2	Workshop	2376.0	7.11	
3	Boys/Girls Hostel with vertical partition.	5989.0	10.66	
Total			**73.08**	

As directed in one of the BOG meetings, the estimates of two college buildings, one library and one seminar hall proposed to be constructed for PIT, Kapurthala were got vetted from an independent agency (Thapar University, Patiala). Accordingly, the estimates of PIT, Mansa

were also forwarded to Thapar University, Patiala for vetting. Report from Thapar University, Patiala has been received and estimates for an amount of Rs. 78.08 Crores have been vetted by them. The estimates submitted by the Architect and report of Thapar University, Patiala is placed at Annexure B.

The matter is placed before the Standing Building Construction Committee for discussions and approval of the estimates for the above buildings of PIT, Mansa proposed to be constructed under phase-I for an amount of Rs. 78.08 Crores.

Item No. 35.5 : **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 Science Block, Workshops and Boys/Girls hostel of proposed PIT at Mansa.**

Based upon the decision taken in previous meeting of Standing Building Construction Committee meeting, the Architect has taken up detailed designing for the buildings (Science Block, Workshops and Boys/Girls hostel) proposed to be constructed at Punjab Institute of Technology at Mansa under Phase-I. Design basis reports in respect of structural design, HVAC, Electrical, Plumbing and Fire Fighting systems for these buildings have been prepared by the Architect and are enclosed at Annexure-C.

The matter is placed before the Standing Building Construction Committee for discussions and finalization of these reports.

Item No. 35.6 : **To discuss and finalize the requirements (Design brief) of Punjab Institute of Technical Teachers Training and Research (PITTTR) proposed to be established at Ladowali Road, Jalandhar.**

Punjab Govt. has allotted 2 acres of land to Punjab Technical University at Ladowali Road, Jalandhar for establishment of Punjab Institute of Technical Teachers Training and Research (PITTTR) at Ladowali Road, Jalandhar. The requirements (design brief) based upon FAR available has been finalized between University and is placed below at Annexure-D.

The matter is placed before the Standing Building Construction Committee for discussions and approval of the above requirements.

Item No. 35.7 : **Any other point with the permission of the Chair.**

ANNEXURE - A

Office of Chief Engineer (Buildings), Punjab
PWD (B&R) Branch, Chandigarh.

To

Dr. Nachhattar Singh Dean (P&D),
Punjab Technical University,
Jalandhar.

Memo No.:2389 ***Dated: 26.07.12***

Subject:- Execution of PTU's works on deposit basis by Punjab PWD.

Reference :- Your office letter No.PTU/DP&D/SPL/16 dated 25.06.12 addressed to Secretary Public Works, Punjab, Chandigarh.

Your letter under reference was discussed with Secretary Public Works and he has refused to construct the buildings of the PTU without levying Departmental Charges as PTU is an autonomous body. For waiving off Departmental Charges permission is required from the Hon'ble C.M. Punjab as he has already waived off Departmental Charges in some other specific cases.

Other issues raised in the letter under reference can be sorted out amicably in the "Building Works Committee of PTU".

Chief Engineer (Buildings),
Pb. PWD B&R Br.,
Chandigarh.

ਡਾ. ਨਛੱਤਰ ਸਿੰਘ
ਡੀਨ (ਯੋਜਨਾ ਤੇ ਵਿਕਾਸ)
Dr. Nachhattar Singh
Dean (P & D)

ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
PTU PUNJAB TECHNICAL UNIVERSITY

Ref No PTU/D P&D/SPL/16 Dated 25-06-12

S. Paramjit Singh Aujla,
Principal Secretary,
Public Works Department, Punjab
Sector-9, Mini Secretariat,
Chandigarh.

Subject : Execution of PTU's works on deposit basis by Punjab PWD.

Dear Aujla Ji,

1.0 This is to inform that Punjab Technical University is in the process of establishing Punjab Institutes of Technology (PITs) at various locations in Punjab. PTU's 'Building Works Committee' discussed to get construction of buildings for these PITs from PWD, Punjab on deposit basis. University is investing funds for the common cause and development of technical education in the state of Punjab, therefore, departmental charges may not be charged to PTU.

2.0 Presently, construction of PIT at Jalandhar-Kapurthala Road, Kapurthala is to be taken up on immediate basis. The estimated costs for these works are Rs. 118 Crores based upon plinth area rates of CPWD. The buildings planned for this Institute are as under :-

S.No.	Buildings	No. of Floors	Covered Area (in Sq. m)
1	College building – 1	G+5	12955.80
2	College building-2	G+5	12728.79
3	Library	G+2	5904.11
4	Seminar Hall	G	339.62
5	College Building -3	G+2	3794.50
6	Administration	G+1	588.53
7	Canteen	G	68.11
8	Hostel (2 Nos.)	G+2	4806.90
Total			41 186.36

Buildings indicated at S.No. 5 to 8 are partially constructed.

3.0 The major worksto be executed for these buildings are as under :-

i) Civil works
ii) Public health works
iii) Electrical works (Internal and External)
iv) Air Conditioning
v) Fire Fighting & Fire protection.
vi) Elevators.

4.0 PTU has already appointed Architect for detailed designing and preparation of plans. Building plans in respect of PIT, Kapurthala have been finalized and got approved from Chief Town Planner, Punjab. These works have been planned to be executed as per CPWD specifications. Detailed estimates for these works have been prepared as per CPWD DSR-07.

5.0 In case, you agree to execute PTU's works on no departmental charges basis, a meeting may be held to discuss the following issues:-

i) Specifications to be followed for execution of works.
ii) Schedule of rates to be followed for preparation of estimates etc.
iii) Nature of work and design/drawings prepared by University's Architect.
iv) University's involvement in award and supervision of works.
v) Packages for invitation of tenders and no. of contractors to be engaged.
vi) Completion periods for various buildings as some buildings are required on priority.
vii) Quality control of works.
viii) Clearances such as Environmental, pollution etc required for start of work.
ix) Services connections such as Electrical, pollution clearance for STP, Gen set, etc.
x) Payment terms between PTU and PWD.
xi) Coordination of various works to be executed by various departments of PWD.

Depending upon your response on the above issues, the matter shall be considered in PTU's 'Building Works Committee' and thereafter by 'Board of Governors'

Thanking you and looking forward to your early response.

Yours sincerely,

(Dr. Nachhattar Singh)
Dean (Planning & Development)
& Secretary Building Works Committee

ANNEXURE - B

Dr. Maneek Kumar

B.E. Civil (Hons.), M. E. Str. (Hons.), Ph. D
Professor and Head
Department of Civil Engineering
Tel: 0175-2393354, Fax: 0175-2393361,2393020
E-mail: maneek@thapar.edu,maneek2k@yahoo.com

THAPAR UNIVERSITY
(Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956)
Thapar Technology Campus, Post Box No. 32
Patiala 147 004 Punjab India
Fax : +91-175-2364498, 2393005
URL : www.thapar.edu

Ref No CED/~~516~~/ 520/1/24
Dated: July 24, 2012

Mr. H.P Singh
Executive Engineer
Punjab Technical University
Kapurthala.

Sub: - Checking of Plinth Area estimate for construction of Science Block, Workshops and Hostel at PTU's Punjab Institute of Technology Campus at Mansa.

This has reference to you letter no. PTU/CC/791 Dated 28.06.2012 on the above subject: It has been checked as per the CPWD Plinth area rates and the total estimated cost along with some observations for different buildings / components are as follows:-

1) **Junior Wing and Engg. College Block**:- On the basis of Plinth area calculations, total cost for this block after vetting comes out to be Rs. 631,338,419.00 instead of Rs. 549,049,450.62 as per the given preliminary cost estimate. Hence there is a difference of around Rs.82, 288,968.40 for this block.

2) **Workshop**: - The estimated cost on plinth area rate basis is Rs. 69,184,283 & is in order with the given preliminary estimate.

3) **Hostels**: - The estimated cost on plinth area rate basis is Rs. 106,433,237.53 & is in order with the given preliminary estimate. But while calculating this hostel total cost, for R.C.C. Framed Structure (up to six storeys) with floor height of 3.35m, rate taken was Rs 9100 per sq.m but this rate of Rs. 9100 per sq.m is for floor height of 2.90m, as per CPWD plinth area rates.

4) The Plinth area of the buildings/components taken is generally in order but however accuracy for exact plinth area lies with the architect as there are slight variations in the additional area calculations in all the blocks.
Assuring you our best attention at all times.
With kind Regards

Yours Sincerely

(MANEEK KUMAR) 27/7/12

Dr. Maneek Kumar
B.E. Civil (Hons.), M. E. Str. (Hons.), Ph. D
Professor and Head
Department of Civil Engineering
Tel: 0175-2393354, Fax: 0175-2393361,2393020
E-mail: maneek@thapar.edu,maneek2k@yahoo.com

THAPAR UNIVERSITY
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Thapar Technology Campus, Post Box No. 32
Patiala 147 004 Punjab India
Fax : +91-175-2364498, 2393005
URL : www.thapar.edu

Ref No CED/5[illegible]
Dated: July 30, 2012

Mr. H.P Singh
Executive Engineer
Punjab Technical University
Kapurthala.

Sub: - Re-Checking of Plinth Area estimate for construction of Science Block, Workshops and Hostel at PTU's Punjab Institute of Technology Campus at Mansa.

This has reference to you letter no. PTU/CC/791 Dated 28.06.2012 on the above subject.

It has been checked again after the first vetting report (given on July 24, 2012) findings have been incorporated by the architect.

1) **Junior Wing and Engg. College Block**: - On the basis of Plinth area calculations, total cost for this block after vetting comes out to be Rs. 603,850,277.66.

2) **Workshop:** - The estimated cost on plinth area rate basis is Rs. 69,184,283 & is in order with the given preliminary estimate.

3) **Hostels:** - The estimated cost on plinth area rate basis is Rs. 107,789,777.74 & is in order with the given revised preliminary estimate.

4) **The total estimated cost for all the buildings/components comes out to be Rs. 780,824,339.00**

4) The Plinth area of the buildings/components taken is generally in order but however accuracy for exact plinth area lies with the architect as there are slight variations in the additional area calculations in all the blocks.

Assuring you our best attention at all times.

With kind Regards

Yours Sincerely

Maneek 30/7/12

(MANEEK KUMAR)

SUMMARY- PRELIMINARY ESTIMATE PHASE 1

S. No.	Builing / Component	Plinth Area* (Sqm)	Cost in Rs	Air conditioning Cost (Refer Annexure 7)	Total Cost of building (4+5)	Reference
1	2	3	4	5	6	7
1	Junior wing & Engg. College Block	18,996.24	54,35,70,686.37	94,88,684.48	55,30,59,370.85	
2	Workshop	2,376.21	7,10,66,352.06		7,10,66,352.06	
3	Boys/Girls Hostel	5,989.14	10,65,94,430.03		10,65,94,430.03	
4	**Sub Total for Buildings (Sum- 1:8)**	**27,361.59**	**72,12,31,468.46**	**94,88,684.48**	**73,07,20,152.94**	

Annexure 1

Junior wing & Engineering College Block

Type of Building -	College		Refer Drg No.
Total Plinth Area -	18,996.24	sq.m	
Plinth Area On G. Floor -	3,532.74	sq.m	
Total covered area-	17,363.51	sq.m	
Double height area	768.33	sq.m	
No. of storey-	G + 5		
Floor height-	3.75	m	

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
3	**Passenger lifts**						
3.1	Passenger lift 8 passenger 1 m/s G+4	nos.	1.00	1.00	13,50,000.00	13,50,000.00	
3.2	Extra for additional floor	floors	1.00	1.00	90,000.00	90,000.00	
3.3	Passenger lift 13 passenger 1m/s G+4	nos.	1.00	2.00	18,00,000.00	36,00,000.00	
3.4	Extra for additional floor	floors	1.00	1.00	90,000.00	90,000.00	
3.5	Sub Total					51,30,000.00	
3.6	Add cost index				@ 51%	26,16,300.00	
	Total F =					77,46,300.00	
4	**Grand Total (D+E+F) =**					54,35,70,686.37	

Annexure 1

Junior wing & Engineering College Block

Type of Building -	College		Refer Drg No.
Total Plinth Area -	18,996.24	sq.m	
Plinth Area On G. Floor -	3,532.74	sq.m	
Total covered area-	17,363.51	sq.m	
Double height area	768.33	sq.m	
No. of storey-	G + 5		
Floor height-	3.75	m	

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six storeys						
1.1.1	Floor height 3.35m						
a.	Floors	sqm	18,996.24	1.0	13,200.00	25,07,50,368.00	
1.2	Extra for						
1.2.1	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	18,996.24	1.00	150.00	28,49,436.00	
1.2.2	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	768.33	1.33	150.00	1,53,281.84	for double height areas
1.2.3	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	3,532.74	2.00	150.00	10,59,822.00	
1.2.4	Resisting Earthquake forces	sqm	18,996.24	1.0	630.00	1,19,67,631.20	
1.2.5	Larger Module over 35 sqm	sqm	18,996.24	1.0	990.00	1,88,06,277.60	
1.2.6	Fire fighting With wet riser system	sqm	18,996.24	1.0	300.00	56,98,872.00	
1.2.7.	Fire Alarm Automatic fire alarm system	sqm	3,532.74	1.0	300.00	10,59,822.00	
1.2.8	RCC Cost of Lab area	sqm	3,567.66	1.0	13,200.00	4,70,93,112.00	
1.2.9	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	3,567.66	1.00	150.00	5,35,149.00	
	Total A (1.1.1.a + 1.2.1) =					**25,35,99,804.00**	
	Total B (1.2.2 to 1.2.7) =					**3,87,45,706.64**	
	Total C (1.2.8+1.2.9)=					**4,76,28,261.00**	
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 4%	1,01,43,992.16	
2.2	Internal Electrical installations	% of A			@ 12.5%	3,16,99,975.50	
2.3	Internal Electrical installations for laboratories	% of C			@15%	71,44,239.15	15% of civil cost of lab area
2.4	Extra for						
2.4.1	Power wiring & plugs	% of A			@ 4%	1,01,43,992.16	
2.4.2	Lightning conductors						
a.	5 to 8 storeyed buildings	% of A			@ 0.33%	8,36,879.35	
2.4.3	Telephone conduits	% of A			@ 0.5%	12,67,999.02	
2.4.4	Data network conduits	% of A			@ 0.5%	12,67,999.02	
	Total C =	% of A				**6,25,05,076.36**	
	Sub Total D = A+B+C					**35,48,50,587.00**	
	Add Cost Index (E =)				@ 51%	**18,09,73,799.37**	

Annexure 5

Workshop

Refer Drg No.

