Internship Program Report

By

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In association with



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Introduction

Internship program arranged by GUDLAVALLERU ENGINEERING COLLEGE in association with Smart Internz, Hyderabad for the benefit of 3rd year EEE batch 2018-2022 on Electrical Detailed design Engineering for Oil& Gas, Power and Utility industrial sectors.

Program organiser

Smart Bridge, Hyderabad.

Pioneer in organising Internships, knowledge workshops, debates, hackathons, Technical



sessions and Industrial Automation projects.

Courtesy

Dr. Sri B. Dasu – HOD – EEE, GEC

Mr. G. Srinivasa Rao – Internship coordinator

Mr. Ramesh V - Mentor

Mr. Vinay Kumar - System Support

Mr. Harikanth – Software/Technical Support

Program details

Smart Internz program schedule: 4 weeks starting from 3rd May 2021

Daily schedule time shall be 4PM to 6.30PM

Mode of Classes: On line through ZOOM

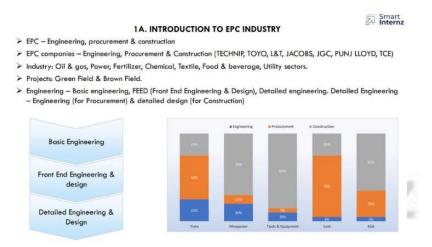
Presenter: Mr Ramesh V

Internship program

We have been given the opportunity to learn and interact with industry experienced engineering specialist to learn the Electrical detailed design engineering for various industrial sectors.

3rd May2021: Introduction to EPC Industry

1	EPC Industry &	EPC Industry	Introduction
	Electrical Detailed	Engineering	Types of Engineering
	Engineering	Procurement	Engineering role in procurement
		Construction	Engineering role during construction



Topic details:

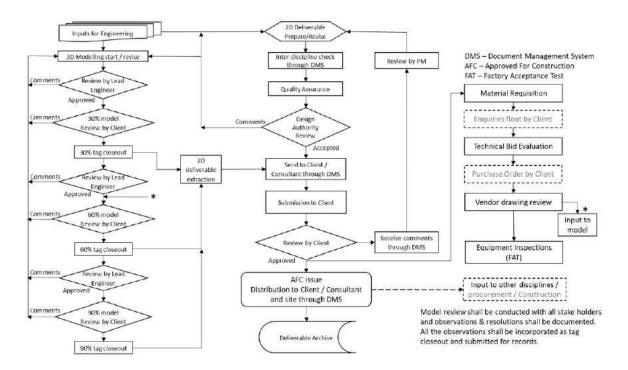
Engineering phases, Engineering deliverables (drawings & documents) list, Design Engineer role at various phases of project.

4th May2021: Engineering documentation for EPC projects

2	Electrical Design	Engineering Deliverables list	Sequence of deliverables
	Documentation	Detailed Engineering work flow	Detailed engineering process
		Document transmission	Document submission and info
			exchange
		Deliverables types	Different types of deliverables

Z

3. ELECTRICAL DESIGN & DETAILED ENGINEERING - PROCESS



Topic details:

Engineering deliverables list, detailed engineering flow, engineering support flow, engineering support to procurements.

5 th May2021: Engineering documentation for commands and formulae

3	B Document & Drawing	MS Word	Report / Calculations formats
	tools	MS Excel	Basic excel commands
		Autocad	Basic line diagrams and layout
			commends

3C. AUTOCAD BASIC COMMANDS



A AUTOCAD BASIC KEYS							
STAND	ARD	DRA	W	MOD	IFY	FORM	AT
NEW	Ctrl+N	LINE	L	ERASE	£	PROPERTIES	MO
OPEN	Ctrl+0	RAY	RAY	СОРУ	CO	SELECT COLOR	COL
SAVE	Ctrl+S	PLINE	PL	MIRROR	MI	LAYER	LA
PLOT	Ctrl+P	3DPOLY	3P	OFFSET	0	LINETYPE	LT
PLOT PREVIEW	PRE	POLIGONE	POL	ARRAY	AR	LINEWEIGHTS	LW
CUT	Ctrl+X	RECTANGLE	REC	MOVE	M	LT SCALE	LTS
COPY	Ctrl+C	ARC	A	ROTATE	RO	LIST	LI
PASTE	Ctrl+V	CIRCLE	С	SCALE	SC	DIMEN. STYLE	D
MATCH PROPE.	MA	SPLINE	SPL	STRECH	S	RENAME	REN
CLOSE	Ctrl+F4	ELLIPSE	EL	TRIM	TR	OPTION	OP
EXIT	Ctrl+Q	BLOCK	В	EXTENED	EX		
		POINT	PO	BRAKE	BR		
		HATCH	Н	CHAMFER	CHA		
		GRADIENT	GD	FILLET	F		
		REGION	REG	EXPLODE	Х		
		BOUNDARY	ВО				
		DONUT	DO				

EXTRA			DRAF'	FING	PAPER SIZE	
UNIT	UN	UCS	UCS	ORTHO	F8, Ctrl+L	A4=210*297
LIMITS	LIMITS	SINGLE TEXT	DT	OSNAP	F3, Ctrl+F	A3=297*420
(0,0; 1000,	1000)	MULTILINE TEXT	MT	POLAR	F10, Ctrl+U	A2=420*594
ZOOM	Z	EDIT TEXT	ED	GRID D	F7, Ctrl+G	A1=594*841
ALL	A	OBJECT SNAP	OB	OTRACK	F11	A0=841*1189
PAN	Р	DIMENTION	DIM	SNAP	F9	
CLEAN SCREEN	Ctrl+0	HORIZONTAL	HOR			
COMMAMD WIN	Ctrl+9	VERTICAL	VER			



Topic details:

Here we need to learn the basis of the autocadbasic keys like standard, modify,draw,format,papersize etc..

