CMR INSTITUTE OF TECHNOLOGY

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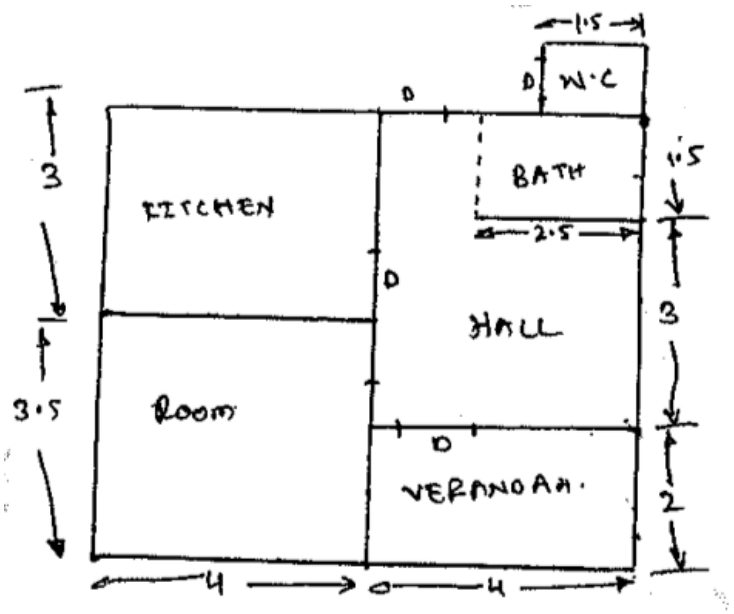
Internal Test –March 2018

Sub:	Electrical Design Estimation and Costing							Code:	10EE81
Date:	13/03 /2018	Duration:	90 mins	Max Marks:	50	Sem:	VIII	Branch:	EEE

Note: **Q6. is compulsory**. Answer any **FOUR** full questions from Q1-Q5
Assume data wherever necessary.

		Marks	OBE CO	OBE RBT
1.	Explain the following terms: i) Contingencies ii) Overhead charges iii) Profit iv) Electrical schedules.	[10]	CO2	L1
2.	Explain activities of purchase department and list out guidelines for inviting tenders.	[5+5]	CO3	L1
3.	Mention important general rules required to be followed for internal wiring.	[10]	CO3	L1
4.	What are the methods for installation of service lines? Describe the various methods used for the installation of overhead lines with neat diagram.	[2+5+3]	CO3	L2
5.	Name various tests required to be performed before connecting new installation to supply. Explain how is polarity of connected switch tested with neat diagram.	[5+5]	CO3	L2
6.	Figure shows the plan of a low income group government quarter. Draw the single line diagram for lighting and heating circuits on the sketch. Calculate total load, length and size of the wire by taking a safety factor=2. All dimensions are in metres. Prepare a list of the required material also.	[10]	CO2	L3



1 i)

Contingencies

- For vague and unforeseen items
- Like extra costs for delays in delivery, minor accidents and unforeseen variations from estimating department, need for exceptional measures such as overtime.
- For natural calamities such as floods, earthquakes..
- Usually expressed as a % of total cost (material + labour cost), say, 5%

1 ii)

Overhead charges/ standing charges

- Expenditure necessary to carry out the business, except for direct labour, direct materials, and direct expenses.

- Rent of offices and workshop
- Allowances for wear and tear of buildings, plant and machinery(depriciation)
- Wages of clerical staff
- General expenses
- Rates and taxes
- Lighting and heating
- Advertising
- Insurance
- Postage and telephone
- Carriage and general travelling expences
- Legal costs…..

1 iii)

Profit

- It is added in the form of percentage to the gross cost of the job in order to determine the selling price of the job
- This amount is purely on discretion of the contractor which is governed by…

I. Size of the job with him

II. Degree of competition

III. The state of turnover

IV. His anxiety to secure a particular job and so on

1 iv)

Electrical Schedule: An electrical schedule is that list or plan of building which provides us the information regarding the numbers of points (ceiling outlets, bracket outlets, single phase 3 way and 4 way rotary switches, wall plugs and other special plugs) in each room of the building under estimation.

2.