Type of Building -	College	
Total Plinth Area -	2,376.21	sq.m
Plinth Area On G. Floor -	2,376.21	sq.m
Total covered area-	2,213.47	sq.m
No. of storey-	G	
Floor height-	4.20	m

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six storeys						
1.1.1	Floor height 3.35m	sqm	2,376.21	1.0	13,200.00	3,13,65,972.00	
a.	Floors						
1.2	Extra for	sqm	2,376.21	2.83	150.00	10,09,889.25	
1.2.1	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	2,376.21	1.00	150.00	3,56,431.50	
1.2.2	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	2,376.21	1.00	990.00	23,52,447.90	
1.2.3	Larger Module over 35 sqm					**3,23,75,861.25**	
	Total A (1.1.1.a + 1.2.1) =					**27,08,879.40**	
	Total B (1.2.2 to 1.2.3) =						
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 4%	12,95,034.45	
2.2	Internal Electrical Installation	% of A			@ 12.5%	40,46,982.66	
2.3	Internal Electrical installations for laboratories	% of A			@ 15%	48,56,379.19	
2.4	Extra for						
2.4.1	Power wiring & plugs	% of A			@ 4%	12,95,034.45	
2.4.2	Lightning conductors						
a.	upto 4 storeyed buildings	% of A			@ 0.5%	1,61,879.31	
2.4.3	Telephone conduits	% of A			@ 0.5%	1,61,879.31	
2.4	Data network conduits	% of A			@ 0.5%	1,61,879.31	
	Total C =					**1,19,79,068.66**	
	Sub Total D = A+B+C					**4,70,63,809.31**	
	Add Cost Index (E =)				@ 51%	**2,40,02,542.75**	
	Grand Total (D+E+F) =					**7,10,66,352.06**	

Annexure 6

Hostels

Type of Building -	Hostel		Refer Drg No.
Total Plinth Area -	5,989.14	sq.m	
Plinth Area On G. Floor -	1,922.49	sq.m	
Total covered area-	5,697.89	sq.m	
Double height area-	533.75	sq.m	
No. of storey-	G +3		
Floor height- ground floor	4.00	m	
Floor height	3.15	m	

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six storeys						
1.1.1	Floor height 3.35m						
a.	Floors	sqm	5,989.14	1.0	9,100.00	5,45,01,174.00	
1.2	Extra for						
1.2.2	Every 0.3m additional height of floor above normal floor height of 3.35m. (Double height areas)	sqm	533.75	11.17	150.00	8,94,031.25	Double height areas
1.2.3	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	1,922.49	1.00	150.00	2,88,373.50	
1.2.4	Fire fighting						
1.2.4.1	With wet riser system	sqm	5,989.14	1.00	300.00	17,96,742.00	
1.2.5	Fire Alarm						
1.2.5.1	Automatic Fire alarm system	aqm	1,922.49	1.00	300.00	5,76,747.00	
	Total A (1.1.1.a + 1.2.1) =					**5,45,01,174.00**	
	Total B (1.2.2 to 1.2.6) =					**35,55,893.75**	
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 10%	54,50,117.40	
2.2	Internal Electrical Installation	% of A			@ 12.5%	68,12,646.75	
2.3	Extra for						
.31	Lightning conductors	% of A			@ 0.5%	2,72,505.87	
2.3.1.1	upto 4 storeyed buildings	% of A				1,25,35,270.02	
	Total C =					**7,05,92,337.77**	
	Sub Total D = A+B+C				@ 51%	**3,60,02,092.26**	
	Add Cost Index (E =)						
	Grand Total (D+E+F) =					**10,65,94,430.03**	

Annexure 7

Cost of Airconditioning

S.No.	Building	Unit	Area	Refrigeration Provided @ 1 TR/100sq.ft	Cost @ 40,000/ TR	Explanation
1	2	3	4			5
	A C Areas					
1	Junior Wing & Engineering College Block	Sqm.	2,204.62	237.22	94,88,684.48	
2	Engineering College Block	Sqm.	2,204.62	237.22	94,88,684.48	
3	Library & Central Research Facilities	Sqm.	2,586.20	278.28	1,11,31,004.80	
4	Administration	Sqm.	1,184.86	127.49	50,99,637.44	
5	Total		8,180.30	880.20	3,52,08,011.20	

AREA CALCULATION																							Annexure 8	
		Building block/ Function- ACADEMIC CAMPUS																		Building block/ Function- Girls/ Boys Hostel		
		1			2			3			4			5			6			7		
		Junior & Engineering College Block			Engineering College Block			Library & Central Research Facilities			Student Activity centre			Administration			Workshop			Hostel		
		Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)
S.NO.		1 (a)	1 (b)	1 (c)	2 (a)	2 (b)	2 (c)	3 (a)	3(b)	3 (c)	4 (a)	4(b)	4(c)	5 (a)	5(b)	5(c)	6(a)	6(b)	6(c)	6(a)	6(b)	6(c)
1	Ground Floor	3,332.67	200.07	3,532.74	3,034.39	200.07	3,234.46	1,859.78	143.77	2,003.55	1,155.96	362.07	1,518.03	1,114.14	-	1114.14	2,213.47	162.74	2376.21	1,756.55	165.94	1922.49
2	First floor	2,598.14	213.36	2,911.50	2,744.78	213.36	2,958.14	1,429.77	37.90	1,467.67	623.77	8.15	631.93	1,030.27	203.41	1,233.68	-	-	-	1,412.28	120.72	1,533.00
3	Second Floor	2,934.60	414.16	3,348.75	2,934.60	414.16	3,348.76	-	-	-	-	-	-	-	-	-	-	-	-	1,303.91	18.24	1,322.15
4	Third Floor	2,746.09	194.54	2,940.63	2,746.09	194.54	2,940.63	-	-	-	-	-	-	-	-	-	-	-	-	1,225.15	(13.65)	1,211.50
5	Fourth Floor	2,924.10	398.37	3,322.47	2,924.10	398.37	3,322.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Fifth Floor	2,727.91	212.23	2,940.14	2,727.91	212.23	2,940.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Total Area/ block	17,363.51	1,632.73	18,996.24	17,111.87	1,632.73	18,744.60	3,289.55	181.67	3,471.22	1,779.73	370.22	2,14[illegible].95	2,144.41	[illegible]	2,347.82	[illegible]	162.74	2376.21	5,697.89	291.25	5,989.14
8	Total Ground Coverage/ block	3,433.17 sqm						1,859.78 sq.m			1,155.96 sq.m			1,114.14 sq.m			2,213.47 sq.m			1,[illegible]1.24 sq.m		

9	Total Covered Area 1(a)+2(a)+3(a)+4(a)+5(a)+6(a)	56,298.32
10	Total Additinal Area 1(b)+2(b)+3(b)+4(b)+5(b)+6(b)	4,766.00
11	Total Plinth Area 1(c)+2(c)+3(c)+4(c)+5(c)+6(c)	60,064.32
12	Total Ground Coverage (approx)	14,917.76

SUMMARY- PRELIMINARY ESTIMATE						
S. No.	Builing / Component	Plinth Area* (Sqm) (refer annexure 5)	Cost in Re	Air conditioning Cost (Refer Annexure 4)	Total Cost of building (4+5)	Reference
1	2	3	4	5	6	7
1	Junior wing & Engg. College Block	18,996.24	59,43,61,593.18	94,88,684.48	60,38,50,277.66	Ref. Annexure 1
3	Workshop	2,312.80	6,91,84,283.82		6,91,84,283.82	Ref. Annexure 2
4	Girls Hostel	5,989.14	10,77,89,777.74		10,77,89,777.74	Ref. Annexure 3
6	**Total estimated cost**	**27,298.18**	**77,13,35,654.73**	**94,88,684.48**	**78,08,24,339.00**	

* For areas refer area statement- Annexure 5

Junior Block

Annexure 1

Type of Building -	College	
Total Plinth Area -	18,996.24	sq.m
Plinth Area On G. Floor -	3,532.74	sq.m
Total covered area-	17,363.51	sq.m
Double height area	768.33	sq.m
No. of storey-	G + 5	
Floor height-	3.75	m

Refer Drg No. PIT- I/PRE/AC/JE-01.01 - 01.18

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six						
1.1.1	Floor height 3.35m						
a.	Floors	sqm	18,996.24	1.0	13,200.00	25,07,50,368.00	
1.2	Extra for						
1.2.1	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	18,996.24	1.33	150.00	37,99,248.00	
1.2.2	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	768.33	13.83	150.00	15,94,284.75	for double height areas
1.2.3	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	3,532.74	2.00	150.00	10,59,822.00	
1.2.4	Resisting Earthquake forces	sqm	18,996.24	1.0	630.00	1,19,67,631.20	
1.2.5	Larger Module over 35 sqm	sqm	18,996.24	1.0	990.00	1,88,06,277.60	
1.2.6	Fire fighting						
	With wet riser system	sqm	18,996.24	1.0	300.00	56,98,872.00	
1.2.7.	Fire Alarm						
	Automatic fire alarm system	sqm	3,532.74	1.0	300.00	10,59,822.00	
	Total A (1.1.1.a + 1.2.1) =					**25,45,49,616.00**	
	Total B (1.2.2 to 1.2.7) =					**4,01,86,709.55**	
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 4%	1,01,81,984.64	
2.2	Internal Electrical installations	% of A			@ 12.5%	3,18,18,702.00	
2.3	Internal Electrical installations for laboratories	% of C			@15%	3,81,82,442.40	
2.4	Extra for						
2.4.1	Power wiring & plugs	% of A			@ 4%	1,01,81,984.64	
2.4.2	Lightning conductors						
a.	5 to 8 storeyed buildings	% of A			@ 0.33%	8,40,013.73	
2.4.3	Telephone conduits	% of A			@ 0.5%	12,72,748.08	
2.4.4	Data network conduits	% of A			@ 0.5%	12,72,748.08	
	Total C =	% of A				**9,37,50,623.57**	
	Sub Total D = A+B+C					**38,84,86,949.12**	
	Add Cost Index (E =)				@ 51%	**19,81,28,344.05**	

Junior Block

Annexure 1

Type of Building -	College		Refer Drg No. PIT- I/PRE/AC/JE-01.01 - 01.18
Total Plinth Area -	18,996.24	sq.m	
Plinth Area On G. Floor -	3,532.74	sq.m	
Total covered area-	17,363.51	sq.m	
Double height area	768.33	sq.m	
No. of storey-	G + 5		
Floor height-	3.75	m	

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
3	**Passenger lifts**						
3.1	Passenger lift 8 passenger 1 m/s	nos.	1.00	1.00	13,50,000.00	13,50,000.00	
3.2	Extra for additional floor	floors	1.00	1.00	90,000.00	90,000.00	
3.3	Passenger lift 13 passenger 1m/s G+4	nos.	1.00	2.00	18,00,000.00	36,00,000.00	
3.4	Extra for additional floor	floors	1.00	1.00	90,000.00	90,000.00	
3.5	Sub Total					51,30,000.00	
3.6	Add cost index				@ 51%	**26,16,300.00**	
	Total F =					**77,46,300.00**	
4	**Grand Total (D+E+F) =**					**59,43,61,593.18**	

Workshop

Annexure 2

Type of Building -	College	Refer Drg No. PIT- I/PRE/AC/WS-01.01 - 01.02
Total Plinth Area -	2,312.80	sq.m
Plinth Area On G. Floor -	2,376.21	sq.m
Total covered area-	2,220.66	sq.m
No. of storey-	G	
Floor height-	4.20	m

