QUESTION PAPER ANSWERED

ELECTRICAL ESTIMATING AND COSTING

4033

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TED (15) – 4033

(REVISION — 2015)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

ELECTRICAL ESTIMATING AND COSTING

[*Time* : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. State Space height ratio.
2. Define illumination.
3. Write any two points to be considered before deciding any type of wiring.
4. Mention the factors influencing earth resistance.
5. List types of guard used for transmission lines. (5 × 2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Draw mercury vapor lamp and mark the main parts.
2. Mention any six lamp holders.
3. Briefly explain Lead sheathed wiring, its merits and demerits.
4. Briefly explain IE rule 88 Guarding.
5. Briefly explain different types of earthing.
6. List out the points to be earthed for electrical installations.
7. List out major components used for overhead transmission lines. (5 × 6 = 30)

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

Unit — I

III (a) In a street lighting scheme lamps having luminous intensity of 600 candela are hung at a height of 6m. The distance between two lamp posts is 8m. Find the illumination under the lamp and at center in between the posts. 8

(b) State and prove inverse square law. 7

Or

IV (a) A small factory of 12m × 8m × 4m is to be illuminated with an average illumination of 80 lux on the working plane. Utilization factor is 0.5 and depreciation factor is 0.8. Find the number of lamps required. Lamp efficiency is 40 lumen/watt. 8

(b) Draw a neat sketch of incandescent lamp and mark important parts. 7

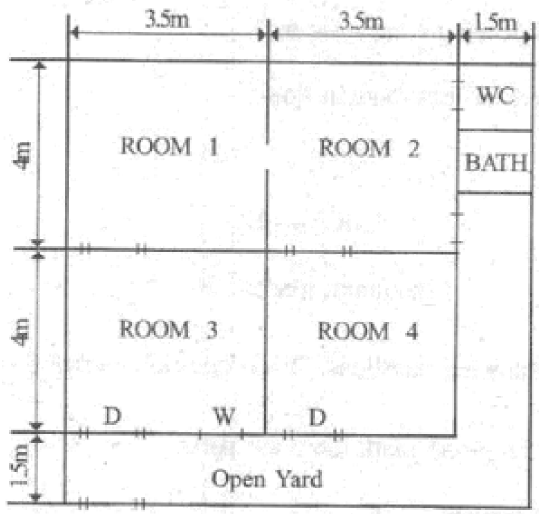
Unit — II

V (a) Explain classification of conduit wiring system and mention merits and demerits. 8

(b) Mention any seven IE rules related to power transmission. 7

Or

VI Estimate the material and cost of a residential building using surface conduit system as per the plan.



Location	Light (60W)	Fan (80W)	5A Socket (80W)	15A Socket (1000W)
Room-1	1	1	1	1
Room-2	1	1	1	1
Room-3	2	1	1	-
Room-4	2	1	1	-
Open Yard	1	-	-	-
WC & bath	1	-	-	-

15

Marks

UNIT — III

VII Estimate the list of material and cost required for a plate earthing with a neat sketch. 15

OR

VIII Draw a neat sketch and estimate list of materials and cost for providing service connection to a single storey building at 240V, 50Hz, single phase having a total load of 3kW. The supply is to be given from an overhead line 10m away from the building. 15

UNIT — IV

IX Estimate the materials required for the 11kV transmission line of the length 8km and assuming 4 cut points and 4 angle points in the total length of installation. Assume span as 90m. 15

OR

X Draw a neat sketch, estimate material required for a 300kVA, 11/0.4 kV plinth mounted substation. 15