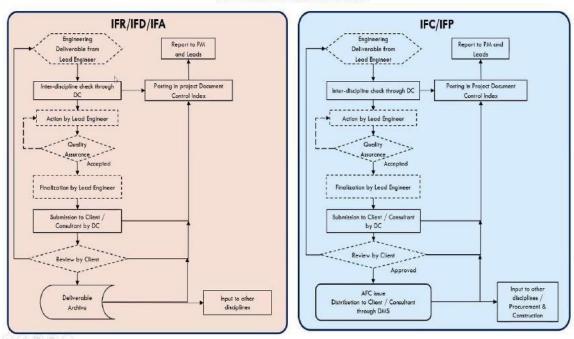
7 th May2021: Engineering documentation for Electrical system design

4	Electrical system	Overall plant description
	design for a small	Sequence of approach
	small project	Approach to detailed design

Topic details:

Internz

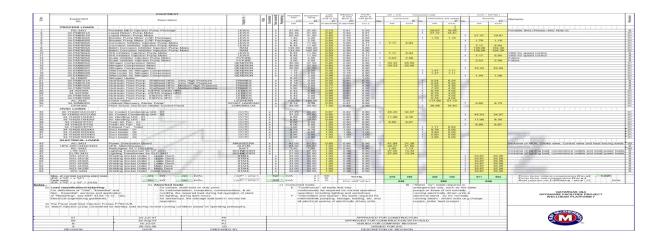
1C. DETAILED ENGINEERING



Here we observed that how to do a project and Sequence of approach, Approach to detail design and Overall plant distribution system.

10th May2021: Engineering documentation for Typical diagrams

5	Electrical system design for typical diagrams		
		Load lists shedule	Power flow diagram
		Single line diagram	Typical schematic
			diagram



Topic details:

We conclude here how to do load calculations and Typical diagrams and inernal structure and also about the power flow diagram.

11th May2021: Classification of Transformers and Generators

6	Classification of		
	Transformers and Generators	Different types of Transformers	Different types of Generators

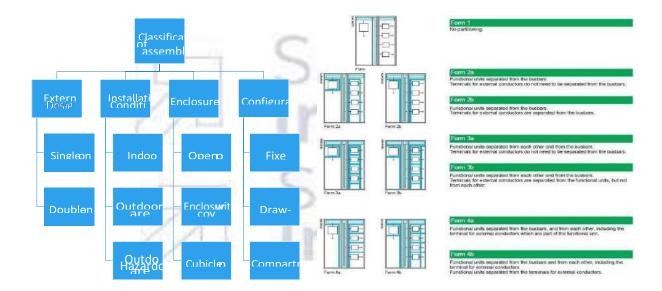


Topic details:

Classification of Transformers and Generators

12th May2021: Classification of Switchgare construction and power factor improvement

7	Classification of Switchgare construction and power factor improvement	Different types of Switchgare assembles	Power factor improvement

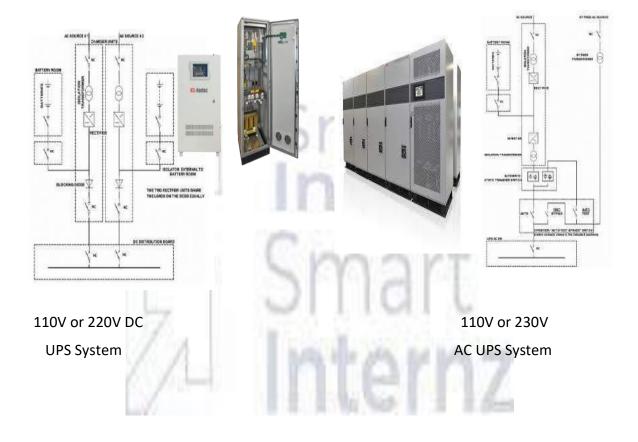


Topic details:

Classification of Switchgare contruction and Power Factor Improvement

17th May2021: Detailing about UPS system and Busducts.

8	Detailing about		
	UPS system and	Uninterruptible power supply	Busduts of the system
	Busducts	system	

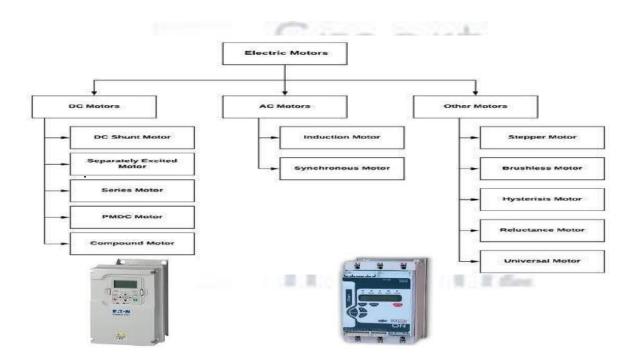


Topic details: Power distribution of UPS system and Busducts.

UPS systems are designed to provide continuous power to a load, even with an interruption or loss of utility supply power. UPS generally involves a balance of cost Vs need.

18th May2021: Detailing about Motor Starters and Sizing of motors.

9	Detailing about Motor	Motor starters and drives	Sizing and selection of
	Starters and Sizing of		motors
	motors		



Topic details: Detailing about Motor Starter and Sizing of motors and their selection.

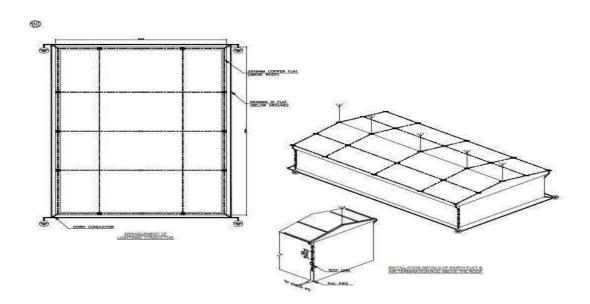
The principal function of a motor starter is to start and stop the respective motor connected with specially designed electromechanical switches which are similar in some ways to relays. The main difference between a relay and a starter is that a starter has overload protection for the motor that is missing in a relay.

Different types of motor starters are as follows:

- Direct-On-Line Starter
- Rotor Resistance Starter
- Stator Resistance Starter
- Auto Transformer Starter

19th May2021: Discribing about Earthing system and Lighting Protection.

10	Discribing	Plant Earthing system	Lighting Protection materials
	about Earthing		
	system and		
	Lighting		
	Protection.		



Topic details: Discribing about Earthing system and Lighting Protection.