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six storeys						
1.1.1	Floor height 3.35m						
a.	Floors	sqm	2,312.80	1.0	13,200.00	3,05,28,960.00	
1.2	**Extra for**						
1.2.1	Every 0.3m additional height of floor above normal floor height of 3.35m.	sqm	2,312.80	2.83	150.00	9,82,940.00	
1.2.2	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	2,376.21	1.00	150.00	3,56,431.50	
1.2.3	Larger Module over 35 sqm	sqm	2,312.80	1.00	990.00	22,89,672.00	
	Total A (1.1.1.a + 1.2.1) =					**3,15,11,900.00**	
	Total B (1.2.2 to 1.2.3) =					**26,46,103.50**	
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 4%	12,60,476.00	
2.2	Internal Electrical Installation	% of A			@ 12.5%	39,38,987.50	
2.3	Internal Electrical installations for laboratories	% of A			@ 15%	47,26,785.00	
2.4	Extra for						
2.4.1	Power wiring & plugs	% of A			@ 4%	12,60,476.00	
2.4.2	Lightning conductors						
a.	upto 4 storeyed buildings	% of A			@ 0.5%	1,57,559.50	
2.4.3	Telephone conduits	% of A			@ 0.5%	1,57,559.50	
2.4.4	Data network conduits	% of A			@ 0.5%	1,57,559.50	
	Total C =	% of A				**1,16,59,403.00**	
	Sub Total D = A+B+C					**4,58,17,406.50**	
	Add Cost Index (E =)				@ 51%	**2,33,66,877.32**	
	Grand Total (D+E+F) =					**6,91,84,283.82**	

Hostels

Annexure 3

Type of Building -	Hostel		Refer Drg No. PIT- I/PRE/AC/HOS-01.01 - 01.6
Total Plinth Area -	5,989.14	sq.m	
Plinth Area On G. Floor -	1,922.49	sq.m	
Total covered area-	5,697.89	sq.m	
Double height area-	533.75	sq.m	
No. of storey-	G +3		
Floor height- ground floor	4.00	m	
Floor height	3.15	m	

Sr.No.	Description	Unit	Qty	Nos	Rate	Amt	Explanation
1	2	3	4	5	6	7 = (4*5*6)	8
1	**R.C.C. FRAMED STRUCTURE**						
1.1	RCC framed structure upto six storeys						
1.1.1	Floor height 2.9m						
a.	Floors	sqm	5,989.14	1.0	9,100.00	5,45,01,174.00	
1.2	**Extra for**						
2.1	Every 0.3m additional height of floor above normal floor height of 2.9m.		5,989.14	1.0	150.00	8,98,371.00	
1.2.2	Every 0.3m additional height of floor above normal floor height of 2.9m (Double height areas)	sqm	533.75	9.83	150.00	7,87,281.25	Double height areas
1.2.3	Every 0.3m deeper foundation over normal depth of 1.20m (on G.F. area only)	sqm	1,922.49	1.00	150.00	2,88,373.50	
1.2.4	Fire fighting						
1.2.4.1	With wet riser system	sqm	5,989.14	1.00	300.00	17,96,742.00	
1.2.5	Fire Alarm						
1.2.5.1	Automatic Fire alarm system	aqm	1,922.49	1.00	300.00	5,76,747.00	
	Total A (1.1.1.a + 1.2.1) =					**5,45,01,174.00**	
	Total B (1.2.2 to 1.2.6) =					**43,47,514.75**	
2	**SERVICES**						
2.1	Internal water supply & sanitary installations	% of A			@ 10%	54,50,117.40	
2.2	Internal Electrical Installation	% of A			@ 12.5%	68,12,646.75	
2.3	Extra for						
2.31	Lightning conductors						
2.3.1.1	upto 4 storeyed buildings	% of A			@ 0.5%	2,72,505.87	
	Total C =	% of A				**1,25,35,270.02**	
	Sub Total D = A+B+C					**7,13,83,958.77**	
	Add Cost Index (E =)				@ 51%	**3,64,05,818.97**	
	Grand Total (D+E+F) =					**10,77,89,777.74**	

Cost of Airconditioning

Annexure 4

S.No.	Building	Unit	Area	Refrigeration Provided @ 1 TR/100sq.ft	Cost @ 40,000/ TR	Explanation
1	2	3	4			5
	A C Areas					
1	Junior Wing & Engineering College Block	Sqm.	2,204.62	237.22	94,88,684.48	
5	**Total**		**2,204.62**	**237.22**	**94,88,684.48**	

AREA CALCULATION

Annexure 5

		Building block/ Function- ACADEMIC CAMPUS						Building block/ Function- Girls/ Boys Hostel		
		1			2			3		
		Junior & Engineering College Block			Workshop			Hostel		
		Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)	Covered Area (sqm)	Additional Area (sqm)	Plinth area 1(a)- 1(b) (sqm)
S.NO.		1 (a)	1 (b)	1 (c)	6(a)	6(b)	6(c)	6(a)	6(b)	6(c)
1	Ground Floor	3,332.67	200.07	3,532.74	2,213.47	162.74	2376.21	1,756.55	165.94	1922.49
2	First floor	2,698.14	213.36	2,911.50	-	-	-	1,412.28	120.72	1,533.00
3	Second Floor	2,934.60	414.16	3,348.76	-	-	-	1,303.91	18.24	1,322.15
4	Third Floor	2,746.09	194.54	2,940.63	-	-	-	1,225.15	(13.65)	1,211.50
5	Fourth Floor	2,924.10	398.37	3,322.47	-	-	-	-	-	-
6	Fifth Floor	2,727.91	212.23	2,940.14	-	-	-	-	-	-
7	Total Area/ block	17,363.51	1,632.73	18,996.24	2,220.56	162.74	2,212.80	5,697.89	291.25	5,989.14
8	Total Ground Coverage/ block	3,433.17 sqm			2,213.47 sq.m			1,941.24 sq.m		

9	Total Covered Area 1(a)+2(a)+3(a)	30,979.95
10	Total Additinal Area 1(b)+2(b)+3(b)	2,307.37
11	Total Plinth Area 1(c)+2(c)+3(c)+4(c)+	33,287.32
12	Total Ground Coverage (approx)	9,529.12

ANNEXURE - C

DOCUMENT COVER SHEET

DESIGN BASIS REPORT

Rev	Date	Description	Checked By
00	24/07/2012	Issued for Approval	

CLIENT:-

PUNJAB TECHNICAL UNIVERSITY

Approved By:-

ARCHITECT:-

ARCHIGROUP ARCHITECTS
A-14, FIRST FLOOR, SECTOR 15, NOIDA
UTTAR PRADESH
Tel: 0120-4312430

STUCTURAL CONSULTANTS :-

NNC DESIGN INTERNATIONAL
B-2,JASWANT CHAMBERS,16 OKHLA,
NEW DELHI-110025, INDIA
Tel: 011-26920197, Fax No : 011-26920198
E-mail: nnc_consultants@hotmail.com

NAME OF PROJECT:-

PUNJAB INSTITUTE OF TECHNOLOGY, MANSA, PHASE I

	SIGN	DATE	DOCUMENT STATUS		DESCRIPTION	SHEET SIZE
DESIGNED BY	M.N	24/07/2012		For Approval	PUNJAB INSTITUTE OF TECHNOLOGY, MANSA, PHASE I	A4
CHECKED BY	MEN	24/07/2012				
APPROVED BY		-			DOC. NO. ATC/DBR/01 / REV.NO. 0 / NO.OF SHEETS 11	

1.0 INTRODUCTION

1.1 GENERAL PROJECT INFORMATION

PROJECT TITLE:

PUNJAB INSTITUTE OF TECHNOLOGY

LOCATION OF THE PROJECT:

MANSA

DESCRIPTION OF THE PROJECT:

Type of Buildings: RCC framed structure

The proposed plot has the following types of buildings.

S. No.	Type	No. of floor
1	Academic Block	G+5
2	Hostel Block	G+3
3	Workshop	Ground

1.2 STRUCTURAL DESIGN:-

The main considerations followed for the design of structure are:

(a) Structure safety and stability.

(b) To meet the demands of aesthetics conceived by the architect.

(c) Availability of material, equipment and expertise.

(d) Constructability and ease of maintenance.

(e) Durability.

(f) Economy.

2.0 STRUCTURAL SYSTEM:

All the Buildings have been designed as RCC framed structure with RCC slab, beams and columns. The buildings have been designed as slab beam arrangement in accordance with the relevant Indian Code of Practice for civil works i.e. IS: 456, IS: 875, IS: 1893-2002, IS: 4326-1976 and IS -13920-1993. The in-plane rigidity of slab is simulated in the model by providing moment of inertia of slabs in the floor beams in both the directions.

2.1 DESIGN APPROCH:

Structural Modeling: Three dimensional model of each building is generated using STAAD- Pro software. All the beams and columns have been idealized as Beam Elements. All the shear walls have been idealized as plate element. The structure is analyzed and designed for all possible combinations of gravity loads (dead and live loads), and lateral loads (earthquake load and wind loads). Faligue effects of persistent cyclic loads are not anticipated therefore ignored, if any.

2.2 FOUNDATION SYSTEM:

Soil report is awaited.

3.0 COMPUTER PROGRAMS USED:

Name	Purpose	Producer
STAAD Pro	Structural and Design Analysis	BENTLEY
AUTOCAD	Drafting Works	Autodesk

4.0 MATERIAL DEAD LOADS:

All the permanent loads on the structure are applied as dead load.

The dead load in a building shall comprise of self weight of beams, columns, walls, partitions, floors, roofs and also include

the weight of all other permanent constructions in the building and shall conform to IS: 1911-Schedule of unit weights of buildings materials.

Unit weight of various materials considered on the structural members is as follows:

S.No.	Item	Density (t/m^3)
1	Concrete	2.50
2	Steel	7.85
3	Saturated Soil	2.0
4	Water	1.0
5	Glass	2.6
6	Aluminium	2.7
7	100mm solid blocks with 25mm Plaster	0.25 T/m^2
8	200mm solid blocks with 25mm Plaster	0.45T/m^2
9	115mm Brick Work with 25mm Plaster	0.275 T/m^2
10	230mm Brick Work with 25mm Plaster	0.50 T/m^2

Following loads has been considered in structure for analysis:-

I. Self wt of structure

II. Slab thickness and floor finish – as per actual

III. Wall loads – as per actual.

5.0 LIVE LOAD:

Live loads on the entire floor shall comprise all loads other than dead loads. The minimum live loads on different occupancies have been considered as per IS: 875 (Parl 2).

Live load shall be considered in design as per Table 1 of I S 875 (Parl 2)-1987 as follows:

5.0.1 ACADEMIC BLOCK:

(a)	Class rooms & Lecture rooms	0.3 T / m^2
(b)	Seminar rooms	0.5 T/ m^2
(c)	Dining room & Cafeteria	0.3 T / m^2
(d)	Office and Staffrooms	0.25T / m^2
(e)	Toilets and bathrooms	0.2 T / m^2
(f)	Kitchen, Laboratories	0.3T / m^2
(g)	Corridors, passages, staircases including fire escapes , lobbies ,balconies	0.5T / m^2
(h)	Terrace	0.15 T / m^2
		0.50 T/m^2 usable Terrace for services

Following capacities have been considered for Water tank load:

Fire	25kl
Domestic	14kl
Flushing	17kl

(i) Machine Room 0.75 T / m^2

5.0.2 HOSTELS

a) Living room, Bed room	0.2 T / m^2
b) Kitchen & Laundry	0.3 T / m^2
c) Dining Room & Cafeteria	0.4 T / m^2
d) Toilets and bathrooms	0.2 T / m^2
e) Corridors, passages, slaircases including fire escapes , lobbies ,balconies	0.3T / m^2
f) Store rooms	0.5 T / m^2

Following capacities have been considered for Water tank load:

Fire	5kl
Domestic	10kl
Flushing	5.5kl

5.0.3 WORKSHOP

a) Work area with machinery/equipment

Light duty	0.5 T / m^2
Medium duty	0.7 T / m^2
Heavy duty	1.0 T / m^2

(RCC grade slab at plinth level is designed to support the above loads.)

b) Roof — 0.075 T / m^2 (Designed as Inclined roof

Following capacities have been considered for Water Tank load:

Domestic	3kl
Flushing	4kl

6.0 SEISMIC LOAD:

Response spectrum method was used as code with the following data:

Design horizontal seismic coefficient (Ah) = $\frac{Z I Sa}{2Rg}$

Zone factor Z = 0.24 corresponding to zone IV.

Importance factor I = 1.5 for Academic Block and Workshop

Importance factor I = 1.0 for Hostel block

Response reduction factor R = 5

(Sa/g) = Curve given for medium soil

T = Time period = 0.075 (h) ¾

HOSTELS

T = Time period

Time Period is calculated from the average of approximate fundamental natural period of vibration of a moment resisting frame building without brick infil panel and buildings with brick infil panels.

Time Period (with Brick infil) = $\frac{0.09 * h}{(d)^{1/2}}$

Time Period (without Brick infil) = 0.075 (h) ¾

h = Height of building above Ground Level

d = Base dimension of the building at the plinth level, along the considered direction of the lateral force.