15

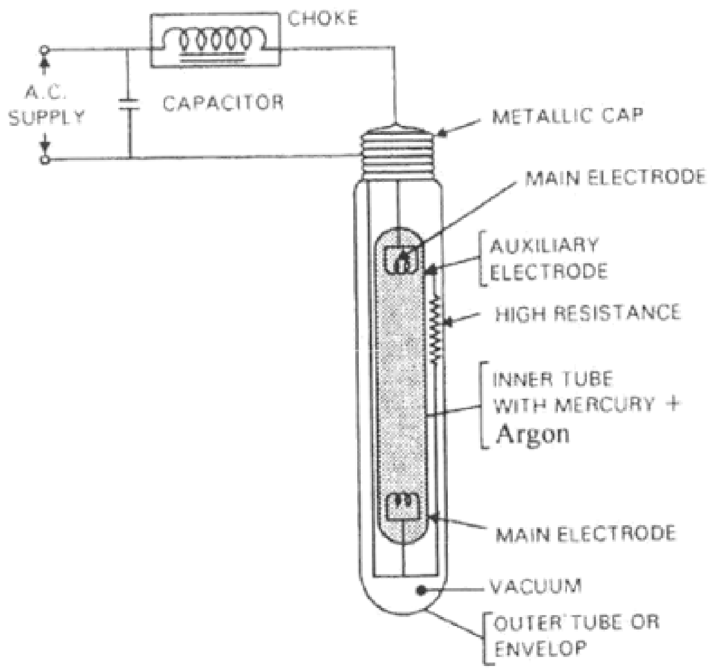
SCHEME OF VALUATION A

(Scoring Indicators)

Revision:15 Course Code: 4033

Course Title: Electrical Estimating and Costing

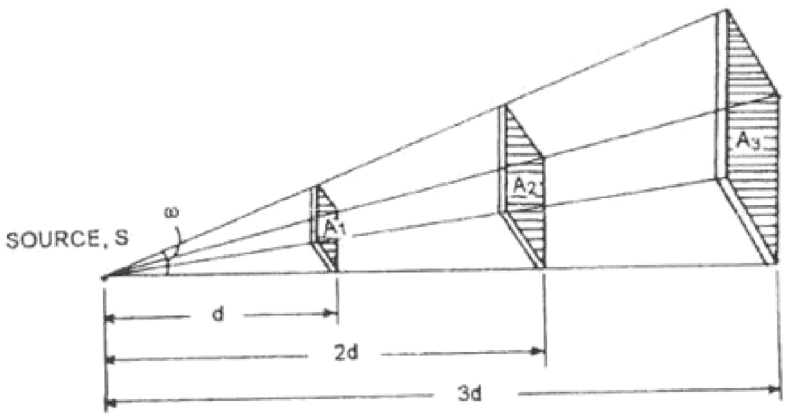
Qn. No	Scoring Indicator	Split up Score	Sub Total	Total
I	Part A			
1.	It is the ratio of the horizontal distance between the lamps to the mounting height of the lamp above the working plane. Space height ratio $= \frac{\textit{Horizontal Space between lamp}}{\textit{Mounting height above the woking plane}}$	2	2	
2	It is the luminous flux received by the surface per unit area. It is represented by E. The unit of illumination is lux. Illumination, $E = \frac{flux}{area}$ lux	2	2	
3	Durability, safety, cost, Appearance, Accessibility (any two)	2	2	10
4	Nature of soil condition, Moisture content, Temperature of the soil, Depth of the electrode embedded below the ground level, size of earth electrode, Material of the electrode (any two)	2	2	
5	Carpet guarding, Cradle type, Box type, PVC guarding (any two)	2	2	

II	Part B			
1		6	6	
2	Batten, bracket, Pendent, Water-tight, Angle, Goliath Edison Screw lamp holder, Swivel, Starter holder, Fluorescent tube holder (any six)	1 mark each	6	
3	**Lead Sheathed Wiring** The cables used as insulated wires, TRS or PVC with metal outer covering of about 1mm thick. The metal covering is known as sheathing and is made of lead, aluminium alloy containing about 95% of lead. The metal sheath cables are run on wooden batten and are fixed to it by link-clips as in the case of CTS or TRS **Merits** 1. It provides protection against mechanical injury 2. It can be used in damp situations	2 2	6	

	Demerits 1. It is costly system of wiring 2. It is not suitable where chemical corrosion may occur	2	6	
4	IE Rule 88-every guard wire should be connected with earth at each point where its electrical continuity is broken, breaking strength should not be less than 635kg, iron and steel shall be galvanized, Every guard wires should have sufficient current carrying capacity in case of accidents, In case of lines crossing trolley wires:- if only one trolly wire two gurad wires should be provided, for two trolly wires:- three guard wires should be provided. For telegraph line sliding, guard books shall be provided	6		
5	**1. Pipe Earthing** In this method of earthing a 38mm internal diameter, perforated galvanized pipe of length 2.5m is placed vertically in a permanently wet soil. The pipe is surrounded by the pieces of coke charcoal and salt in alternate layers of about 15cm around the pipe, is used to decrease the earth's resistance At the top of the 19mm pipe a funnel is fitted and is fastened in a cement concrete work. The earth wire is carried in a GI pipe of 12.7mm diameter and at a depth of 60cm from the ground level. A cast iron cover is hinged in a small masonry work on the top of the earthing to facilitate identification and periodical checking.	2	6	
	2. Strip or Wire Earthing In this method, a metal strip or wire is used as earthing electrode. This type of earthing is used where soil is rocky. In this system 25x4 mm GI strip or 25x1.6 mm Cu strip is buried in horizontal trenches of minimum depth of 0.5m. The length of strip wire is not less than 15m. Sometimes one strip or wire is layed in parallel or radial	2		