Purchase system

- 3 major heads
  - Objective
  - Function
  - Set up(organisation)

Purchase system

Purchase objectives:

1. To purchase competitively and wisely
2. To ensure that fair and open purchase practices are followed
3. To ensure timely formulation and commitment of purchase
4. To serve as information centre on materials knowledge
5. To ensure that investment made on inventory is at an optimum level
6. Training of purchase personnel in latest techniques of materials management
7. To keep management appraised of the likely shortfalls in purchase performance by introducing appropriate reporting system

Purchase functions

1. Creation and updating of vendor list
2. Maintenance of vendor evaluation and rating records
3. Conducting market surveys to find new vendors
4. Analyzing bids/ offers for decision making
5. Arranging negotiations with the suppliers
6. Issue of purchase order on time
7. Obtaining government clearance, where necessary
8. Follow up of purchase orders to ensure arrival of materials, ensure after sales service during warranty and post warranty
9. Finalization of rate contracts for regular stock items
10. To enable timely action in initiating purchase requests
11. Maintaining library of product catalogues

12. Entering into service contracts for transport,customs clearence, advertising etc
13. Entering into transit insurance agreement for goods in transit.
14. Updated information regarding govt laws.tax etc

Purchase setup

Purchase head

- Procurement of heavy plant and machinery
- Procurement of routine materials
- Registration of vendors/ suppliers and market survey
- Tender opening and submission of reports

Purchase enquiry and selection of appropriate purchase mode

- Enquiry tender shall indicate complete description and specifications of the required materials
- Drawing, wherever available, shall be enclosed
- Tender must be invited to ISS/other standard specifications as far as possible (~~Best quality~~)
- Where no drawing is available and which can not be correctly described, a sample is to be shown to the vendors or they may be requested to submit their sample

- Delivery expected shall be realistic and specifically indicated
- in case quantity required not readily marketed, minimum order quantity stipulation shall be requested in the tender enquiry

3.

General rules for wiring

- Every installation is to be properly protected near the point of entry of supply cables by a two pole linked main switch and a fuse unit.
- The conductor used is to be of such a size that it may carry load current safely.
- Every sub-circuit is to be connected to a distribution fuse board
- Every line is to be protected by a fuse of suitable rating as per requirements.

- A switch board is to be installed so that its bottom lies 1.25- 1.5 metre above the floor.
- All plugs and socket outlets are to be 3-pin type, the appropriate pin of socket being connected permanently to the earthing system.
- Adequate number of socket outlets are to be provided at suitable places in all rooms so as to avoid use of long lengths of flexible cords.
- Only 3-pin,5A socket outlets are to be used in all light and fan sub-circuits and only 3-pin, 15A socket outlets are to be used in all power sub-circuits.
- Individual switches for socket outlets are to be controlled by individual switches, which are to be located immediately adjacent to it.

- No socket outlet is to be provided in the bathroom at a height less than 1.30 metres.
- Depending on the size of the kitchen, one or two 3-pin 15A socket outlets are to be provided.
- Dining rooms, bedrooms, living rooms, if required, each is to be provided with at least one 3-pin 15A socket outlet.
- All incandescent lamps, unless otherwise required, are to be hung at a height of 2.5 metre above the floor level and all ceiling fans are to be hung 2.75 metre above the floor level

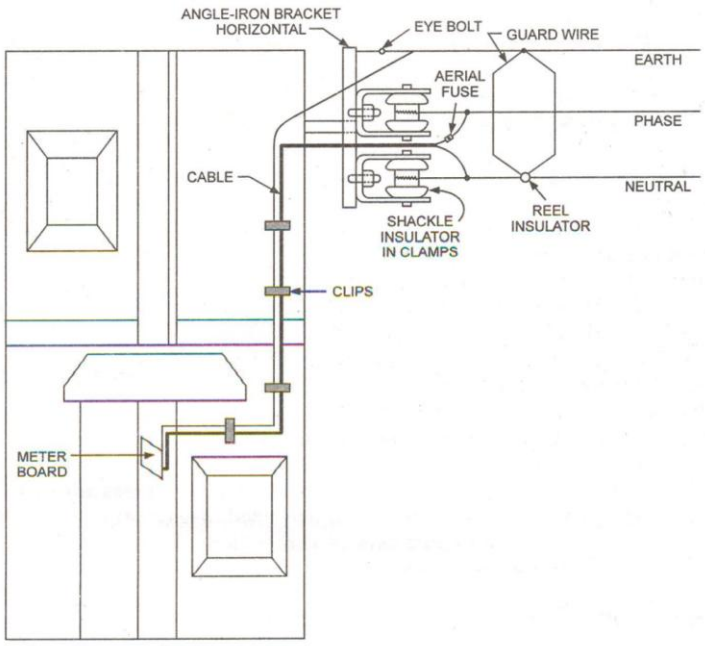
- Each sub circuit is restricted to 800W or total of ten points of lights, fans and socket outlets.
- The load on each power sub circuit is to be normally restricted to 3,000 Watt.
- In no case more than two socket outlets are to be in one power sub circuit.
- No fuse or switch is to be provided in earthed conductor.
- Every apparatus is to be provided with a separate means of isolation such as switch.
- Light + fan wiring and power wiring are to be kept separate.