7.0 MATERIALS

Concrete: -

Concrete mix of M25, M30 & M35 conforming with IS: 456 and CPWD specifications are used.

Steel Reinforcement: -

Fe 500 Grade (TMT - bars) conforming with IS: 1786.

Structural steel: -

Fy 250

8.0 DESIGN LIMIT STATES

The Limit state design method is used for the structural design of concrete member, except water tank.

For the design of water tanks working stress design method is used.

For design of the individual members loads are combined in accordance with the loading combinations specified in IS 875 to achieve the respective limit state. These are listed below:

S. No.	Dead Load	Live Load	Earthquake/Wind load
1	1.5	1.5	–
2	1.2	1.2	1.2
3	1.5	–	1.5
4	0.9		1.5

9.0 LOAD COMBINATIONS:

1. 1.5* (DL + LL)
2. 1.5*(DL+/-EQX)
3. 1.5*(DL+/-EQZ)
4. 0.9*DL+/-1.5EQX
5. 0.9*DL+/-1.5EQZ
6. 1.2*(DL+LL+/-EQX)
7. 1.2*(DL+LL+/-EQZ)
8. 1.5*(DL+/-WLX)
9. 1.5*(DL+/- WLZ)
10. 0.9*DL+/-1.5 WLX
11. 0.9*DL+/-1.5 WLZ
12. 1.2*(DL+LL+/- WLX)
13. 1.2*(DL+LL+/- WLZ)

Notations

DL =Dead Load
LL =Live Load
RLL = Reduced Live Load
EQX = Earthquake Load in-X-direction
EQZ = Earthquake Load in Z-direction
WLX = Wind Load in X-direction
WLZ = Wind Load in Z-direction
Whereas X & Z are two principal axes.

10.0 REQUIREMENTS FOR DURABILITY AND FIRE

Concrete cover requirements is governed by Indian Code. The values in the following table are appropriate for a fire rating of 2 hours.

The following classification also applies in the design of structural elements:

Exposure	Classification
Members in contact with the ground	Very Severe
Members in interior environments	Mild
Members in above-ground exterior environments	Moderate

In general, adopting the minimum concrete strengths and reinforcement covers will ensure the durability and fire resistance of concrete elements. Values shown on the drawings shall not be less than the following:

Element/Location	Minimum Cover (mm)	Minimum Thickness (mm)	Minimum Concrete Design (used in the design)
Cast In Place Concrete			
1. Concrete cast against and permanently exposed to earth	75	200	25

2. Concrete exposed to weather and not in contact with ground (moderate)			
a.) RC slabs	25	125	25
b.) RC walls	25	200	25
c.) RC beams	30	230	25
d.) RC columns	40	230	25

11.0 DESIGN CODES, STANDARDS AND REFERENCE DOCUMENTS

11.1 CODES, STANDARDS AND COMMENTARIES

S. No.	CODE	NAME
1	IS: 1893 – 2002	Criteria for Earthquake resistant deign of Structures
2	IS: 13920	Ductile detailing of Reinforced Concrete Structures subjected to Seismic forces.
3	IS: 4326 – 1993	Earthquake resistant Design and construction of Buildings
4	IS: 875 – 1987 (Part I to III & Part V)	Code and Practice for Design Loads (Other than earthquake) for Building and Structures like Dead, Imposed, Wind and other Loads
5	IS: 456 – 2000	Plain and Reinforced Concrete (Code of practice)
6	SP: 16	Design aids for Reinforced concrete Structure.
7	SP: 34	Handbook on Concrete Reinforcement and Detailing
8	IS: 3370 Part I, Part II and Part IV	Code of practice for Concrete structures for the storage of liquids.
9	IS: 1786	Specification for High Strength Deformed Steel bars and wires for concrete reinforcement
10	IS: 1904	Code and Practice for design and Construction of Foundations in Soils

11	IS: 2950	Code and Practice for Design and Construction of Raft Foundations
12	IS: 800-1980	Code of Practice for general Construction in Steel.
13	IS: 1343-1980	Code of Practice for Prestressed Concrete.

12.0 DESIGN REFERENCES AND HAND BOOKS:

S.No.	Name of Book	Author
1	Reinforced Concrete Design	W.H.Mosley
2	Foundation Analysis & Design (4Ih Edition)	Bowles
3	Foundation Design and Construction	Tomlinson
4	Concrete Structures	Warner, Rangan, Hall & Faulkes (Longman, 1998)
5	Reinforced Concrete Designers Handbook	Fourth Edition, Reynolds & Steedman
6	Reinforced Concrete Design (Second Edition)	S Unnikrishna Pillai, Devdas Menon
7	Reinforced Concrete	S. N. Sinha
8	Reinforced Concrete	O. P. Jain
9	Design of steel structure	P. Dayaratanam
10	Prestress Concrete Structure	P. Dayaratanam
11	Handbook of concrete, Engineering	Mark Fintel
12	Properties of concrete	A.M.Neville
13	Dynamic of Structures: Theory and Application Io Earthquake Engineering	Anil K. Chopra
14	Tall building structures: Analysis and design	B.S.Smith & Cauli
15	Structural Analysis	C.S.Reddy

GENERAL

1.1 The development at PIT-Mansa is proposed on two plots of land (site 1 – 32.98 acres and site 2 – 8.2 acres). Both the plots face each other with a road running between them. Academic buildings are proposed to be located on site 1 and the site 2 will be used for hostel buildings. The table below gives the list of buildings for each site:

S.No.	Type of Building	Covered Area (Sq. mt.)	Phase I	Phase II
	SITE 1			
1	College Building 1	18,665	X	
2	College Building 2	18,665		X
3	College Building 3	18,665		X
4	Work Shop	2,325	X	
5	Library and central research facility	3,710		X
6	Students' Facilitation Center	2,284		X
7	Administration	2,445		X
8	Auditorium			
	SITE 2			
1	Hostels - I	5,800	X	
2	Hostel - 2	5,800		X
3	Warden Quarter			X
4	Hotels for 1500 seats			X

ELECTRICAL INSTALLATIONS

GENERAL

Electricity – Most Important Utility in any development. Nothing works without it. Be it the lighting, Lifts, Air- Conditioning, kitchen or other equipment.

Design Requirements -

i) Sufficient lighting in the Common Areas like Lobbies, passages, wash rooms, stair cases, lift lobbies, entertainment areas etc.

ii) Attractive Façade Lighting.

iii) Security lighting around the buildings

iv) Power supply to various consumers and services.

Design Philosophy - Power distribution system to be designed keeping in view the following:

i) Continuity and reliability of power supply.
ii) Flexibility of operation.
iii) Concentration/distribution of loads.
iv) Safety of personnel and equipment.
v) Investment and operational costs.
vi) Compliance with various statutory provisions such as Indian Electricity Act and Rules, National Electrical Code and the relevant B.I.S. Specifications and State Electricity Authority' norms.
vii) Easy future extensions/modifications.
viii) Ease of maintenance.
ix) Maximum interchangeability of equipment resulting in minimum inventories and spare parts.
x) Minimum fire risk.
xi) Simplicity of operation.

TOTAL ELECTRICAL LOAD

Total electrical load on the basis of general norms and on the basis of Approved Design Basis Report of Kapurthala works out to be as under:

SUMMARY OF ELECTRICAL LOADS					
S. No.	Description	Area (Sq.ft.)	Total Connected Load (KW)	Max Demand Load after diversity (KW)	Emergency Load (KW)
1	SITE 1 (Academic Buildings)				
1A	Phase-1 - (One College Building housing 3 colleges + workshop Block)	234583	1908	1330	273
1B	Phase-2 - (Two College Building housing 6 colleges + Library + Student Activity Center + Admin + Auditorium)	516727	3699	2589	1003
1C	Total = 1A + 1B	751311	5608	3919	1276
2	SITE 2 (Hostel Buildings)				
2A	Phase-1 - (OneHostel Building - 198 Seats)	31199	245	172	25
2B	Phase-2 - (OneHostel Building - 198 Seats + 1500 Seats)	440079	1976	1379	125
2C	Total = 2A + 2B	471277	2221	1550	150
3	Total for Phase-1 (Site-1+ Site-2)	265782	2153	1501	298
4	Total for Phase-2 (Site-1+ Site-2)	956806	5675	3968	1128
	Grand Total (3+4)	1222588	7828	5470	1426

* For detailed Load Calculations of Each Building, Please refer Annexure I and II

ELECTRICAL SUPPLY SYSTEM:

Since both Site-I and Site II are located across the road and are also registered under one name, it is safe to assume that the PSEB will give one connection for both the sites together on one metering room. Initially a connection for the current requirements will be taken which will be enhanced as and when the constructed area in the campus keeps on increasing.

Based on the prevailing Electricity rules and as had been approved at Kapurthala, the power supply to meet this requirement, from the local electric supply board shall be made available at 11 KV (PTU to confirm this please).

From this metering room, HT Cable will terminate at HT VCB Panel and will be tapped from VCB Panel to the Subsequent Electrical Substations. These ESS's will be located near the load centers for most economical distribution. Each ESS will house VCB's, transformer for the corresponding loads being fed from there, DG sets for those buildings and related panels.

In all three ESS's are proposed for the complete development. However, only one ESS is proposed for the phase I for buildings in both Site I and Site II. The list of buildings proposed to be fed from each ESS and their corresponding electrical loads are given in the table below:

ESS-1 (Phase I)

S. No.	Description	Area (Sq.ft.)	Total Connected Load (KW)	Diversity	Max Demand Load after diversity (KW)	Emergency Load (KW)
1	2	3	4	5	6	7
1A	Site-1- One College Building	202197	1309	0.7	916.3	171.4
1B	Site-1- Work Shop Building	32387	484	0.7	339.1	17.4
1C	Site-2- One Hostel Building	31198.51	246.00	0.7	171.5	25.0
	Plumbing Pumps		75	0.7	52.5	52.5
	External Development		30	0.5	15.0	17.5
	Misc Load	LS	10	0.7	7.0	14.0
1D	**Total**		**2153**		**1501**	**298**
2	**Equipment Selection**					
2A	Transformer					
2A.1	Total Load		1501 KW			
2A.2	Overall Diversity of 80 %		1201 KW			
2A.3	Transformer Loading at 85 % and Power Factor 0.9		1570 KVA			

2A.4	Capacity	1 x 1600 KVA
2B	**Generator**	
2B.1	Total Load	298 KW
2B.2	Overall Diversity of 80 %	238 KW
2B.3	DG Loading at 80 % and Power Factor 0.8	372 KVA
2B.4	Capacity	1 x 380 KVA
Note : Workshop will be fed from ESS-1 in phase-1 and will be disconnected and will get fed from ESS-2 after the ESS 2 in Phase-2 is energised.		

ESS-1 (Phase-2)

S. No.	Description	Area (Sq.ft.)	Total Connected Load (KW)	Diversity	Max Demand Load after diversity (KW)	Emergency Load (KW)
1	2	3	4	5	6	7
1A	Site-1- Library	39920	419.2	0.7	293.4	293.4
1B	Site-1- Student Activity Centre	24587	159.8	0.7	111.9	15.4
1C	Site-1- Administration	26308	276.2	0.7	193.4	193.4
1D	Site-1- Auditorium	21520	226.0	0.7	158.2	158.2
1E	Site-2- One Hostel Building	31199	245.0	0.7	171.5	25.0
1F	Total		1326		928	685
2	**Equipment Selection**					
2A	**Transformer**					
2A.1	Total Load		928KW			
2A.2	Overall Diversity of 80 %		743 KW			
2A.3	Transformer Loading at 85 % and Power Factor 0.9		971 KVA			
2A.4	Capacity		1 x 1600 KVA (The same size of the transformer is proposed as proposed in Phase I)			

2B	Generator	
2B.1	Total Load	985 KW
2B.2	Overall Diversity of 80 %	548 KW
2B.3	DG Loading at 80 % and Power Factor 0.8	857 KVA
2B.4	**Capacity**	**1 X 500 + 1 x 380 KVA**

ESS-2 (To be Established in Phase-2)

S. No.	Description	Area (Sq.ft.)	Total Connecte d Load (KW)	Diversity	Max Demand Load after diversity (KW)	Emergency Load (KW)
1	2	3	4	5	6	7
1A	**Site-1**- Two College Buildings	404393	2618.0	0.7	1832.6	342.7
1B	**Site-1**- Work Shop Building	32387	484.4	0.7	339.1	17.4
1C	**Total**		**3102**		2172	**360**
2	**Equipment Selection**					
2A	Transformer					
2A.1	Total Load	2172 KW				
2A.2	Overall Diversity of 80 %	1737 KW				
2A.3	Transformer Loading at 85 % and Power Factor 0.9	2271 KVA				
2A.4	**Capacity**	**2 x 1250 KVA (If required, these can be installed as required as per the construction phasing)**				
2B	Generator					
2B.1	Total Load	360 KW				
2B.2	Overall Diversity of 80 %	288 KW				
2B.3	DG Loading at 80 % and Power Factor 0.8	450 KVA				
2B.4	**Capacity**	**1 x 500 KVA**				

ESS-3-Future						
S. No.	Description	Area (Sq.ft.)	Total Connected Load (KW)	Diversity	Max Demand Load after diversity (KW)	Emergency Load (KW)
1	2	3	4	5	6	7
1A	Site-2- Hostel-1500Seats	408880	1635.5	0.7	1144.9	30.0
	External Lighting		20.0	0.5	10.0	10.0
	Plumbing Load		75.0	0.7	52.5	52.5
1B	Total		1731		1207	93

2	**Equipment Selection**	
2A	**Transformer**	
2A.1	Total Load	1207 KW
2A.2	Overall Diversity of 80 %	966 KW
2A.3	Transformer Loading at 85 % and Power Factor 0.9	1263 KVA
2A.4	**Capacity**	**1 x 1250 KVA**
2B	**Generator**	
2B.1	Total Load	93 KW
2B.2	Overall Diversity of 80 %	74 KW
2B.3	DG Loading at 80 % and Power Factor 0.8	116 KVA
2B.4	**Capacity**	**1 x 160 KVA**

SUMMARY OF EQUIPMENT IN THE 3 ELECTRICAL SUB STATIONS (ESS)		
ESS No.	TRANSFORMER	DG SET
ESS-1	2 X 1600 KVA	1 X 500 + 2 X 380 KVA
ESS-2	2 X 1250 KVA	1 X 500 KVA
ESS-3	1 X 1250 KVA	1 X 160 KVA

PROVISION OF ESSENTIAL SUPPLY/ STAND-BY POWER

It is proposed to provide backup power from generators on the basis of what has been approved at Kapurthala. See the table below:

1. Entire Library Block, Admin Area, Auditorium.
2. For College Buildings, Workshop and Student Activity Centre, 25 % of lighting, Fans and Small Power Load and all lifts are being considered on Generator Backup.
3. For Hostel Buildings- Corridors, Dining Hall and Common Area is being considered on Generator Backup.