	trenches. **3. Plate Earthing** In this type of earthing, a copper plate of 60cm X 60cm X 6.3mm is used as an earth electrode. Plate electrode should be buried with its face vertical such that top edge is at a depth of not less than 1.5m below the surface of the ground. The electrode is surrounded by alternate layers of broken pieces of coke coal and salt. The earth wire is connected to the GI electrode. A cast iron tower is provided at the top of the earthing when resistance of one plate earthing is higher than the required value more than one plate should be earthed and connected together	2		
	4. Rod Earthing This method of earthing is simple, cheap and does not need earth excavation. It is suitable for the areas which are having loose soil condition or sanding. In this system of earthing a 16mm diameter GI solid rod of length not less than 2.5m driven vertically into the ground. (Any Three)	2		
6	**POINTS TO BE EARTHED** 1. Earth pin of 3-pin lighting plug socket and 4-pin power plug sockets. All metallic casing or metallic coverings of all electrical apparatus 3. Metal casing of portable apparatus such as heaters, refrigerators, soldering iron, electric drills…etc. 4. Frame of every generator, stationary motor, metallic parts of transformers…etc. 5. The neutral conductor of a 3-phase 4-wire system and the middle conductor of a 2-phase 3 wire system should be earthed not less than two separate and distinct connections with earth at the generating stations and at the substations 6. The case of a system comprising electric supply line having	1 mark for each point		

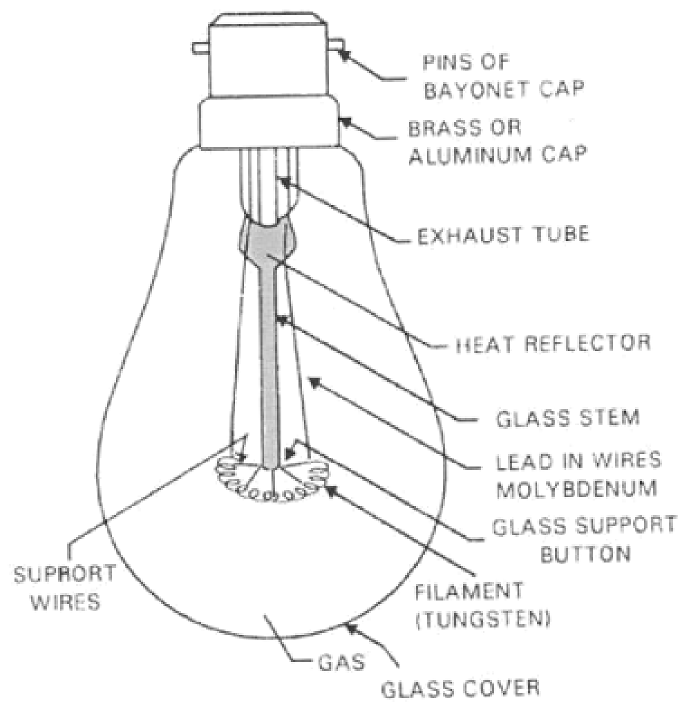
	concentric cables, the external conductor of such cable should be earth by two separate and distinct collections with earth. 7. In a DC 3-wire system the middle conductor should be earthed at the generating stations. 8. Steel towers, line towers, tubular steel or rail poles carrying overhead conductors should be earthed. The continuous earth wire is provided and connected with earth at 4 point in every mile, the spacing between the points is being as nearly equi-distant as possible. 9. Stay wires provided for overhead line should be connected to earth by connecting at least one strand to the earth. (any six points)			
7	Supports, insulators, Cross-arms, conductors, Guys and stays, Lightning arrestor, Fuses and isolators, earth wire, Vee guards, Guard wires, Barbed wire (Any six)	1 mark for each point		
	PART-C			
III a.	D1=7.211m, d2 = 10m, $\cos\theta_1 = \frac{h}{d_1} = 0.8$, $\cos\theta_2 = \frac{h}{d_2} = 0.6$ Illumination o f centre due to L1= $E_1 = \frac{I}{d^2} \times \cos\theta_1 = 9.6 lux$ Illumination o f centre due to L2 = L1= 9.6 lux Illumination at centre due to L1 and L2= 19.2 lux	4	8	
	Illumination Under the post Illumionation due to L1 = 3.6 lux Illumionation due to L2 = 16.667 lux Illumination at centre due to L1 and L2= 3.6 +16.667 = 20.267 lux	4		15