Lightning protection required for high rise structures and important buildings against lightning currents during thunder storms. Primarily Lightning protection system calculations are done based on soil resistivity, conductor material, coverage structure / Building to determine whether lightning protection is required or not.

20th May2021: Lighting or illumination systems and calculations.

11	Lighting		
	or	Lighting or illumination systems	Lighting calculations
	Illuminatio		
	n systems		
	and		
	Calculation		
	S		

Topic details: Lighting or Illumination systems and Calculations.

All outdoor lighting fittings shall be connected with armoured PVC cable of suitable no. of cores and size. Necessary type and no. of junction boxes shall be provided for branch connections. Indoor light fittings shall be connected with FRLS PVC wires laid in cable trunks or conduits.

Inputs required: Equipment and cable routing layouts, lighting calculations, Design basis for type of light fittings to be used, required lux levels

Lighting calculations software: Dialux, Chalmlite, Calculux, Relux, Luxicon,

CG Lux Applicable Standards: IS 6665: Code of practice for industrial



lighting, IS 3646: Code

of practice for interior illumination, IEC 60598: Luminaires, IEC 62493: Assessment of lighting equipment related to human exposure to electromagnetic field

Deliverables: Indoor Lighting layouts, socket outlet layouts, Street lighting and area lighting layouts. BOQ.

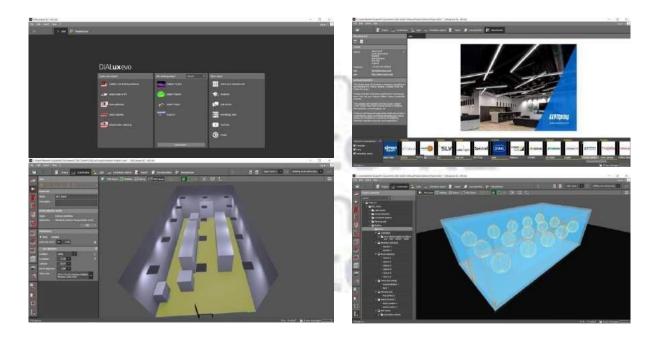
Types of light fittings: Industrial, flame proof type (EX d), increased safety type (Ex e).

21th May2021: Lighting or illumination systems using DIALUX software.

Illumination using DIALUX software Lighting or illumination systems of tware	12	12	using DIALUX	Lighting or illumination systems	l *_	of	dialux
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Topic details: Lighting or Illumination Calculations using DIALUX software.

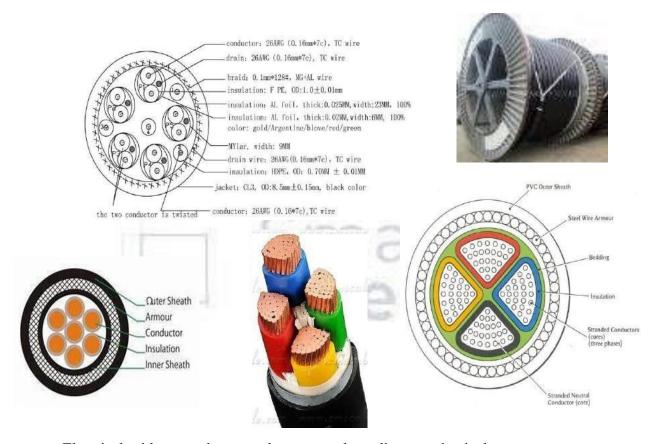
Here we are using this Dialux evo 5.9.2 software windows to construct the power plant and we can perform the operation from this software.



24th May2021: Cabling and their calculations and types.

13	Cabling and their				
	types and claculations	Cabling calculations	Types materials	of	cabling

Topic details: Cabling and their types and claculations .



Electrical cables must be properly supported to relieve mechanical stresses on the conductors, and protected from harsh conditions such as abrasion which might degrade the insulation.

Cables generally laid in the cable trays above ground, direct buried underground and in metallic or PVC conduits. Derating factors may be applicable for each type of cable laying conditions.

25th May2021: Cabling calculations and Cable gland selection.

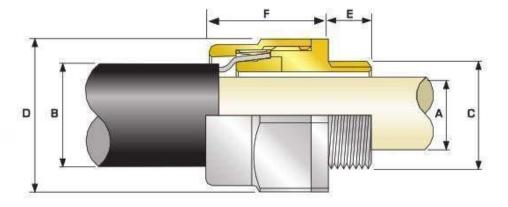
14	Cabling		
	claculations and cable gland	Cabling calculations	Cable gland selection
	selection		

Topic details: Cable sizing calculation and cable gland selection.

Inputs required: Load List, Design basis, Electrical equipment layout, cable schedule, vendor catalogues for cable tray.

Cable tray sizing shall be performed for each branch of cable tray routing up to the load point. Results shall be checked with specified limits mentioned in design basis.

Cable gland:



Cable Gland Selection Table
Refer to illustration at the top of the page.

Cable Gland Size	(Alternat	Entry Threads "C" te Metric Thread hs Available)	Cable Bedding Diameter "A"	Overall Cable Diameter "B"	Armou	r Range	Across Flats "D"	Across Corners "D"	Protrusion Length "F"
Size	Metric	Thread Length (Metric) "E"	Max	Max	Min	Max	Max	Max	Length F
20516	M20	10.0	8.7	13.2	0.8	1.25	24.0	26.4	35.2
205	M20	10.0	11.7	15.9	8.0	1.25	24.0	26.4	32.2
20	M20	10.0	14.0	20.9	0.8	1.25	30.5	33.6	30.6
25	M25	10.0	20.0	26.2	1.25	1.6	36.0	39.6	36.4
32	M32	10.0	26.3	33.9	1.6	2.0	46.0	50.6	32.6
40	M40	15.0	32.2	40.4	1.6	2.0	55.0	60.5	36.6
505	M50	15.0	38.2	46.7	2.0	2.5	60.0	66.0	39.6
50	MSO	15.0	44.1	53.1	2.0	2.5	70.1	77.1	39.1
635	M63	15.0	50.0	59.4	2.0	2.5	75.0	82.5	52.0
63	M63	15.0	56.0	65.9	2.0	2.5	80.0	0.88	49.8
755	M75	15.0	62.0	72.1	2.0	2.5	90.0	99.0	63.7
75	M75	15.0	68.0	78.5	2.5	3.0	100.0	110.0	57.3
90	M90	24.0	80.0	90.4	3.15	4.0	114.3	125.7	66.6