To meet the requirement, the following DG Sets are proposed to be provided:

1. **ESS-1**
   a) Phase-1- 380 KVA
   b) Phase-II- 1 x 500 KVA + 1 X 380 KVA

2. **ESS-2**
   a) Phase-II- 500 KVA

3. **Future ESS-3**
   a) Future Phase- 160 KVA

These DG sets shall be air cooled units with acoustic canopy enclosure.

SEB Power

The SEB meter for 11 KV HT supply will be installed at the North East Corner of Site-1. From there the HT cable will terminate at HT VCB PANEL. From there HT line will be lapped from VCB PANEL to the Subsequent ESS's.

H.T. Panels

The H.T. Panel shall consist of 1 Number, 4 VCB Panel located near the metering room.

ESS-1 will have 3 Panel VCB Board (1 VCB for Incomer + 1 VCB for Phase-1 and 2nd for Phase-2).
ESS-2 will have 3 VCB Panel.
Future ESS-3 will have 1 VCB Panel.

Transformers

These shall be oil type for 11/.433 KV sub-stations and will be located outside the building.

Transformer shall be provided with ON circuit taps in the range of + 5% to -15%. There will be on load tap changer on the H.T. winding controlled by automatic voltage regulator to maintain constant voltage in specified range of variation.

The transformers will be provided with all the necessary protection and earth.

L.T. PANEL AND POWER DISTRIBUTION

Automatic Power Factor Correction Panel will also be installed here. The L.T. Panel will have air circuit breakers for controlling the feeders of more than 630 Amp. rating whereas feeders of 630 Amp. and below will have MCCB.s to control them. LT panel shall supply power to sub distribution boards (SDBs) and floor distribution boards (FDBs) located on the area basis.

Main Distribution Board shall be indoor type of metal clad construction, partly draw out type having self aligning type auxiliary contacts for circuit breakers and draw out modules.

4 pole Bus bars and air circuit breakers shall have short circuit withstand capacity of 50 KA for 1 second duration.

Air circuit breakers of incoming transformer, DG and bus coupler shall be of electrically operated type with the necessary protections.

For all incomers and the main outgoing feeders, a data logger having digital display, scanning facility of Electrical parameters, data storing with battery backup and data retrievable by PC shall be provided.

DOL starters will be provided for motors rated upto 7.5 KW and Star Delta starters for all motors rated above 7.5 KW will be provided.

AUTOMATIC POWER FACTOR CORRECTION PANEL

Automatic Power Factor Correction Panel will also be installed in the LT panel room to maintain a power factor of more than 0.95. It will be thyristor controlled multi stage type. Power factor relay with metering will also be incorporated.

CABLES

All cables proposed to be used shall be of aluminum conductor, XLPE type. All wires shall be PVC insulated FRLS or otherwise as required with copper conductor. All electrical conduits for medium voltage systems will be PVC. All conduits for low voltage and fire detection and alarm system will be Mild Steel.

LIGHTNING PROTECTION

Single pole Early Streamer type lightening arrestors will be provided in the College building as the height is more than 15 meters.

EARTHING SYSTEMS

Earthing system including earthing strips/cables and earth pits will be provided.

It is proposed to provide electrolytic, chemical earthing system. This type of earthing system has:

1 Low electrical resistance to earth.
1. Good Corrosion resistance.
2. Ability to carry high currants repealedly.
3. Reliable long life system
4. Low Maintenance.

Main earth electrode will be suitable to achieve a maximum resistance to earth of 1 Ohm.

Proper Grounding will be provided for

a) Normal AC supply
b) All apparatus and metal pieces
c) Steel Structures
d) Mechanical plant and pipe work
e) Gas and water pipe work

Separate systems of earthing shall be provided in the building for:

(i) UPS
(ii) Telephone / EPABX
(iii) Servers and computer equipment
(iv) AV Systems

ILLUMINATION SYSTEM

The provision of luminaries in various areas of the building to be designed to achieve the illumination levels as per relevant standards and site requirement. The luminaries will be selected keeping in mind Aesthetics, location requirement, ease of maintenance and energy conservation.

S. No.	DESCRIPTION OF SPACE	TYPE OF LIGHTING	ILLUMINATION (LUX LEVEL)	REMARKS
i)	Class Rooms	CFL /T5 lamps	300-350	
ii)	Corridors and circulation spaces	CFL /T5 lamps	150-200	
iii)	Toilets	CFL lamps	100-150	
iv)	Staircases	CFL lamps	100-150	
v)	Office Areas	CFL /T5 lamps	300-400	

vi)	Service Areas	CFL lamps	150-200	
vii)	Stores	CFL lamps	150-200	
viii)	Seminar Hall	As per Interiors	400-500	The lighting will be as per interior design
ix)	MEP Shafts/Closets	Fluorescent Tube Lights/bulk head	150	
x)	Kitchen/Dining	CFL /T5 lamps	300-400	
xi)	Laboratories / Library / Music Rooms	CFL /T5 lamps	300-400	
xii)	Workshop	Fluorescent covered Tube Lights	300-500	

LV SERVICES

The Scope of design and execution would consider only the provision of Mild Steel (MS) conduiting for the Data Networks i.e we would not be considering the actual cabling and the Outlets for the computer system. Inputs on Locations of Data points would be marked on the layout and conduiting will be done accordingly. However, conduiting, wiring as well as the sockets for voice (telephone) system would be included in the design and execution.

PROVISION OF SOCKET OUTLETS

Provision of socket outlets shall be made as per space requirements. All 16 amp. Sockets shall be 5pin 6/16 amp. type. All sockets shall be shuttered type. Sockets are proposed to be provided in the Common areas for house keeping and in the utility room like sub-stations, pump room etc. Provision of sockets will be kept as per the interior layout.

Sockets will be provided in each class room for Projector and smart board.

Sockets will also be provided in staff areas, library, Laboratories as required.

ENERGY CONSERVATION

To economize on the use of energy, following main systems are proposed to be adopted :

i) Adequate design to limit the losses in transmission and distribution system.
ii) Use of energy efficient devices like light sources such T5 lamps and compact fluorescent lamps.
iii) Use of insulation on roof top to reduce air-conditioning load.
iv) Use of capacitors at load centers to improve voltage and power factor to reduce distributional losses and also to avoid penalty by state electricity authority.
v) Part Solar Lighting and solar water heating systems will be used.

SECURITY / PA SYSTEM

Provision for installing a CCTV system may be made to monitor the Main Entries & Exits of the buildings. 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 may be made for seminar hall, Library, corridor. Wiring, outlets & hardware is not being considered in this scope.

FIRE ALARM SYSTEM

The main emphasis of fire detection system shall be on having the timely warning in case of any fire.

Buildings in Phase I namely College Building 1, workshop and hostel building, are proposed to be provided with manually operated electrical fire alarm system as per the requirements of the NBC-2005, Part IV. A system consisting of Hooters, Manual call stations and all the floors at the staircase exits and Fire Control panel at the ground floor shall be provided.

ANNEXURE I

Electrical Load Calculation (Building Wise), Site 1, Phase 1

College Building 1										
S. No.	Description	Covered Area / Block (In Sq.mtr.)	Covered Area/ Block (In Sq.ft.)	Light/Power Load (2.5W/Sqft)	AC Load (8w /Sqft)	Lab Equipment (as per recommendation)	Total Connected	Diversity	Max Demand Load (KW)	Emergency Load (25% of L/P Load)
1	Ground Floor	3658.9	39369.76	98.42	62.99	75	236.42	0.7	165.49	24.61
2	First Floor	2899.49	31198.51	78.00	49.92	60	187.91	0.7	131.54	19.50
3	Second Floor	3009.94	32386.95	80.97	51.82	90	222.79	0.7	155.95	20.24
4	Third Floor	3145.68	33847.52	84.62	54.16	60	198.77	0.7	139.14	21.15
5	Fourth Floor	3029.49	32597.31	81.49	52.16	90	223.65	0.7	156.55	20.37
6	Fifth Floor	3048	32796.48	81.99	52.47	60	194.47	0.7	136.13	20.50
	LIFT Load 3 Nos at 15 KW/Lift						45.00	1	45.00	45.00
	Total	18791.5	202196.54	505	324	435	1309.01		929.80	171
	*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 per as PTU recommendation.									

Hostel Building, Site 1, Phase 1

S. No.	Description	Covered Area / Block (In Sq.mtr.)	Covered Area/ Block (In Sq.ft.)	Light/Power Load (2W/Sqft)	AC Load (8w /Sqft)/Cooler Load 2w/Sqft	Lab Equipment (as per recommendation)	Total Connected	Diversity	Max Demand Load (KW)	Emergency Load
1	Ground Floor	1756.5	18899.94	37.80	37.80		75.60	0.7	52.92	7.56
2	First Floor	1412.28	15196.13	30.39	30.39		60.78	0.7	42.55	6.08
3	Second Floor	1303.91	14030.07	28.06	28.06		56.12	0.7	39.28	5.61
4	Third Floor	1225.15	13182.61	26.37	26.37		52.73	0.7	36.91	5.27
	Total	**5697.84**	**61308.76**	**123**	**123**	**0**	**245**		**172**	**25**

Workshop Building, Site 1, Phase 1

S. No.	Description	Covered Area / Block (In Sq.mtr.)	Covered Area/ Block (In Sq.ft.)	Light/Power Load (2.5W/Sqft)	AC Load (8w /Sqft)	Lab Equipment (as per recommendation)	Total Connected	Diversity	Max Demand Load (KW)	Emergency Load (25% of L/P)
1	Ground Floor	2580.36	27764.89	69.41		415	484.41	0.7	339.09	17.35
	Total	2580.38	27764.89	69	0	415	484		339	17

ANNEXURE II

Electrical Load Calculation For Site 1, Phase 2

S. No.	Description	Covered Area / Block (In Sq.mtr.)	Covered Area/ Block (in Sq.ft.)	Light/Power Load (2.5W/Sqft)	AC Load (8w /Sqft)	Lab Equipment (as per recommendation)	Total Connected	Diversity	Max Demand Load (KW)	Emergency Load (25% of L/P Load)
1	College Building-II	18791.5	202196.54	505.49	323.51	435	1309.01	0.7	916.30	171.37
2	College Building-III	18791.5	202196.54	505.49	323.51	435	1309.01	0.7	916.30	171.37
3	Library	3710	39919.60	99.80	319.36		419.16	0.7	293.41	293.41
4	Student Activity Centre	2285	24586.60	61.47	98.35		159.81	0.7	111.87	15.37
5	Admin	2445	26308.20	65.77	210.47		276.24	0.7	193.37	193.37
6	Auditorium	2000	21520.00	53.80	172.16		225.96	0.7	158.17	158.17
	Plumbing Load						100	0.7	70.00	70.00
	Total	**48023**	**516727.48**	**1292**	**1447**	**870**	**3799.18**		**2659.42**	**1073**

LIST OF APPLICABLE INDIAN STANDARDS FOR ELECTRIFICATION WORK

S. No. STANDARDS	TITLE
(1) IS: 732 - 1989	Code of practice for electrical wiring installations.
(2) IS:4648 - 1968	Guide for electrical layout in residential buildings.
(3) IS:8061 - 1976	Code of practice for design, installation and maintenance of service lines upto and including 650V
(4) IS:8884 - 1978	Code of practice for installation of electric bells and call system.
(5) IS:5578 - 1985	Guide for marking of insulated conductor.
(6) IS:11353- 1985	Guide for uniform system of marking and identification of conductors and apparatus terminals.
(7) IS:5728 - 1970	Guide for short-circuit calculations.
(8) IS:7752(Part-1)-1975	Guide for improvement of power factor in consumer installation : Low and medium supply voltages.
(9) IS:3646(Part-1)-1966	Code of practice for interior illumination: Principles for good lighting and aspects of design.
(10) IS:3646(Part-2)-1966	Code of practice for interior illumination: Schedule of illumination and glare index.
(11) IS:2672 - 1966	Code of practice for library lighting.
(12) IS:10118(Part-1)-1982	Code of practice for selection, installation and maintenance of switchgear and control gear : General.
(13) IS:10118(Part-2)-1982	Code of practice for selection, installation and maintenance of switchgear and control gear.
(14) IS:10118(Part-3)-1982	Code of practice for selection, installation and maintenance of switchgear and control gear: Installation.
(15) IS:10118(Part-4)-1982	Code of practice for selection, installation and maintenance of switchgear and control gear: Maintenance.
(16) IS:2309 - 1989	Code of practice for the protection and allied structures against lightning.
(17) IS:3043 - 1987	Code of practice for earthing.
(18) IS:5216(Part-1)-1982	Guide for safety procedures and practices in electrical work: General.
(19) IS:4237 - 1983	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC.