III b.	**Inverse Square Law** It states that the illumination of a surface is inversely proportional to the square of the distance between the square and the light source.	Law 2 mark		
		Fig 2 marks	7	
	Let S= point source A_1, A_2, A_3 = 3 parallel surface areas in m^2 d, 2d,3d = distance of A_1,A_2,A_3 in m ω = solid angle I = luminous intensity			
	For area A1 solid angle $\omega = \frac{A_1}{d^2}$ Flux φ1 on area A_1 $= I\omega = I\frac{A_1}{d^2}$ Illumination E on area $A_1 = \frac{flux}{area}$ $= \frac{\varphi 1}{A1} = \frac{IA_1}{d^2} \times \frac{1}{A_1}$ $E_1 = \frac{I}{d^2}$ lux Similarly illumination on A_2. $E_2 = \frac{I}{(2d)^2}$ lux	Deriv ation 3 marks		

<table>
<tr><td></td><td>Illumination on A_3, $E_3 = \frac{I}{(3d)^2}$ lux

From this we can see that the illumination of surface is inversely proportional to the square of the distance between source and the object. Thus inverse square law is proved.</td><td></td><td></td><td></td></tr>
<tr><td>IV
(a)</td><td>Total floor area = 12x 8 = 96m^2 , Total flux = 80 x 96 = 7680 lumen

Total flux required on working plane = $\frac{total\ flux}{CU \times MF} = \frac{7680}{0.5 \times 0.8} = 19200\,lumen$, Total wattage= $\frac{Flux}{\eta} = \frac{19200}{40} = 480\,w$

No. of lamp required $= \frac{480}{40} = 12$</td><td>8</td><td rowspan="2">15</td><td rowspan="2">15</td></tr>
<tr><td>IV
(b)</td><td>
</td><td>7</td></tr>
<tr><td>V
(a)</td><td>Conduit Wiring System
It consists of VIR or PVC cables taken through rigid steel pipes known as conduits Conduit wiring system can be classified into two:</td><td></td><td></td><td></td></tr>
</table>

	Concealed (Recessed) and surface conduit wiring **a) Concealed or Recessed conduit Wiring** The conduits are embedded along walls or ceiling in plaster at the time of construction. The conduits are fixed by means of saddles or staples not more than 60mm apart. Now-a-days PVC conduits are widely being used as it is resistant to acids, alkalis, oils and moisture. Concealed conduit wiring is used in residential, commercial and public buildings. **b)Surface Conduit Wiring** All conduits are fixed to the surface of wall with the help of saddles with a fixed interval of span not more than 0.60m. PVC conduits are widely used because of its weather resistance and its life span. Surface conduit is used for factory or workshop lighting and for motor wiring. **Advantages** 1. This system is water proof 2. Replacement of effective wiring is easy 3. It is shock proof 4. It requires less time **Disadvantages** 1. PVC conduits doesn't provide protection against fire hazards 2. Metal conduit wiring is very costly 3. Metal conduit wiring needs skilled labour	2 2 2 2	8	15
V (b)	1) Rule 79- Clearance from buildings of low and medium voltage lines 2) Rule 80- Clearance from buildings of high and extra –high voltage lines 3) Rule 81- Conductors at different voltages on same supports 4) Rule 82- Erection of or alteration to buildings, structures,floods banks and elevation of roads	1 mark for each rule	7	