- No additional load is to be connected to an existing installation unless it has been ascertained that the installation can safely carry the additional load and that the earthing arrangements are adequate.
- The metal sheaths or conduits for all wiring and metal coverings of all consumer apparatus or appliances is to be properly earthed
- Each sub-circuit is to be protected against excessive current by fuse or automatic circuit breaker.

4. service lines: Types
   1. Over head service connection (OH)
   2. Under ground service connection (UG)

Over head service connection

- For high roof building
- For low roof or single storeyed building
- Weather proof cable method
- Use of junction or joint box



Service lines are of two types:

1. Overhead service lines.
2. Underground cable service lines

There are various methods of installation of overhead service lines and their use depends upon the conditions prevailing. The various methods used for installation of overhead service lines are:

1. *(i) For High Roof Building.* The wire may be connected to the gable provided the building has the necessary height and there is no gable window from which the incoming conductor can be reached. In such cases a service bracket (mild steel angle iron piece) is embedded into a wall at a suitable height. The pin type or shackle type insulators are fitted to this wall bracket. The number of insulators to be fitted depends upon the number of incoming wires (two in case of general service connection and four in case of power service connection). As a rule the vertical distance between the insulators should be 35 cm and the lateral distance 30 cm. The phase and neutral wires are taken from existing service pole and connected to the insulators fitted on the service bracket. The earth wire is connected to angle iron with the help of eye bolt. Now a weatherproof or PVC cable known as *service cable* is connected to the conductors (overhead service line) solidly or by means of connectors and may be carried either on wooden batten or inside a GI pipe or conduit of suitable size up to the service board. The GI pipe, if used, is bent at the upper end with opening face downward in order to prevent the entry of rain water into the pipe.

Although a house may be high enough for the connection to be made at the gable, it may have windows in the gable from which the gable from wall and thus the house connection at the gable may be reached. In this case, a bracket pole may be used for lead in arrangement.

(ii) For Low Roof or Single Storeyed Building. If a building is of very low height, service bracket cannot be directly fixed to the wall, if fixed the power conductors may not have distance from ground as mentioned in IER. In such cases use of roof pole or GI pipe connection is made. In case of roof pole connection (Fig. 12.5) roof pole consists of a strong steel tube (60 mm, 80 mm or 90 mm in diameter) provided with lateral arms on which the insulators are mounted. The height of the roof pole should not exceed 3 metres otherwise the tensile stresses involved will become too high. To keep tensile stress low, the roof pole is braced by a steel rope as is done in the case of the stayed pole. If possible, the roof pole should be fastened to the main truss of the roof construction. In case of GI pipe connection GI pipe

is raised above the roof to a suitable height. The GI pipe is suitably clamped to the wall at its lower end and is bent back and provided with a stay as its upper end. The service cable is carried to service board through GI pipe and heavy gauge conduit.