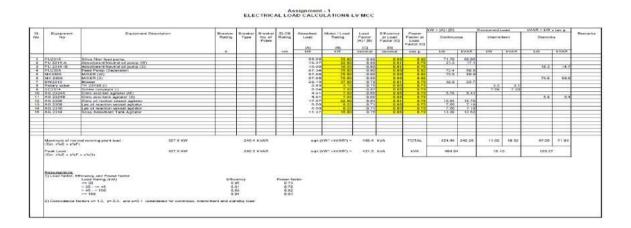
ROLL NO:18481A0286

28 th May 2021: Load calculations and Transformer sizing calculations

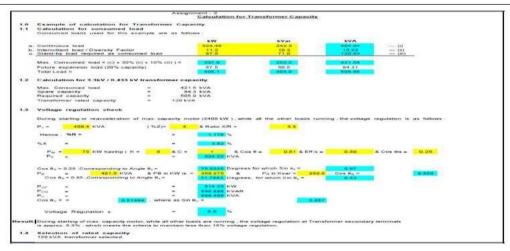
15	Load calcu	ulations		
	and	TR	Load calculations	TR calculations
	calculation	ns		

Topic details:

List of electrical load calculations.



T/F calculation:

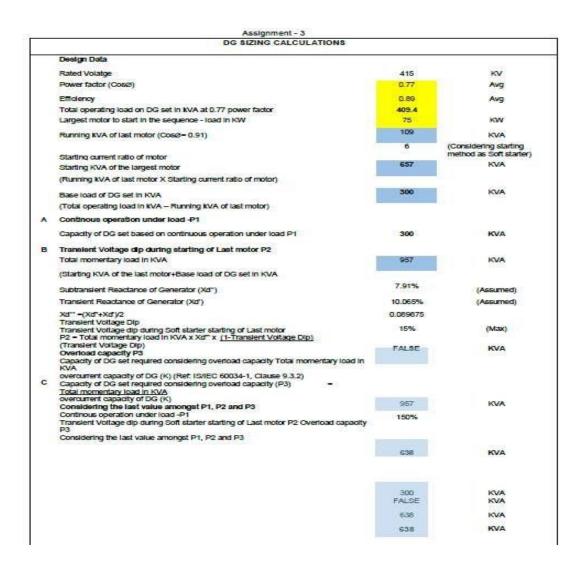


29th May2021: DG set calculations

16	DG set
	calculations

Topic details:

Transformer and DG set calculations, types, sizing or selections

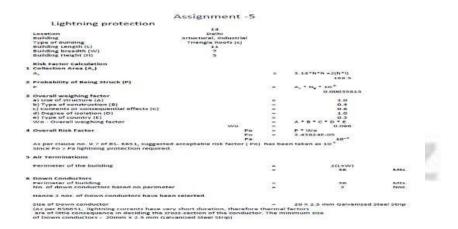


2nd june2021: Caluculations of Earthing and Lighting protection.

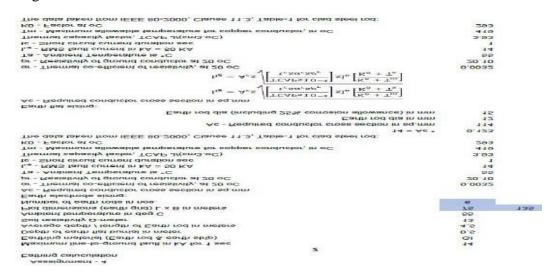
17	Calculation of Earthing and	Earthing calculations	Lighting protection
	Lighting		calculation
	protection		
	calculations		

Topic details:

Calculation of Earthing and Lighting protection calculations



Earthing calculation

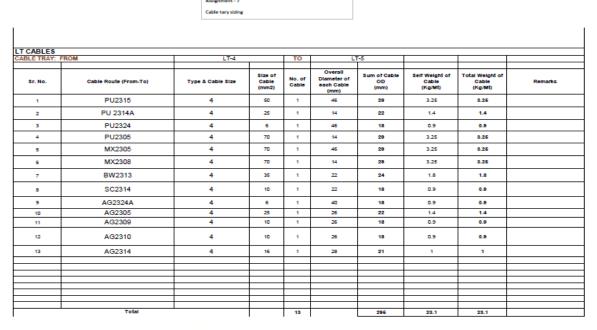


5 th june 2021: Cable sizing and cable tray sizing calculations.

18	Cable sizing and		
	cable tray	Cable sizing calculations	Cable tray calculation
	sizing		
	calculations		

Topic details:

Cable sizing and cable tray sizing calculations for LV cables and MV/HV cables.