<table>
<tr>
<td></td>
<td>5) Rule 83. Clearance General
6) Rule 84- Routes: Proximity to acrodrome
7) Rule 85- Maximum intervals between supports
8)Rule 86-Conditions to apply where tele-communication lines and power lines are carried on same supports
9)Rule 87- Lines crossing or approaching each other</td>
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<tr>
<td>VI
(a)</td>
<td>Total wattage = 1120 watts
No of sub circuits =2, $1mm^2$ cable can be used for wiring
Length of conduit for subcircuit 1 =19m
Length of conduit for subcircuit 2 = 22 m
Length of cable required for subcircuts = (19+22)x 3= 123 m</td>
<td>5</td>
<td rowspan="2">15</td>
<td rowspan="2">15</td>
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<tr>
<td></td>
<td>
<table>
<tr><th>Material</th><th>Quantity</th><th>cost</th></tr>
<tr><td>DP main switch 15A, 250 V</td><td>1</td><td>1000</td></tr>
<tr><td>IC cutout 15 A , 250 V</td><td>1</td><td>250</td></tr>
<tr><td>Flush type fuse unit 15 A , 250 V</td><td>1</td><td>500</td></tr>
<tr><td>Flush type fuse unit 5 A , 250 V</td><td>1</td><td>250</td></tr>
<tr><td>PVC conduit 25mm</td><td>60m</td><td>300</td></tr>
<tr><td>$1mm^2$ cable</td><td>123m</td><td>750</td></tr>
<tr><td>Switches 5 A , 250 V</td><td>12</td><td>360</td></tr>
<tr><td>3-pin sockets 5 A , 250 V</td><td>4</td><td>240</td></tr>
<tr><td>Ceiling rose</td><td>6</td><td>120</td></tr>
<tr><td>Lamp holders</td><td>6</td><td>150</td></tr>
<tr><td>Switch boards</td><td>8</td><td>800</td></tr>
<tr><td>Wooden gutties</td><td>12</td><td>120</td></tr>
<tr><td>Saddles 25mm</td><td>4box</td><td>400</td></tr>
<tr><td>Nails</td><td>2kg</td><td>100</td></tr>
<tr><td>Cement</td><td>5kg</td><td>100</td></tr>
<tr><td>Earthwire 16SWG copper</td><td>1kg</td><td>300</td></tr>
<tr><td>Earth set</td><td>1 set</td><td>5000</td></tr>
<tr><td>Labour cost</td><td></td><td>9000</td></tr>
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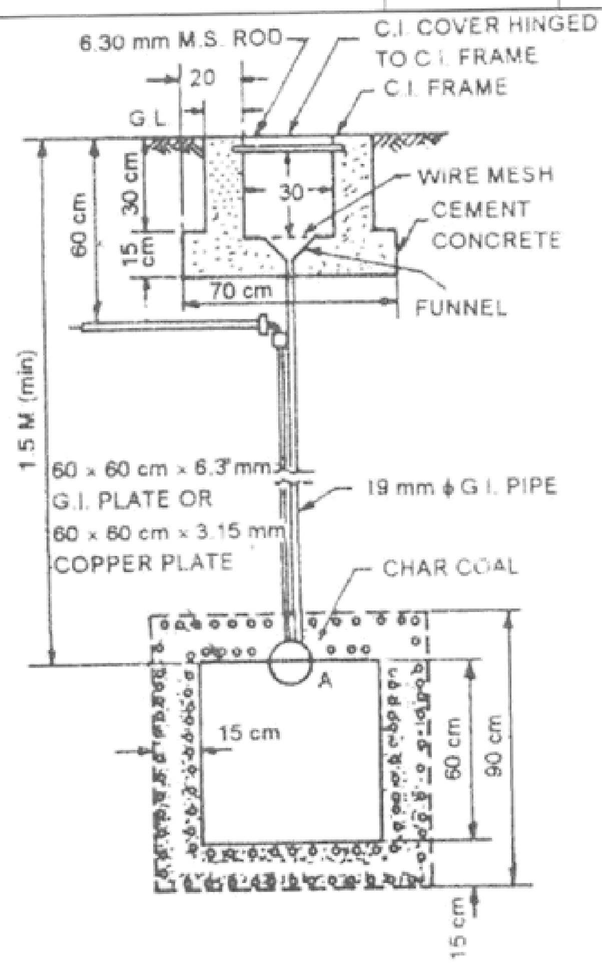
	Total		19740	
	10% contingency		1974	
	Grand Total		21714	

VII (a)