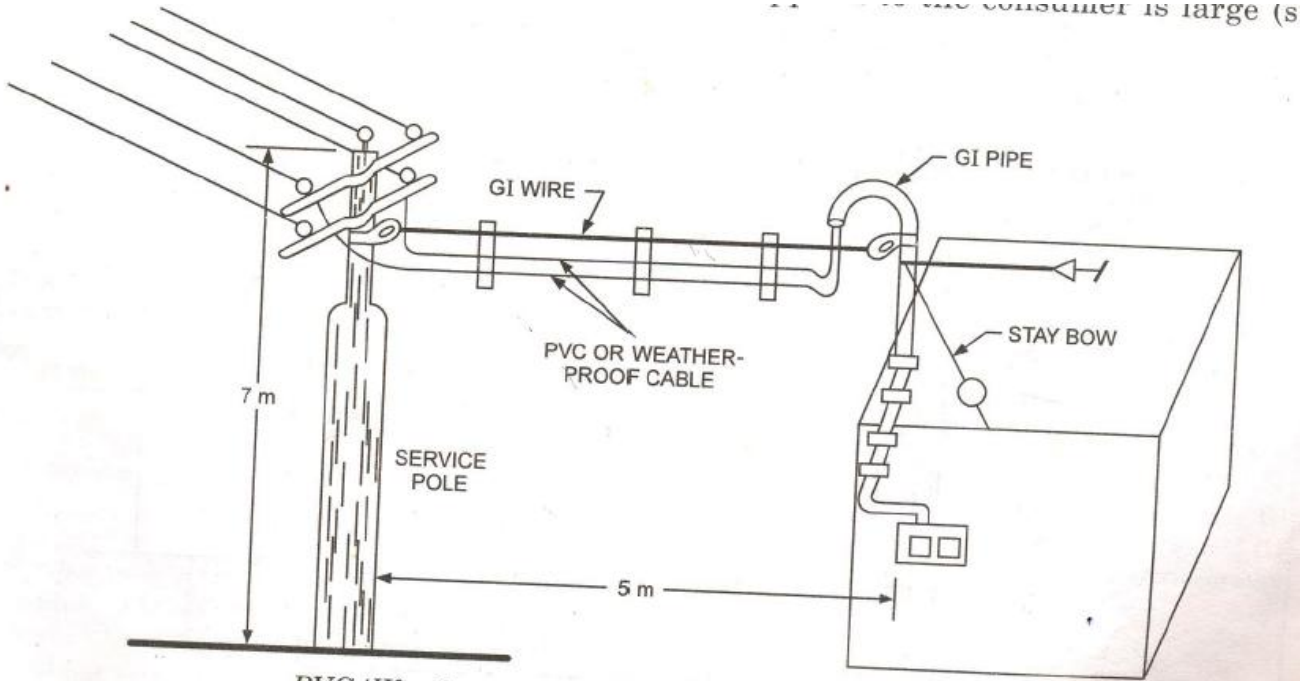
(iii) Weatherproof Cable Method. In this method an 8 SWG GI wire is stretched from the service pole to eye screw bolt fixed into a wall at a suitable height (in case of a double storeyed building) or to a GI pipe raised above the roof (in case of a single storeyed building). The weatherproof or PVC cable is then brought to the building by clipping it to the GI wire stretched between service pole and building and then carried to service board as usual i.e. on wooden batten or in a GI pipe or in a HG conduit.

(iv) Use of Junction or Joint Box. For taking service connection from one house to another house use of junction or joint box is made. In this system the connections from existing pole are taken to the existing

Fig. 12.6

pole are taken to the junction box where the joints to cables for bifurcating the connections are made, as shown in Fig. 12.8.

2. Underground Cable Service Connection. Use of underground cable is usually made for service connection when the power to be supplied to the consumer is large (say



PVC/Weatherproof Cable Service Connection

above 25 kW). For installation of underground cable service connection a cable box of suitabl size is fitted to the service pole by means of MS channel of size 16 mm × 250 mm and bolt and nuts. The cable is carried from the cable box fitted on pole to another cable box fitte on service board; first along the pole to the ground, then in the trench and lastly verticall along the wall to the second cable box. The trench starts from the pole and terminate vertically below the service board. Use of GI pipe of suitable size is made up to 2 metres fron the ground for enclosing the cable in order to save it from mechanical damage at both places i.e. along the pole and below the service board. The cable is held to the pole by means o clamps.

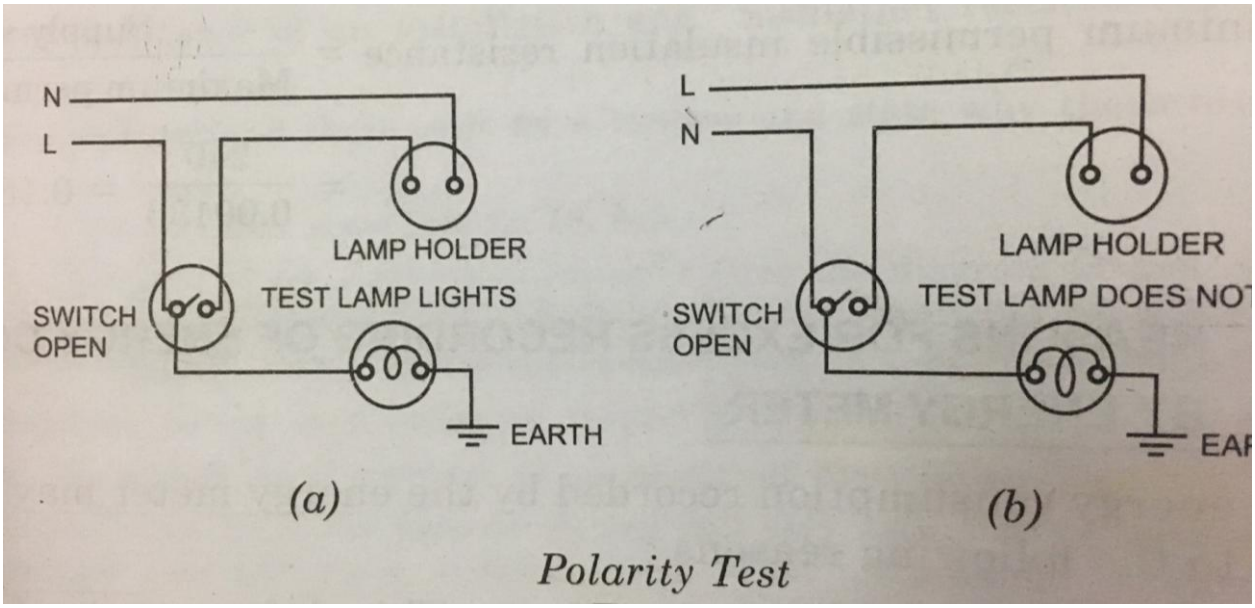
5.