										Assignment - S Calle story																								
880	Description	fquipment Mis	Description	Consumer Load MW	Load Factors Way	tot ()	age of	Fall Land Cuman	Hotor Starting Certed (k)	Lost P.F. Backing	SB(9 Standing	Noter I State	f SNO Starting	Type	No. of Rate	So. of Cons	Ho per2	Current Rating (A)	Desting factor 83	Dending factor LT	Densiting Nation NO	Denting State 64	Overall Desting Sector	Dented Current (A)	Cable Long®: (II)	Cable Resistance (Ctrosk®)	Cable Reactance (Disrack)	Personal (Receive)	Anno Anno (Exemple)	Virtage drop (Storting) M	drop (starting)	Gable size result	CO of Cable (mm)	Gland size
11	TA MCC	PUDIE	Sites fibr feet pure	65.58	- 72	- 6	5 3	1181	58.76	95	0.8	.03	1 25	- 2	1 1	40	50	450	028	0.0	1 1	9 10	0.892	49271	25	400	407	#EST	#R257	#REP1	4017	W(2)	F001	1 20
2	LYNCO	F9/2014A	Respectively slove	937	2	4	8 3	- 33.7	22211	95	0.8	0.09	2.8	- 3	1	40	- 25	AREA	0.00	0.0		1	0.002	46571	60	#RD1	FUE	#IZP	#ID71	Milf:	#EET!	WEST	P027	Th
2	LIV NCC	FUCTOR	Ditte Acid Tark pump	437	7.5	- 4	8 3	05	11.23	95	0.8	0.03	1 68	- 2	1 1	40	(B)	4500	038	. 9.9	1 1	8 1	0.002	40271	10	#177	#E7	作工作	#E7:	#REF1	4007	WEST	#501	The Control
4	LYNED	PUINE	Feet Purp) Seperator	6734	19	4	15 3	117.5	32.65	35	1.5	68	1.5	- 1	1 1	40	70	487	028	3.9		1	0.85	40277	25	49371	4927	4837	4827	#R171	400	400	#8271	70
1	LV NCC	M COSE	More	807.68	75	4	15 3	1155	708.07	32	0.5	0.3	1.5	112	1 1	40	70	6807	038	0.0	1 1	1	0.852	48271	26	#RDF	FEE	HITT:	#IEP:	#RDF	400	ATES:	#1011	23
	LY NCC	M CSS	User	67.88	13	4	15 3	1150	708.07	33	0.5	0.8	1.5	- 3	1.1	40	- Z	480	038	0.0		1	0.82	48271	135	#R371	#E271	MITH	#IEF1	48D(WD1	ATEST.	#1071	29
2	17 NCC	BWZE3	Sowe	2013	- 12	4	15 3	50.7	330.05	33	0.5	. 001	1.15	2	1 1	40	- 25	4807	0.28	0.3	1 1	1	CHEC	49271	- 55	#R171	#ED!	MITT	#1007	#RD1	4000	4500	#837	201
6	DAMCO	502014	Screen conveyor	154	7,5	-4	5 3	. 11.4	K.68	88	1.5	- 0/3	1 25	- 2	1. 1	40	- 62	ARXI	038	33		8 10	0.802	#RE/T	- 6	FUE!	#ECT	新宝川	(FET)	#R81	#th:	(FEE)	1 MOS	Th:
- 1	- FA MCD	ADDEDNA	oftic add fan agfaiter	415	7.6	4	5 3	85	11.25	0.5	1.3	0.2	1 25	- 2	11	140	0.08.00	ARTH	038	0.0	1 1	1 10	0.862	AREH	85	#137	#0.7°	MILE	#姓方:	#00F	40.00	WEF)	#80°1	Th
13	LYMCO	AGCINE	cate of redict reach agilative	12.62	22	- 4	8 3	31.5	190.48	7.5	8.3	.03	1.5	2	1.3	40	2	ARET	036	0.0		1	0.865	49211	70	#tj/	MECE	MIXT	#E21	WILD!	#III	ATEX?	PRO	D
- 11	LY NCC	AG2300	ye of teaction was agrace.	\$50	1.2	4	6 0	11.3	57.EL	0.2	6.8	0.0	2.5	1.2	0.01	40	D 10	ART	0.28	0.3		1.0	082	48371	18	#R171	#827	HITH	#IDT	#REET !	#RET!	#ED)	#REET!	Th:
12	LYNCO	AGCONG	ye of reador were agrain.	\$30	1.2	4	5 3	11.3	RID.	0.5	6.5	0.0	5.5	- 1	1 1	40	10	AND	0.00	3.3	1 3	1	0.85	11256	- 65	#0.07	FEE	HIXTH	#RUT	#REF1	#REPS	WEST	#825	20s
th	TAWCO	A5(2)14	Sno schotertani aglator	16.00	15.	4	2 2	19.8	113.84	38	8.8	00.	\$5	3	1	40	16	AREA	038	33		-1	0.852	#REFT		#E271	AUT	報文門	#RE7:	#H#1	#ten	#IL7:	#E21	20
3	S .			3					Н	V F	9		H																- 18					
8	8				-	-				Ü	18 3						8 8			8 1									- 13	- 4			F	-

Constituting from 4-14 (1) (1-15) (16)

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Conclusion

We have been taught many aspects of engineering activities during the EPC stages for all electrical and related other disciplines also.

Feedback

Smart Bridge

They conduct summer internships, work shops, debates, hackthons, technical sessions.

Method of conducting program

Online virtual program with presentation slides and explanation on the topic and practical usage of topic and with some examples.

Program highlights

It is for the detailed design of any industrial sectors.

Material

The material was good.

Benefits

It has been given the opportunity to learn and interact with industry experienced engineering specialist to learn the Electrical detailed design engineering for various industrial sectors.