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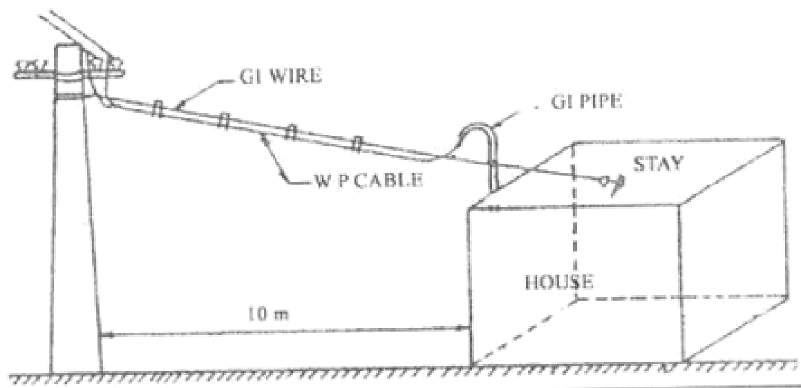
Specification of Material	Qty	cost					
GI plate 60cmX60cmX6.3mm	1	2000			15	15	
GI wire (8SWG)	10m	100					
12.7mm GI pipe	1	250					
19mm GI pipe	1	200		5			
GI nut,bolt, washers, checknut	Lumpsome	200					
GI bend 12.7mm	1	100					
GI lugs	1 packet	100					

Cast iron frame with hinges	1	500					
Cast iron cover 30cmX30cm	1	1000					
Funnel with wire mesh	1	100					
Charcol or cock	2 packet	1000					
Salt	2 packet	200					
Cement	1 packet	400					
Caution plate	1	50					
Total		6200					

VIII
(a)



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Material	Quantity	Cost
1 phase energy meter	1	2000
16 A fuse unit	1	200
7/20 WP twin core cable	15m	300
GI wire for supporting cable	15m	150
Link clips	1 box	25
Insulation tape	1	10
GI Pipe 18mm dia	1	150
Neutral link	1	50
Cement	1sack	350
Sand	LS	200
Wooden board 10" X 10"	1	200
Nails and Screws	2kg	50
Wooden gutties	LS	50
Labour charge		1500
Total		5235