(20) IS:6875(Part-1)-1973	Control switches (switching devices for control and auxiliary circuits including contractor relays) for voltages upto and including 1000 V AC and 1200 DC : General requirements and tests.
(21) IS:4064(Part-1)-1978	Air break switches, air break dis-connectors, air-break switch disconnectors and fuse-combination units for voltages not exceeding 1000 V AC or 1200 DC : General requirements.
(22) IS:8828 - 1978	Miniature air break circuit breakers for voltages not exceeding 1000 volt.
(23) IS:13032 - 1991	Miniature circuit breaker boards for voltages upto and including 1000 volts AC.
(24) IS:12640 - 1988	Residua current operated circuit breakers.
(25) IS:2959 - 1985	Contactors for voltages not exceeding 1000 V AC or 1200 V DC.
(26) IS:8623(Part-1)-1977	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC: General requirements.
(27) IS:8623(Part-2)-1980	Factory assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC : Particular requirements for busbar trunking system (busways).
(28) IS:694 - 1990	PVC Insulated cables for working voltages upto and including 1100 V.
(29) IS:1554(Part-1)-1988	PVC insulated (heavy duty) electric cables :For working voltages upto and including 1100 V.
(30) IS:3961 (Part-5)-1968	Recommended current ratings for cables: PVC insulated light duty cables.
(31) IS:9537(Part-1)-1980	Conduits for electrical installations :General requirements.
(32) IS:9537(Part-2)-1981	Conduits for electrical installations Rigid steel conduits.
(33) IS:3480 - 1966	Flexible steel conduits for electrical wiring.
(34) IS:2667 - 1988	Fittings for rigid steel conduits for electrical wiring.
(35) IS:3837 - 1976	Accessories for rigid steel conduits for electrical wiring.
(36) IS: 5133(Part-1)-1969	Boxes for enclosure of electrical accessories: Steel and cast iron boxes.
(37) IS:371 - 1979	Ceiling roses.
(38) IS:3854 - 1988	Switches for domestic and similar purposes.

(39)	IS:4615 - 1968	Switch socket outlets (non-interlocking type).
(40)	IS:4160 - 1967	Interlocking switch socket outlet.
(41)	IS:1293 - 1988	Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes.

AIR CONDITIONING SYSTEM

GENERAL

The development at PIT-Mansa is proposed on two plots of land (Site1- 32.98 acres and Site 2- 8.2 acres). Both the plots face each other with a road running between them. Academic buildings are proposed to be located on site I & the site 2 will be used for hostel buildings. Following is list of buildings at each site:

S. No.	Type of Building	Covered Area (Sq. mt.)	Phase I	Phase II	Air-conditioned	Kitchen Ventilation
	SITE 1					
1	College Building 1	18,665	X		X	
2	College Building 2	18,665		X	X	
3	College Building 3	18,665		X	X	
4	Work Shop	2,325	X			
5	Library and central research facility	3,710		X	X	
6	Students' Facilitation Center	2,284		X		
7	Administration	2,445		X	X	
8	Auditorium				X	
	SITE 2					
1	Hostels - I	5,800	X			X
2	Hostel - 2	5,800		X		X
3	Warden Quarter			X		
4	Hotels for 1500 seats			X		X

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

a) .Outside Conditions

i) Summer:

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

ii) Monsoon:

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

HVAC

AIR CONDITIONING SYSTEM

GENERAL

The development at PIT-Mansa is proposed on two plots of land (Site1- 32.98 acres and Site 2- 8.2 acres). Both the plots face each other with a road running between them. Academic buildings are proposed to be located on site I & the site 2 will be used for hostel buildings. Following is list of buildings at each site:

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3	College Building 3	18,665		X	X	
4	Work Shop	2,325	X			
5	Library and central research facility	3,710		X	X	
6	Students' Facilitation Center	2,284		X		
7	Administration	2,445		X	X	
8	Auditorium				X	
	SITE 2					
1	Hostels - I	5,800	X			X
2	Hostel - 2	5,800		X		X
3	Warden Quarter			X		
4	Hotels for 1500 seats			X		X

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

a) **Outside Conditions**

i) Summer:

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

ii) Monsoon:

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

b) **Inside Conditions**

(i) Faculty Rooms & Seminar Hall

Summer & Monsoon
D.B.T. - 26.0±1.0° C (79±2° F)
R.H.. - 55% (Design Value-No control)

(il) Library

Summer & Monsoon
D.B.T. - 26.0±1.0° C (79±2° F)
R.H. - 55% (Design Value-No control)

(iil) Auditorium

Summer & Monsoon
D.B.T. - 26.0±1.0° C (79±2° F)
R.H. - 55% (Design Value-No control)

(Iv) Administration Block

Summer & Monsoon
D.B.T. - 26.0+1.0o C (79+2o F)
R.H. - 55% (Design Value-No control)

c) **Design Criteria (Source NBC)**

Outdoor Air	17 CFM/ Person (Design Value) (Faculty Rooms, Library, Seminar Hall, Administration etc)
Lighting Load	1.5 watt/Sq.ft. (Considering CFL Fixtures)
Equipment Load	As per area considered.

d) **Factor Considered**

i) **Glass:**
Single Glazed tinted glass (6 mm thick)

Solar heat gain factor = 0.37

U-VALUE = 1.0 BTU / Hr – S.ft - °F

ii) **Walls:**
Solid Concrete Block (200 mm thick)

'U' Value = 0.29 BTU / Hr – S.ft - °F.

iii) **Roof:**
Insulated with 50 mm Polyurethane

'U' Value = 0.12 BTU / Hr – S.ft - °F

iv) **Internal Partition:**
Solid Concrete Block (100 mm thick)

'U' Value = 0.35 BTU / Hr – S.ft - °F.

HVAC Design Concept:

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

- Individual and quickly responding temperature control for each area
- 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.

SUMMARY OF AIR-CONDITIONING REQUIREMENTS

(See Annexure I for detailed floor wise heat load summary of College Building-1 & Annexure II for area based heat load summary for other buildings.)

The table below gives the summary of total calculated cooling load:

Site 1	Phase I	150 T.R.
Site 1	Phase II	854 T.R.

THE SYSTEM

After a lot of deliberations, VRV system had been selected for the PTU campus at Kapurthala. The functional expectations are same in this campus also. Therefore, the same system is proposed for this campus also. The advantages of the VRV system are highlighted below for a ready re-cap:

- Variable Refrigerant Volume / Flow Systems were introduced in Japan more than 20 years ago, have become popular in many countries including India.
- Less moving part so less wear and tear.
- The electrical energy consumption is 1.1 kW/H P including indoor units.
- The refrigerant in the machine is CFC/HCFC free.

In addition the system has several key benefits, including:

- Installation Advantage
- Design Flexibility
- Energy Efficiency
- Eco Friendly
- Low Life cycle cost
- Flexibility in operating mode

Some of the characteristics of VRV/VRF Machine are:

- The units will consist of high efficiency air-cooled, Variable Speed compressors with all the latest materials and technology.
- The VRF unit is driven by Inverter Driven Scroll Compressors with Inverter speeds typically running between 20–97Hz. Outdoor Units typically have

Dynamic capacity between 8% - 108% while Indoor Units have Dynamic capacity between 25% - 100%.

- VRV / VRF systems are flexible and diverse with a single condensing unit connected to multiple indoor units. Overall COP (Co-efficient of Performance) and SEER (Specific Energy Efficiency Ratio) remain high due to effective zone control.
- Indoor units adjust capacities to match actual load. The occupant selects necessary units to operate while the rest remain off. Each zone has independent control on operation mode – temperature, air flow, fan speed, ventilation, etc...
- VRV / VRF systems use HFC (Hydro fluorocarbon), non-CFC (Chloro fluoro carbon) containing refrigerant with Zero Ozone Depletion.

We propose the indoor units as follows:

Phase-I

1. College Building-1 (Faculty Block)-Wall mounted type.

2. Seminar Hall-Ceiling suspended ductable type.

The concept drawings of Phase-I are attached to explain the Air conditioning Scheme.

Phase-II

These will be decided at the appropriate time of the project design.

EQUIPMENT SELECTION

Phase-I: To meet the cooling load requirement the selected VRV/VRF Machine capacity will be 218 H.P.(175 T.R.).

Phase-II: The capacity of the VRV/VRF Machine will be selected at the appropriate time of project design.

MECHANICAL VENTILATION

Kitchen Ventilation

The ventilation system is proposed for kitchen hood. The system includes Dry Scrubber for exhaust and Airwasher for make-up air requirement.

- Phase-I Hostel Kitchen (100 sq. m. approx.)

The ventilation requirements of the Phase II will be decided during the design development stages at the appropriate time.

Air Conditioning System Design

The ouldoor units will be located at the terrace of the building.

Duct Design

Maximum flow velocity	:	1500 Ft./Min
Maximum friction	:	0.1 in WC/100 Ft. Run
Maximum velocity at supply air outlet	:	500 FL/Min.

ANNEXURE-1

HEAT LOAD SUMMARY FOR COLLEGE BUILDING-1

		BASIS 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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
I	GROUND FLOOR													
1	HOD ROOM	386	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.47	1.21	593	424	34
2	PA & WAITING	369	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.06	1.45	762	528	34
3	BOARD ROOM	390	12.0	17.0	26.0+1	55%	5	1.50	1.00	1.57	1.59	554	428	85
4	DEPT. OFFICE	257	12.0	17.0	26.0+1	55%	4	1.50	1.00	1.13	1.17	389	298	68
5	EXAM CONTROL	257	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.12	1.10	438	376	34
6	PROFF. ROOM-1	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.07	1.08	416	364	34
7	PROFF. ROOM-2	264	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.00	0.99	384	328	34

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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(I)	(J)	(K)	(L)	(M)
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
8	PROFF. ROOM-3	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.22	1.13	481	389	34
9	ASSOC. PROFF.-1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.82	0.70	307	201	34
10	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.83	0.73	310	213	34
11	SEMINAR HALL	1790	24.0	17.0	26.0+1	55%	150	1.50	2.00	18.32	26.33	4100	3532	2550
	Sub Total	**4529**					**175**			**30**	**37**	**8735**	**7081**	2975
II	**FIRST FLOOR**													
1	ASST. PROFF. ROOM-1	1194	12.0	17.0	26.0+1	55%	2	1.50	1.00	4.38	3.26	1865	1320	34
2	PROFF. ROOM-1	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.51	1.56	610	575	34
3	PROFF. ROOM-2	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.24	1.14	492	394	34
4	ASSOC. PROFF.-1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.65	0.65	231	176	34
5	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.65	0.65	231	176	34
6	ASSOC. PROFF.-3	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.75	0.78	278	236	34
7	ASSOC. PROFF.-4	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.75	0.78	278	236	34
8	ASSOC. PROFF.-5	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.75	0.78	278	236	34

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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(J)	(K)	(L)	(M)
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
9	ASSOC. PROFF.-6	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.75	0.78	278	236	34
10	ASSOC. PROFF.-1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.82	0.70	307	201	34
11	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.83	0.73	310	213	34
	Sub Total	2910					22			13	12	5156	3999	374
III	SECOND FLOOR													
1	HOD	392	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.75	1.46	714	532	34
2	PA & WAITING	296	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.89	0.85	337	265	34
3	BOARD ROOM	390	12.0	17.0	26.0+1	55%	5	1.50	1.00	1.54	1.56	542	417	85
4	EXAM CONTROL	257	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.16	1.11	456	380	34
5	PROFF.-1	264	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.12	1.09	437	371	34
6	PROFF.-2	248	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.50	1.20	604	420	34
7	PROFF.-3	199	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.70	1.45	692	527	34
8	ASSOC. PROFF.1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.71	0.64	258	174	34
9	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.88	0.77	331	229	34