Assignment - 1 ELECTRICAL LOAD CALCULATIONS LV MCC

Silica filter feed pump Absorbesnt/Neutral oil pump (W) Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric oil rection vessol agitator Lye oil reaction vessel agitator	Breaker Rating A		Breaker No. of Poles	Rating	[A] kW 66.68 19.37 16.66 67.34 67.86 67.86 29.13	22.00 18.50 75.00 75.00	Load Factor [A] / [B] [C] decimal 0.89 0.88 0.90 0.90	Efficiency at Load Factor [C] [D] decimal 0.93 0.91 0.91	Power Factor at Load Factor [C] cos φ 0.82 0.78 0.78	kW = [A] / [D] Continuo kW 71.70 21.3	kVAR 50.05 17.1	Intermit	kVAR	Stand-b	y kVAR	Remarks
Absorbesnt/Neutral oil pump (W) Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric oil rection vessol agitator Lye oil reaction vessel agitator	A			mA	66.68 19.37 16.66 67.34 67.86 67.86	75.00 22.00 18.50 75.00	0.89 0.88 0.90	0.93 0.91 0.91	cos φ 0.82 0.78	71.70	50.05	kW	kVAR	kW	kVAR	
Absorbesnt/Neutral oil pump (W) Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric oil rection vessol agitator Lye oil reaction vessel agitator	A			mA	66.68 19.37 16.66 67.34 67.86 67.86	75.00 22.00 18.50 75.00	0.89 0.88 0.90	0.93 0.91 0.91	0.82 0.78	71.70	50.05	kW	kVAR	kW	kVAR	
Absorbesnt/Neutral oil pump (W) Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric oil rection vessol agitator Lye oil reaction vessel agitator					66.68 19.37 16.66 67.34 67.86 67.86	75.00 22.00 18.50 75.00 75.00	0.89 0.88 0.90	0.93 0.91 0.91	0.82 0.78	71.70	50.05					
Absorbesnt/Neutral oil pump (W) Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric oil rection vessol agitator Lye oil reaction vessel agitator					19.37 16.66 67.34 67.86 67.86	22.00 18.50 75.00 75.00	0.88 0.90	0.91 0.91	0.78							
Absorbesnt/Neutral oil pump (S) Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator					16.66 67.34 67.86 67.86	18.50 75.00 75.00	0.90	0.91		21.3	17.1					
Feed Pump (Seperator) MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator					67.34 67.86 67.86	75.00 75.00			0.78							
MIXER (W) MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator					67.86 67.86	75.00	0.90							18.3	14.7	
MIXER (S) Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator					67.86			0.93	0.82	72.4	50.5					
Blower TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator						75.00	0.90	0.93	0.82	73.0	50.9			70.0	= 0.0	
TK 2313B (I) Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator							0.90	0.93	0.82	20.0	05.7			73.0	50.9	
Screw conveyor (I) Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator							0.79 0.76		0.78 0.73	32.0	25.7	0.0	0.4			
Citric acid tan agitator (W) Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator			1	1 1	2.83		0.76	0.85 0.85	0.73			3.3 7.69	3.1 7.20			
Citric acid tank agitator (S) Citric oil rection vessol agitator Lye oil reaction vessel agitator			1	+	6.54 4.91	7.50 7.50	0.87		0.73	5.78	5.41	7.09	7.20			
Citric oil rection vessol agitator Lye oil reaction vessel agitator		+		1	4.91	7.50	0.65		0.73	5.76	3.41			5.8	5.4	
Lye oil reaction vessel agitator					17.87		0.81	0.83	0.73	19.64	15.75			3.0	5.4	
	l l		1		6.50		0.71	0.85	0.73	7.65	7.16					
-, · · · · · · · · · · · · · · · ·					6.50		0.71	0.85	0.73	7.65	7.16					
Soap Adsorbant Tank Agitator					11.37	15.00	0.76		0.73	13.38	12.52					
3																
		1	I													
normal running plant load : 327.8 kW %F)	V	245.4	4 kVAR		sqrt (I	kW² +kVAR²) =	409.4	kVA	TOTAL	324.46	242.28	11.02	10.32	97.05	71.03	
337.5 kV %F + z%G)	V	252.5	5 kVAR		sqrt (I	kW² +kVAR²) =	421.5	kVA	kVA	404.94	4	15.1	0	120.27		
701 1 2 700)								·								
<u>s</u>																
Eff: 1 and 1 B	F#	cionov		Power fa	octor											
r, Efficiency and Power factor.	EII	ciency		0.73												
Load Rating (kW)																
Load Rating (kW) <= 20	(
Load Rating (kW)	(1.93		0.91												
Load Rating (kW) <= 20 > 20 - <= 45	((
٢		> 20 - <= 45	> 20 - <= 45 > 45 - < 150 0.91	> 20 - <= 45 > 45 - < 150 0.93	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150	> 20 - <= 45 > 45 - < 150

Assignment - 2

Calculation for Transformer Capacity

1.0 Example of calculation for Transformer Capacity

1.1 Calculation for consumed load

Consumed loads used for this example are as follows:

	kW	kVar	kVA	
a. Continuous load	324.46	242.3	404.94	(i)
b. Intermittent load / Diversity Factor	11.2	10.3	15.23	(ii)
c. Stand-by load required as consumed load	97.5	71.0	120.63	(iii)
	-		_	
Max. Consumed load = ((i) + 30% (ii) + 10% (iii)) =	337.6	252.5	421.54	
Future expansion load (20% capacity)	67.5	50.5	84.31	
Total Load =	405.1	303.0	505.85	

1.2 Calculation for 3.3kV / 0.433 kV transformer capacity

 Max. Consumed load
 =
 421.5 kVA

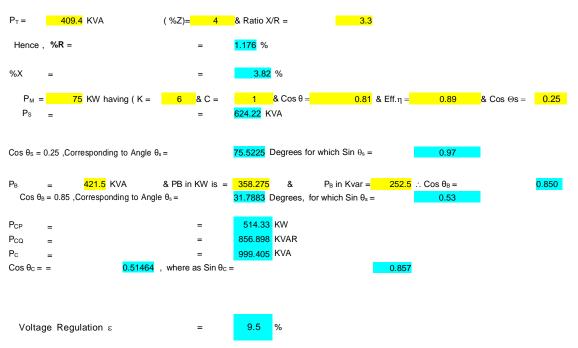
 Spare capacity
 =
 84.3 kVA

 Required capacity
 =
 505.9 kVA

 Transformer rated capacity
 =
 120 kVA

1.3 Voltage regulation check

During starting or reacceleration of max. capacity motor (3400 kW), while all the other loads running, the voltage regulation is as follows:



Result: During starting of max. capacity motor, while all other loads are running, the voltage regulation at Transformer secondary terminals is approx. 5.3%, which meets the criteria to maintain less than 15% voltage regulation.

1.4 Selection of rated capacity

120 kVA transformer selected.