10

15 15

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<td>IX</td>
<td>
Length of 11kV line = 8000m
Span = 90m, No of span = 8000/90 = 89
No of poles = Span+1= 90
10 H pole structure, 2 at dead end 4 at cut point and 4 at angle
$\therefore$ Total no of poles = 90 single pole structure + 11 for H-pole structure
= 101
Conductor
Length of ACSR = 3x 8000 + 4% sag and connections
=24960m
Length of 8SWG GI wire for earth = 8000+4% sag and connections
=8320
Insulators
11kV pin type insulator= Single pole structurex3 = 79 x 3 =237
11kV pin disc insulator = 3 on each dead end pole + 6 on each intermediate H pole structure = (3 x 2) + (6 x 8) = 54
Cross Arms
1.52 m X 75mm X 37mm for single pole =79
12.15 m X 75mm X 37mm for dead end =18
Top insulator brackets = 79
Stay Set
Stay sets two on each cut point, angle turn poles and H- type structures, one for every fifth pole = 40
Earthing set
For every fifth pole = 18
<table>
<tr><td>Material</td><td>Quantity</td></tr>
<tr><td>PSCC pole</td><td>101</td></tr>
<tr><td>ACSR conductor</td><td>2496m</td></tr>
<tr><td>Pin insulators</td><td>237</td></tr>
<tr><td>Disc insulators</td><td>54</td></tr>
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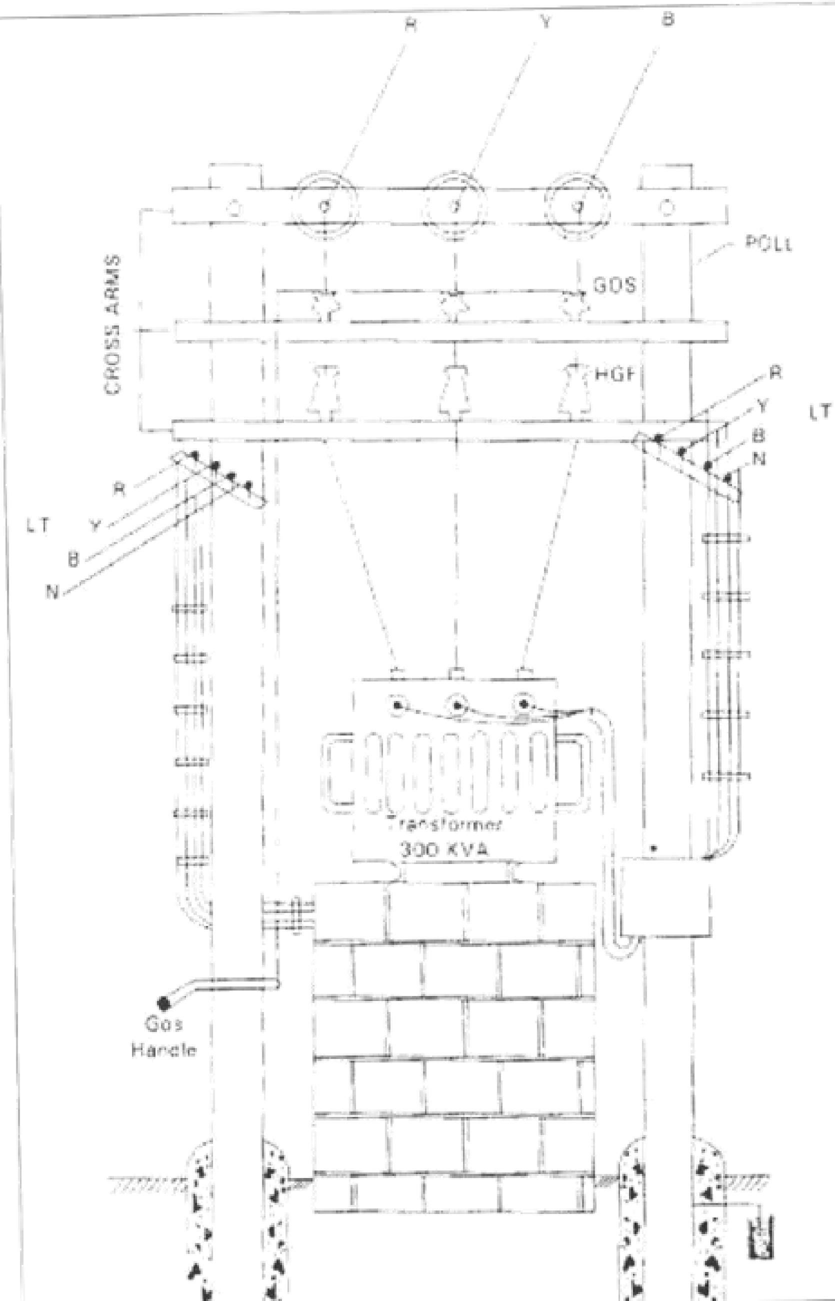
<td>8
For calculation</td>
<td>15</td>
<td>15</td>
</tr>
</table>

	MS cross arms single pole structure	79	7		
	MS cross arms H pole structure	18			
	Top insulator brackets	79			
	8 SWG GI wire	832m			
	Stay sets	40			
	Lightning arrestors	6			
	Earthing set	18			
	Cradle guard	3			
	Knee bracing set	79			
	Barbed wire	75kg			
	Binding wire	25 kg			
	Nut and bolts of various size	100 kg			
	Danger plates	90			
	Cement and sand	LS			

X



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15 15

	Description of material with specification	Qty				
	PCC poles 11 m long	2				
	11 kV disc insulators	3				
	Lightning arrestor (1 set of 3)	1				

	Gang operating switch	1			
	11 kV DO fuse unit(Drop out)	1			
	500 kVA, 11/440 V 3 phase 4 wire 50 Hz outdoor type T/F with complete accessories and oil filled	1			
	MS angle iron ,50mmX50mmX6mm	6			
	MS channel iron 100mm X 50mm X 6 mm	2	7		
	400A, 500 V, ICTPN switch with rewirable type porcelain Fuses (complete set)	1			
	ACSR conductor 7/2.11 mm	15 m			
	Single core VIR cable 95mm^2	20 m			
	19/ 1.63 mm single core VIR cable	7 m			
	Clamps	6			
	Earthing set	4			
	Stay set with insulation	2			
	Barbed wire	10m			
	Danger plates with clamps	2			
	Nuts and bolts	LS			
	Cement	10 sack			
	Sand	1 tonne			
	Pebbles	2 sack			