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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
10	DEPT. OFFICE	257	12.0	17.0	26.0+1	55%	4	1.50	1.00	1.84	1.59	701	483	68
11	SEMINAR HALL	1790	24.0	17.0	26.0+1	55%	150	1.50	2.00	18.32	26.33	4100	3532	2550
	Sub Total	**4393**					175			31	38	9173	7331	2975
IV	**THIRD FLOOR**													
1	ASST PROFF.-1	409	13.0	17.0	26.0+1	55%	2	1.50	1.00	2.30	1.72	956	647	34
2	ASST. PROFF.-2	775	13.0	17.0	26.0+1	55%	2	1.50	1.00	3.12	2.50	1312	987	34
3	ASSOC. PROFF.-1	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.67	0.66	241	183	34
4	ASSOC. PROFF.-2	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.67	0.66	241	183	34
5	ASSOC. PROFF-3	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.84	298	259	34
6	ASSOC. PROFF-4	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.84	298	259	34
7	ASSOC. PROFF-5	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.84	298	259	34
8	ASSOC. PROFF-6	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.84	298	259	34
9	PROFF-1	248	13.0	17.0	26.0+1	55%	2	1.50	1.00	1.63	1.30	662	462	34
10	PROFF.-2	199	13.0	17.0	26.0+1	55%	2	1.50	1.00	1.60	1.37	650	494	34

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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
11	ASSOC. PROFF-1	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.83	0.74	310	217	34
12	ASSOC. PROFF-2	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.75	0.66	276	183	34
	Sub Total	**2831**					**24**			**15**	**13**	**5839**	**4393**	**408**
III	**FOURTH FLOOR**													
1	HOD ROOM	386	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.47	1.21	593	424	34
2	PA & WAITING	369	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.06	1.45	762	528	34
3	BOARD ROOM	390	12.0	17.0	26.0+1	55%	5	1.50	1.00	1.57	1.59	554	428	85
4	DEPT. OFFICE	257	12.0	17.0	26.0+1	55%	4	1.50	1.00	1.13	1.17	389	298	68
5	EXAM CONTROL	257	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.12	1.10	438	376	34
6	PROFF. ROOM-1	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.07	1.08	416	364	34
7	PROFF. ROOM-2	264	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.00	0.99	384	328	34
8	PROFF. ROOM-3	258	12.0	17.0	26.0+1	55%	2	1.50	1.00	1.22	1.13	481	389	34
9	ASSOC. PROFF.-1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.82	0.70	307	201	34
10	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.83	0.73	310	213	34
11	SEMINAR HALL	1790	24.0	17.0	26.0+1	55%	150	1.50	2.00	18.32	26.33	4100	3532	2550
	Sub Total	**4529**					**175**			**30**	**37**	**8735**	**7081**	**2975**

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
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(J)	(K)	(L)	(M)
		S.FT	FT.	OUTDOOR AIR CFM//PERSON Design Value	TEMP (°C)	RH Design Value	NOS.	W/S.FT	W/S.FT	TR	TR	CFM	CFM	CFM
VI	FIFTH FLOOR													
1	ASST. PROFF. ROOM-1	1194	13.0	17.0	26.0+1	55%	2	1.50	1.00	4.74	3.57	2021	1455	34
2	PROFF. ROOM-1	264	13.0	17.0	26.0+1	55%	2	1.50	1.00	1.60	1.63	648	607	34
3	PROFF. ROOM-2	258	13.0	17.0	26.0+1	55%	2	1.50	1.00	1.32	1.21	525	423	34
4	ASSOC. PROFF.-1	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.69	0.68	250	193	34
5	ASSOC. PROFF.-2	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.69	0.68	250	193	34
6	ASSOC. PROFF.-3	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.82	297	253	34
7	ASSOC. PROFF.-4	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.82	297	253	34
8	ASSOC. PROFF.-5	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.82	297	253	34
9	ASSOC. PROFF.-6	150	13.0	17.0	26.0+1	55%	2	1.50	1.00	0.80	0.82	297	253	34
10	ASSOC. PROFF.-1	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.82	0.70	307	201	34
11	ASSOC. PROFF.-2	150	12.0	17.0	26.0+1	55%	2	1.50	1.00	0.83	0.73	310	213	34
	Sub Total	2916					22			14	12	5500	4297	374
	Total	22108					593			134	150	43138	34182	10081

Annexure II

Estimated cooling load on area basis for Phase II:

Sr. No.	CONDITIONED SPACE	AREA (SQ.FT.)	COOLING LOAD (T.R.)
1	LIBRARY BUILDING	32,280	215
2	ADMINISTRATION BUILDING	15,602	125
3	AUDITORIUM	21,520	196
4	COLLEGE BUILDING 2 & 3	51,920	318
	Total	**1,21,322**	**854**

PLUMBING AND FIRE FIGHTING

SANITARY ENGINEERING AND FIRE FIGHTING SERVICES

GENERAL

The project consists of developing various buildings in the proposed campus of Punjab Institute of Technology at Mansa.

Total area of the campus has been divided in two sites i.e., (i) Site 1: site for academic function (32.85 acres) (ii) Site 2: Site for hostel purposes (8.18 acres). These sites face each other across the main road. Following is the list of buildings in each site:

S. No.	Type of Building	Covered Area (Sq. mt.)	Phase I	Phase II
	SITE 1			
1	College Building 1	18,665	X	
2	College Building 2	18,665		X
3	College Building 3	18,665		X
4	Work Shop	2,325	X	
5	Library and central research facility	3,710		X
6	Students' Facilitation Center	2,284		X
7	Administration	2,445		X
8	Auditorium			
	SITE 2			
1	Hostels - I	5,800	X	
2	Hostel - 2	5,800		X
3	Warden Quarter			X
4	Hotels for 1500 seats			X

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 requirements as per I.S. specifications and Govt. manuals are as following:

S. No.	Type of Building	Occupancy	Water Requirement (LPCD)	Total Water Requirement (LPD)	Water Requiremet For Domestic LPD	Water Requiremet For Flushing LPD
			SITE-1 - (PHASE-I)			
A	**COLLEGE BUILDING**					
1	Students	1,140	45	51,300.00	20,520.00	30,780.00
2	Teachers	92	45	4,140.00	1,656.00	2,484.00
3	Techanical Staff	24	45	1,080.00	432.00	648.00
4	Support Staff	18	45	810.00	324.00	486.00
5	IV Class Staff	10	45	450.00	180.00	270.00
6	Laboratory Requirement	L.S		5,000.00	5,000.00	
B	**Work Shop**					
1	Work Shop	300	45	13,500.00	5,400.00	8,100.00
2	Staff	12	45	540.00	216.00	324.00
3	Labs	L.S		500.00	500.00	
	Sub Total Of Phase I			**77,320.00**	**34,228.00**	**43,092.00**
			SITE-1 - (PHASE-II)			
C	**COLLEGE BUILDING (2 NOS)**					
1	Students	1,800	45	81,000.00	32,400.00	48,600.00
2	Teachers	184	45	8,280.00	3,312.00	4,968.00
3	Techanical Staff	48	45	2,160.00	864.00	1,296.00
4	Support Staff	36	45	1,620.00	648.00	972.00
5	IV Class Staff	20	45	900.00	360.00	540.00
6	Laboratory Requirement	L.S		10,000.00	10,000.00	
D	**Administration**					
1	Administration	150	45	6,750.00	2,700.00	4,050.00
E	**Library**					
1	Library	200	15	3,000.00	1,200.00	1,800.00
F	**Student Activity Centre**					
1	Dining	50	20	1,000.00	400.00	600.00
2	Students	100	15	1,500.00	600.00	900.00
G	**Auditorium**					
1	Auditorium	500	15	7,500.00	3,000.00	4,500.00
	Sub Total Of Phase- II			**1,23,710.00**	**55,484.00**	**68,226.00**
	Total			**2,01,030.00**	**89,712.00**	**1,11,318.00**

	SITE - 2 - (PHASE-I)					
A	Hostels					
1	Students	198	135	26,730	16,038	10,692
2	Staff	4	45	180	108	72
3	IV Staff	6	45	270	162	108
	Sub Total Of Phase I			**27,180**	**16,308**	**10,872**
	SITE - 2 - Future					
B	**Hostels**					
1	Students	1,700	135	29,500	107,700	91,800
2	Staff	20	45	900	540	360
3	Warden residence	10	135	1,350	810	540
4	IV Staff	20	45	900	540	360
	Sub Total Of Phase II			**2,32,650**	**1,39,590**	**93,060**
	Total			**2,59,830.00**	**1,55,898.00**	**103,932.00**

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

A. Green area coverage For Phase I of Site I= 10550 sq.m @ 5 l/sq.m = 10550 x 5 l/sqm

= **52750 Liters per day**

Or Say Total = 53 KL

B. Green area coverage For Phase I of Site II= 1700 sq.m @ 5 l/sq.m = 1700 x 5 l/sqm

= **8500 Liters per day**

Or Say Total = 8.5 KL

Quantity of Water Available after Sewage Treatment:

Site - 1 (Phase-I)
Waste water available = 80% of 77,320 LPD
= **61,856 LPD**

Treated water available after Treatment = 90% of 61,856 LPD
= **55,670 LPD**

Site - 1 (Phase-II)
Waste water available = 80% of 123,710 LPD
= **98,968 LPD**

Treated water available after Treatment = 90% of 98,968 LPD
= **89,071 LPD**

Site - 2 (Phase-I)
Waste water available = 80% of 27,180 LPD
= **21,744 LPD**

Treated water available after Treatment	= 90% of	21,744	LPD
	=	**19,570**	**LPD**
Site - 2 Future Waste water available	= 80% of	232,650	LPD
	=	**186,120**	**LPD**
Treated water available after Treatment	= 90% of	186,120	LPD
	=	**167,508**	**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 water requirement. For this purpose, bore wells are proposed as following:

Site – 1 (Phase-I) - 1 No. Borewell of 15,000 LPH Capacity

Site – 1 (Phase-II) - 1 No. Borewell of 15,000 LPH Capacity

Site – 2 (Phase-I) - 1 No. Borewell of 15,000 LPH Capacity

Site – 2 Future - 1 No. Borewell of 15,000 LPH Capacity

2.2.2 Part of the water requirement will also be met by recycling the treated effluent from sewage treatment plant for flushing and horticulture.

Available treated effluents from STP are as following:

Phase-I (Total of Academic and Hostel) - 75,240 LPD Capacity

Phase-2 (Total of Academic and Hostel) - 89,071 LPD Capacity

Site – 2 Future - 1,67,508 LPD Capacity

2.3 Storage

Underground tanks will be provided individually in each site. The capacity of tank will be considering minimum requirement of storage for one day(excluding for horticulture purpose).

	UNDER GROUND WATER TANK		
A	Under Ground Water Tank For		
	SITE 1 (Academic Functions)		
	Compartments:-		
a)	Fire Water Tank	=	100KL
b)	Raw Water Tank (Phase I)	=	50KL
c)	Treated Water Tank (Phase I)	=	50KL
d)	Raw Water Tank (Phase II)	=	50KL
e)	Treated Water Tank (Phase II)	=	50KL

B	Under Ground Water Tank For		
	SITE 2 (Hostel Purposes)		
	Compartments:-		
a)	Raw Water Tank (Phase I)	=	75 KL
b)	Treated Water Tank (Phase I)	=	75 KL
	Future		
c)	Raw Water Tank	=	75 KL
d)	Treated Water Tank	=	75 KL

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 portability.

However, as a standard, the water shall be disinfected by chlorination prior to the supply to the buildings.

2.5 Pumping System:-

It is proposed to locate all the pumps and equipments in the underground pump room. The pumps shall be connected with outlets of the tanks wich suction headers. Delivery header of the pumps shall be connected with water supply line. The pumps shall be as following:

Site – 1 (U.G. Tank)

1. Raw Water Pump (1 Working + 1 Stand by)
2. Domestic Water Pump (1 Working + 1 Stand by)

Site – 2 (U.G. Tank)

1. Raw Water Pump (1 Working + 1 Stand by)
2. Domestic Water Pump (1 Working + 1 Stand by)

2.5 Water Supply System

For College Building (Site – 1)

2.5.1 Water from the sources (borewell or otherwise) will be brought into fire tank. Over flow of fire tank shall be flowed into raw water tank. From raw water tank water will over flows to treated water tank. Since data for quality of water is not available, raw water and treated water compartments of the tanks shall be used as domestic water tanks. From these tanks water shall be pumped out by centrifugal pumps to water supply system ring main with after Chlorination. When the data will be available and if trealement will required, the filter and pumps shall be provided with raw water tank and after

filtration the water will sent to treatment water tank from there treated water supply system shall be as above.

For Hostel Building (Site – 2)

2.5.2 Water from the sources (borewell or otherwise) will be brought into raw water tank. From raw water tank water will over flows to treated water tank. Since data for quality of water is not available, raw water and treated water compartments of the tanks shall be used as domestic water tanks. From these tanks water shall be pumped out by centrifugal pumps to water supply system ring main with after Chlorination. When the data will be available and if treatement will required, the filter and pumps shall be provided with raw water tank and after filtration the water will sent to treatment water tank from there treated water supply system shall be as above.