	ASSIGNMENT - 3 DG SIZING CALCULATIONS		
	Design Data		
	Rated Volatge	415	KV
	Power factor (CosØ)	0.77	Avg
	Efficiency	0.89	Avg
	Total operating load on DG set in kVA at 0.77 power factor	409.4	Avg
	Largest motor to start in the sequence - load in KW	75	KW
		109	KVA
	Running kVA of last motor (CosØ= 0.91)		KVA
		6	(Considering starting
	Starting current ratio of motor	657	method as Soft starter) KVA
	Starting KVA of the largest motor	657	NVA
	(Running kVA of last motor X Starting current ratio of motor)		
	Base load of DG set in KVA	300	KVA
	(Total operating load in kVA - Running kVA of last motor)		
١,			
A	Continous operation under load -P1		
	Capacity of DG set based on continuous operation under load P1	300	KVA
В	Transient Voltage dip during starting of Last motor P2		
	Total momentary load in KVA	957	KVA
	(Starting KVA of the last motor+Base load of DG set in KVA		
	Subtransient Reactance of Generator (Xd")	7.91%	(Assumed)
	Transient Reactance of Generator (Xd')	10.065%	(Assumed)
	Xd''' = (Xd'' + Xd')/2	0.089875	
	Transient Voltage Dip Transient Voltage dip during Soft starter starting of Last motor	15%	(Max)
	P2 = Total momentary load in KVA x Xd" x (1-Transient Voltage Dip)		(,
	(Transient Voltage Dip)	FALSE	KVA
	Overload capacity P3 Capacity of DG set required considering overload capacity Total momentary load in		
	KVA		
С	overcurrent capacity of DG (K) (Ref: IS/IEC 60034-1, Clause 9.3.2) Capacity of DG set required considering overload capacity (P3)		
	Total momentary load in KVA overcurrent capacity of DG (K)		
	Considering the last value amongst P1, P2 and P3	957	KVA
	Continuous operation under load -P1 Transient Voltage dip during Soft starter starting of Last motor P2 Overload capacity	150%	
	P3		
	Considering the last value amongst P1, P2 and P3		
		638	KVA
		200	10.4
		300 FALSE	KVA KVA
		638	KVA
		638	KVA

2		
Maximum line-to-ground fault in kA for 1 sec	14	
Earthing material (Earth rod & earth strip)	GI	
Depth of earth flat burrial in meter	0.5	
Average depth / length of Earth rod in meters	4.5	
Soil resistivity Ω -meter	13	
Ambient temperature in deg C	55	
Plot dimensions (earth grid) L x B in meters	75	135
Number of earth rods in nos.	6	
Earth electrode sizing:		
Ac - Required conductor cross section in sq.mm		
αr - Thermal co-efficient of resistivity, at 20 oC	0.0032	
pr - Resistivity of ground conductor at 20 oC	20.10	
Ta - Ambient Temperature is °C	55	
I _{-g} - RMS fault current in kA = 50 KA	14	
tc - Short circuit current duration sec	1	
Thermal capacity factor, TCAP J/(cm3.oC)	3.93	
Tm - Maximum allowable temperature for copper conductor, in oC	419	
K0 - Factor at oC	293	
The data taken from IEEE 80-2000, Clause 11.3, Table-1 for clad steel rod:		
14 = Ac *	0.123	
Ac - Required conductor cross section in sq.mm	114	
Earth rod dia in mm	12	
Earth rod dia (including 25% corrosion allowance) in mm	15	
Earth flat sizing:		
Ac - Required conductor cross section in sq.mm		
$I_{lg} = A_c x \sqrt{\left[\frac{TCAPx10^{-4}}{t_c x \alpha_r x \rho_r}\right] x l_n \left[\frac{K_0 + T_m}{K_0 + T_a}\right]}$		
$I_{lg} = A_c x \sqrt{\left[\frac{TCAPx10^{-4}}{t_c x \alpha_r x \rho_r}\right]} x l_n \left[\frac{K_0 + T_m}{K_0 + T_a}\right]$		
ar - Thermal co-efficient of resistivity, at 20 oC	0.0032	
pr - Resistivity of ground conductor at 20 oC	20.10	
Ta - Ambient Temperature is °C	55	
I _{I-g} - RMS fault current in kA = 50 KA	14	
tc - Short circuit current duration sec	1	
Thermal capacity factor, TCAP J/(cm3.oC)	3.93	
Tm - Maximum allowable temperature for copper conductor, in oC	419	
K0 - Factor at oC	293	

The data taken from IEEE 80-2000, Clause 11.3, Table-1 for clad steel rod:

Assignment -5

Lightning protection

	14
Location	Delhi
Building	Srtuctural, Industrial
Type of Building	Triangle Roofs (c)
Building Length (L)	11
Building breadth (W)	7
Building Height (H)	5

Risk Factor Calculation

1 Collection Area (Ac)

 A_c = 3.14*h*h +2(h*l) 188.5

2 Probability of Being Struck (P)

 $A_c^* N_g^* 10^{-6}$ 0.00035815 3 Overall weighing factor a) Use of structure (A) 1.0 b) Type of construction (B) 0.4 c) Contents or consequential effects (C) 8.0 d) Degree of isolation (D) 1.0 e) Type of country (E) 0.3 Wo - Overall weighing factor A * B * C * D * E Wo P * Wo 4 Overall Risk Factor Ро Ро 3.43824E-05

As per clause no. 9.7 of BS- 6651, suggested acceptable risk factor (Po) has been taken as 10^{-5} Since Po > Pa lightning protection required.

5 Air Terminations

Perimeter of the building	= =	2(L+W) 36	Mts.
6 Down Conductors			
Perimeter of building	=	36	Mts.
No. of down conductors based on perimeter	=	2	Nos.

Pa

Hence 2 nos. of Down conductors have been selected.

Size of Down conductor = 20 X 2.5 mm Galvanized Steel Strip

(As per BS6651, lightning currents have very short duration, therefore thermal factors are of little consequence in deciding the cross-section of the conductor. The minimum size of Down conductors - 20mm X 2.5 mm Galvanized Steel Strip)

Assignment - 6

									Cable sizing																								
S.NO.	Description	Equipment No.	Description	Consumed Load KW	Load Rating KW	Voltage (V)	No. of Cur	ull Motor ad Starting rent Curren A) (A)	Load P.F. Running	SIN Ф Running		F SIN Φ Staring		No. of Runs	No. of Cores	Size (mm2)	Current Rating (A)	Derating factor k1	Derating factor k2	Derating factor k3	Derating factor k4	Overall Derating factor k	Derated Current (A)			Cable Reactance (Ohms/kM)	Voltage drop (Running) (V)	Voltage drop (Running) (%)	Voltage drop (Starting) (V)	Voltage drop (starting) (%)	size	OD of Cable (mm)	Gland size
1	LV MCC	PU2315	Silica filter feed pump	66.68	75	415	3 11	6.0 695.76	0.8	0.6	0.8	0.5	2	1	4.0	50	#REF!	0.98	0.9	1	1	0.882	#REF!	95	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20
2	LV MCC	PU 2314A	Absorbesnt/Neutral oil pump	19.37	22	415	3 33	3.7 202.11	0.8	0.6	0.8	0.5	2	1	4.0	25	#REF!	0.98	0.9	1	1	0.882	#REF!	60	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
3	LV MCC	PU2324	Citric Acid Tank pump	4.91	7.5	415	3 8	.5 51.23	0.8	0.6	0.8	0.5	2	1	4.0	6	#REF!	0.98	0.9	1	1	0.882	#REF!	85	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
4	LV MCC	PU2305	Feed Pump(Seperator)	67.34	75	415	3 11	7.1 702.65	0.8	0.6	0.8	0.5	2	1	4.0	70	#REF!	0.98	0.9	1	1	0.882	#REF!	75	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20
5	LV MCC	MX2305	Mixer	67.86	75	415	3 11	8.0 708.07	0.8	0.6	0.8	0.5	2	1	4.0	70	#REF!	0.98	0.9	1	1	0.882	#REF!	75	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20
6	LV MCC	MX2308	Mixer	67.86	75	415	3 11	8.0 708.07	0.8	0.6	0.8	0.5	2	1	4.0	70	#REF!	0.98	0.9	1	1	0.882	#REF!	105	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20
7	LV MCC	BW2313	Blower	29.13	37	415	3 50	0.7 303.95	0.8	0.6	0.8	0.5	2	1	4.0	35	#REF!	0.98	0.9	1	1	0.882	#REF!	95	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
8	LV MCC	SC2314	Screw conveyor	6.54	7.5	415	3 1	.4 68.24	0.8	0.6	0.8	0.5	2	1	4.0	10	#REF!	0.98	0.9	1	1	0.882	#REF!	65	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
9	LV MCC	AG2324A	citric acid tan agitator	4.91	7.5	415	3 8	.5 51.23	0.8	0.6	0.8	0.5	2	1	4.0	6	#REF!	0.98	0.9	1	1	0.882	#REF!	85	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
10	LV MCC	AG2305	citric oil rection vessol agitator	17.87	22	415	3 3	1.1 186.46	0.8	0.6	0.8	0.5	2	1	4.0	25	#REF!	0.98	0.9	1	1	0.882	#REF!	75	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
11	LV MCC	AG2309	lye oil reaction vessel agitator	6.50	9.2	415	3 11	67.82	0.8	0.6	0.8	0.5	2	1	4.0	10	#REF!	0.98	0.9	1	1	0.882	#REF!	65	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
12	LV MCC		lye oil reaction vessel agitator	6.50	9.2	415	3 11	67.82	0.8	0.6	0.8	0.5	2	1	4.0	10	#REF!	0.98	0.9	1	1	0.882	#REF!	65	#REF!	#REF!	#REF!	#REF!	#REF!		#REF! #	#REF!	20s
13	LV MCC	AG2314	Soap adsorbant tank agitator	11.37	15	415	3 19	9.8 118.64	0.8	0.6	0.8	0.5	2	1	4.0	16	#REF!	0.98	0.9	1	1	0.882	#REF!	65	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF! #	#REF!	20s
																														<u> </u>			
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		, and the second	_																														
				•		•		•	•	•			•	•	•							•	•										

Basis:

1. Overall derating factor $k = k1 \times k2 \times k3 \times k4$

K1=Rating factor for variation in air/ground temperature

K2=Rating factor for depth of laying

K3=Rating factor for spacing between two circuits

K4=Rating factor for variation in thermal resistivity of the soil

2. LT Motors : Running Voltage Drop = 3%, Starting Voltage Drop = 15%

3. Cable type:

TYPE 1: Al Conductor, XLPE Insulated, Armoured, PVC outer sheathed

TYPE 2: Cu Conductor, XLPE Insulated, Armoured, PVC outer sheathed

4. Effect of Frequency Variation ± 5%

5. Combined Effect of Voltage & Frequency Variation ±10%

Assignment - 7
Cable tary sizing

BLETRAY: FI	ROM	LT-4	1	TO	Ľ	Г-5			
Sr. No.	Cable Route (From-To)	Type & Cable Size	Size of Cable (mm2)	No. of Cable	Overall Diameter of each Cable (mm)	Sum of Cable OD (mm)	Self Weight of Cable (Kg/Mt)	Total Weight of Cable (Kg/Mt)	Remarks
1	PU2315	4	50	1	46	29	3.25	3.25	
2	PU 2314A	4	25	1	14	22	1.4	1.4	
3	PU2324	4	6	1	46	18	0.9	0.9	
4	PU2305	4	70	1	14	29	3.25	3.25	
5	MX2305	4	70	1	46	29	3.25	3.25	
6	MX2308	4	70	1	14	29	3.25	3.25	
7	BW2313	4	35	1	22	24	1.8	1.8	
8	SC2314	4	10	1	22	18	0.9	0.9	
9	AG2324A	4	6	1	40	18	0.9	0.9	
10	AG2305	4	25	1	26	22	1.4	1.4	
11	AG2309	4	10	1	26	18	0.9	0.9	
12	AG2310	4	10	1	26	18	0.9	0.9	
13	AG2314	4	16	1	28	21	1	1	
+									

Calculation			Result		
Maximum Cable Diameter:	29	mm	Selected Cable Tray width:	O.K	
Consider Spare Capacity of Cable Tray:	30%		Selected Cable Tray Depth:	O.K	
Distance between each Cable:	0	mm	Selectrd Cable Tray Weight:	O.K	Including Spare Capacity
Calculated Width of Cable Tray:	384	mm	Selected Cable Tray Size:	O.K	Including Spare Capacity
Calculated Area of Cable Tray:	11122	Sq.mm			_
No of Layer of Cables in Cable Tray:	2		Required Cable Tray Size:	300 x 100	mm
Selected No of Cable Tray:	1	Nos.	Required Nos of Cable Tray:	1	No
Selected Cable Tray Width:	300	mm	Required Cable Tray Weight:	90.00	Kg/Meter/Tray
Selected Cable Tray Depth:	100	mm	Type of Cable Tray:	Ladder	
Selected Cable Tray Weight Capacity:	90	Kg/Meter			
Type of Cable Tray:	Ladder		Cable Tray Width Area Remaning	36%	
Total Area of Cable Tray:	30000	Sq.mm	Cable Tray Area Remaning:	63%	
•					