2.5.2 There will be a water supply ring main in phase-1 and risers connected to water supply ringmain will fill the Over Head Water Tanks of buildings. Seperate water supply ring main shall be provided for Phase-II with seperate pumps as required depending upon the phasing.

2.5.3 U.G Water Tanks and pump rooms have to be constructed separately for Site 1 and Site 2 (Refer clause 2.3). The water tanks/pump room will be made in a modular way such that the water tanks are constructed around the pump room. Reinforcement Dowells for future construction for the tanks will be left in phase 1. The pump room will be constructed to accommodate for pumps and equipment for the future also.

2.5.4 Flushing water supply tanks will be constructed at the STP from where water will be pumped on to a separate ring main for flushing water supply. These tanks will also feed the garden irrigation ring main. There will be independent overhead water tanks for flushing over each building which will be filled up by booster pumps installed at the STP.

3. HOT WATER SYSTEM

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

It is suggested that a 3500 liters per day solar water heating system with an electrical backup may be provided on top of each Hostel building to supply hot water to the showers.

4. MATERIALS FOR WATER SUPPLY

4.1. All the external pipes to be used for water supply shall be Ductile Iron (DI) / Galvanized steel tubes confirming to I.S.1239 medium class of superior quality. Fittings shall be malleable iron/ brass as applicable. For pipes above 80mm dia, Ductile Iron pipes will be used.

4.2. For internal works, the pipes running on the terrace, shaft 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
- 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 fixtures shall be provided with access doors for cleaning (door junctions).

5.5 All traps shall be with a minimum water seal of 50mm.

5.6 Materials

(a) All soil, waste, vent and anti-syphonage pipes and fittings 50mm and above shall be CI centrifugally cast (IS:3989).

6. SEWERAGE SYSTEM

6.1 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 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 pipes flowing half full	0.75 m/sec

(iv) Max Velocity of flow — 2.0 m/sec.

(v) Min. depth for sewers — 0.9m

(vi) 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:

(viii)

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

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 steep 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) Spacing

(i) Manholes shall be provided at all junctions, change of directions, and change in diameters, as per connection requirement.

(ii) A distance of 30 meters 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.

A common STP is proposed to be constructed for Phase 1 of both sites in Site 1 behind the auditorium building. The capacity of STP will be 85 KLD upgradable to 185 KLD in subsequent phases.

The future phase in site 2 will have its own STP of capacity 190 KLD which will be constructed in the vicinity of construction.

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) -- 250 –300
- Suspended solids (mg/lit) - - 400 – 600
- PH - - 6.5 – 8.5

(B) Characteristic of Effluent (after treatment)

- B.O.D (5 days 20°C) (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 MBR.

7.2 PROCESS DESCRIPTION: MBR (Membrane Bio Reactor) system

- Waste water will flow via gravity through a bar screen chamber & Oil & Grease Trap to an Equalization Tank. A bar screen shall be provided at the inlet point in the bar screen chamber and the waste water will flow through this bar screen into the Tank. Bar screen shall be so designed that it can be cleaned manually from outside the Tank. The oil & grease from the Oil & Grease Trap would have to be removed manually. Air mixing is also provided to mix the contents of the equalization tank. A coarse bubble aeration grid is provided to distribute air uniformly at the base of the equalization tank.

- After above treatment, raw sewage is fed into aeration basin.

In aeration tank MLSS (mixed liquor suspended solids) in the range of 12000 to 15000 mg/l are maintained. The high amount of bacteria gives better and complete removal of organic matter from the raw sewage in relatively small area. Oxygen required for the bacteria is supplied through the blower. The air is used both for scouring of membranes and supplying oxygen to bacteria.

- The filtration is carried out by the suction pump directly sucking permeates water. The permeate water produced is clear and devoid of bacteria and viruses to the minimum levels.

- As the membranes are continuously under operation, they are polluted with organic or inorganic substances. Hence, chemical cleaning is carried out once in two to three months for removing substances polluting and clogging the membranes. Normal cleaners used are sodium hypo chloride and citric acid.

- The characteristic of the MBR process is the use of submerged polymeric hollow fiber membranes in the biological process water tank, so as to produce high quality permeate from domestic sewage, primary and secondary waste water, cooling tower blow down etc.

- The hollow fibers are combined into bundles and wound around a carrier cartridge, which gives the membranes the required strength and allows for high-pressure air scour for cleaning. The MBR can handle very high sludge concentrations in the aeration tank because of which the size of the aeration tank reduces four to five fold. As the membrane acts as a fine filter, it does not require any further treatment using sand filters, activated carbon filters, etc.

  Water from this tank will be lifted with suitable submersible pumps for further use for Flushing and gardening purpose. In case of extra effluent the arrangement shall be made to dispose off into municipal sewer.

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
Max Velocity of flow	=	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

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

Where V = Velocity in m/sec.
R = Hydraulic mean radius in m

S = Hydraulic gradient in m/meter 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 silt 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 runoff, 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. Silt traps will be provided at inlet 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 TITLE

IS 651-1965	Specification for salt Glazed stoneware pipes and fittings (First revision).
IS 782-1978	Specification for caulking lead.
IS 1172-1971	Code of basic requirements for water supply, drainage and sanitation (revised).
IS 1239-1 968 (Part-I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1239-1 968 (Part-II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1537-1 976	Specification for vertically cast iron pressure pipes for water, gas and sewage.
IS 1536-1 976	Specification for centrifugally Cast (Spun) Iron 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 sanitary 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?
IS 4127-1 967	Code of Practice for laying glazed stone ware pipe.

IS 4515	Specification for unplasticised PVC pipe fittings?
IS 4985-1 981	Specification for unplasticised PVC pipes for portable water supplies.
IS 1703-1 984	Ball Valves
IS 2548-1 970	Toilet Seat Cover

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 a requirement of the local authority is so far as these become applicable to the installation. Where-ever 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 specifications 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:

College Building

Group-B: Educational Building (Above 15 m but not exceeding 30m in height)

Hostel Building

Group-A: Residential Building (Height Less than 15 M)

Auditorium

Group-D: Assembly buildings (Above 15 m but not exceeding 24 M)

Library and Admin Block

Group-E: Business buildings (Less than 10 m)

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.

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

1 College Building

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	Not Required	Not Provided
5	Down Comer	Required	Provided
6	Yard Hydrant	Not Required	Not Provided
7	Automatic Sprinkler System	Not Required	Not Provided
8	Manually Operated Electric Fire Alarm System	Required	Provided
9	Automatic Detection Alarm System	Not Required	Not Provided
10	Underground Static Water Storage Tank	Not Required	Not Provided
11	Terrace Tank	Required	Provided 25,000L
12	Pump Near UG Tank	Not Required	Not Provided
13	Pump at Terrace	Required	Provided, 900 LPM Pump

2. Hostel Building

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	Not Required	Not Provided
5	Down Comer	Not Required	Not Provided
6	Yard Hydrant	Not Required	Not Provided
7	Automatic Sprinkler System	Not Required	Not Provided
8	Manually Operated Electric Fire Alarm System	Not Required	Not Provided
9	Automatic Detection Alarm System	Not Required	Not Provided
10	Underground Static Water Storage Tank	Not Required	Not Provided

11	Terrace Tank	Required	Provided 5,000L
12	Pump Near UG Tank	Not Required	Not Provided
13	Pump at Terrace	Required	Provided, 450 LPM Pump

3. Auditorium

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	Not Required	Not Provided
6	Yard Hydrant	Required	Provided
7	Automatic Sprinkler System	Required	Provided
8	Manually Operated Electric Fire Alarm System	Required	Provided
9	Automatic Detection Alarm System	Required	Provided
10	Underground Static Water Storage Tank	Required	Provided 100 KL.
11	Terrace Tank	Required	Provided 10,000L
12	Pump Near UG Tank	Required	Provided 1.Electric Pump-2280 LPM 2.Diesel Pump -2280 LPM 3.Jockey Pump-180 LPM
13	Pump at Terrace	Not Required	Not Provided

Library and Admin Block

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	Not Required	Not Provided
5	Down Comer	Required	Provided
6	Yard Hydrant	Not Required	Not Provided
7	Automatic Sprinkler System	Not Required	Not Provided
8	Manually Operated Electric Fire Alarm System	Required	Provided
9	Automatic Detection Alarm System	Not Required	Not Provided
10	Underground Static Water Storage Tank	Not Required	Not Provided
11	Terrace Tank	Required	Provided 10,000L
12	Pump Near UG Tank	Not Required	Not Provided
13	Pump at Terrace	Required	Provided, 450 LPM Pump

2.5 A fire hose cabinet with complete fire fighting 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 male 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.

2.6 Also it has been proposed to provide following portable type fire extinguishers.

- 9 lit. Water expelling type.
- 4.5 lt. CO_2 Type.
- 5 kg ABC type.
- Dry chemical powder type of 1 0kg/5kg capacity.

2.7 Sprinkler system although not specified by NBC, we recommend sprinkler should be provided in Library building for the safety of documents and casually.

2.8 Sprinklers shall be provided in all the floors of the library building, each sprinkler covering an area of up to 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.

2.9 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.

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

IMPORTANT INDIAN STANDARDS FOR FIRE FIGHTING WORK TITLE

IS 1239-1 968 (Part-I)	Specifications for mild steel tube, lubular and other steel pipe fittings.
IS 1239-1 968 (Part-II)	Specifications for mild steel tube, lubular and other steel pipe fittings.
IS 1536-1 976	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 flexible fire fighting delivery hose (third revision)
IS 694-1990	PVC insulated cables for working voltages up to 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 first-aid hose-reel 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 fighting of purposes (third revision)
IS 903-1984	Specification of fire hose delivery couplings branch pipe, nozzles and nozzle spanner (third revision) (Amendment 5)
IS 937-1981	Specification for washers for water fittings for fire fighting purposes (revised) (with amendment No, 1)

IS 1520-1 980	Horizontal centrifugal pumps for clear cold, fresh water (second revision)
IS 1536-1 976	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 1648-1 961	Code of practice for fire safety of buildings (General) Fire fighting equipment and its maintenance (with amendment No.1)
IS 3624-1 987	Pressure and vacuum gauges (Second revision)
IS 4736-1 968	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 7285	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.

ANNEXURE - D

PUNJAB INSTITUTE OF TECHNICAL TEACHER TRAINING & RESEARCH, JALANDHAR			
S.no.	Particulars	Area required (sq.m)	Remarks
1	**Total Site area**	**8,096.00**	
2	**Permissible Ground coverage**	**3,238.40**	**calculated at 40%**
3	**Proposed Ground coverage**	**1,457.28**	**calculated at 18%**
4	**Permissible FAR**	**1:1**	
5	**Built up area**	**8,096.00**	**@ FAR: 1:1**
6	Area requirement for college building	4,052.80	refer annexure 1
7	Area requirement for Student Facilitation Centre	150.00	
8	Remaining area for hostel	3,893.20	5-6-7
9	No. of students that can be accomodated in the hostel block (@ 28 sqm/ student for double seater room)	140.00	8/28
10	**Parking area calculation**		
10.1	No. of ECS required	81.00	@1 ECS /100 sqm
10.2	Taking 70% of the total parking required in basement & 30% on surface		
10.2.1	Area required for parking in basement (@ 32 sqm/ECS)	1,814.40	7.1*0.7*32
10.2.2	Area required for parking on surface (@ 23 sqm/ECS)	558.90	7.1*0.3*23
11	**Thus a basement of about 3,000 sqm can be constructed to accommodate 70% of the total parking & remainig 1,200 sqm can be used for accomodating services & Meditation hall (which would not be a legal proposition) etc.**		

Annexure 1

PUNJAB INSTITUTE OF TECHNICAL TEACHER TRAINING & RESEARCH, JALANDHAR					
1	College Block				
S.no.	Room Requirement	Carpet Area/ Room (sqm)	Total Requirement		
			No. of Rooms	Total Carpet Area	Remarks
	1	2	3	4=2 x 3	5
A	**Instructional Area**				
1	Class Rooms	50	8	400	for 40 students
2	Tutorials	25	2	50	for 20 students
3	Seminar room/ Convention Hall	525	1	525	For 300 students
4	Meeting Hall	100	1	100	For 50 persons
5	Conference hall	60	1	60	For 30 students
6	Computer Lab	75	1	75	for 20-25 workstations
7	Library & reading Room	200	1	200	
	Sub total (A)			**1,410.00**	
B	**Faculty Area**				
1	Principal's/ Head Room	40	1	40	
2	PA & Waiting	20	1	20	
3	Board Room	50	1	50	For 30 persons
4	Office	60	1	60	
5	Faculty Offices	12	12	144	
6	Deputy Registrar	20	2	40	
7	Office Blocks	50	1	50	
8	Conference	130	1	130	50 Pax
9	Estate office	20	1	20	
	Sub total (B)			**654.00**	
C	Amenities Area				
1	Male & Female Toilets & other services	200	2	400	
3	Dry Canteen	20	1	20	
	Sub Total (C)			**420.00**	
D	**TOTAL (A+B+C)**			**2,384.00**	
E	TOTAL BUILT UP AREA			4,052.80	