Testing of wiring Installation

1. Insulation resistance between the wiring and earth with all fuses and lamps in and all switches ‘on’
2. Insulation resistance between conductors with all lamps out and all switches on
3. Testing of polarity of non-linked single pole switches
4. Testing of earth continuity path
5. Testing of earth resistance

Testing Of Polarity of Single pole switches:

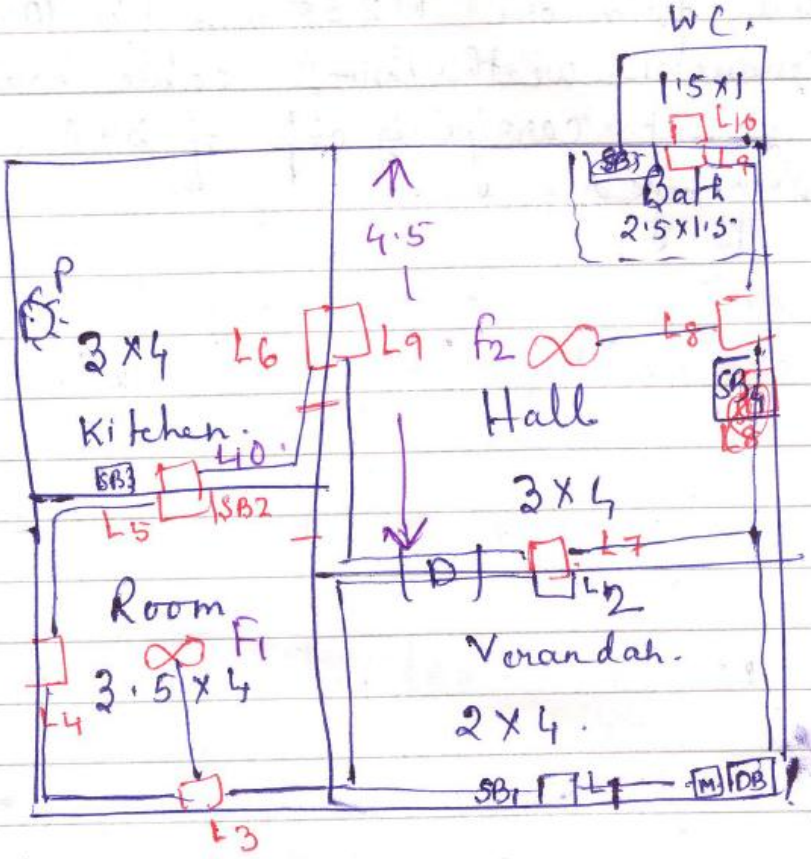
- To ensure that all switches are placed in phase or live conductors and not in neutral conductors
- By neon tube testers
- One terminal in hand other in feed terminal of switch
- Switch correctly connected neon will glow.



Polarity Test

6.

6:



Place	Area (m^2)	Wattage (W)	Points.				Type of f-
			Light	Socket	Fan	Power	
Verandah	8	80	40x2				Balter
Room	14	140.	40x2	100x1			Fluor
			60x1		80		& Ba
Kitch	12	120.	60x2			1000x	
Hall	12	120.	40x3	100x1	80		Pl2
Bath	3·75	37·5	40x1				Sla
WC	1·5	15	40x1				Sl
Total.			540	200	160		

Power circuit and light circuit should be different.

Power socket in Kitchen = 1000W.

Total wattage = ~~620W~~ 900W.

Total no. of points = 16.

As number of points more than 8.
Two subcircuits are required,
for light and fan and one for power circuit.

Let subcircuit-1 ⇒ Verandah, Room, Kitchen.

Sub-circuit-2 ⇒ Hall-Bath Kitch

Total load = 1900W.

F.L current = 1900/230 = ~~3.91~~ 8.26 A

safety factor = 2.

∴ 7/1.63 mm Cu ~~Al~~ conductor, 250V grade is chosen from main board to distribution board. ≈ 0.5 m.

Total load in sub-circuit-1 = 520W.

Full load current = 2.26A

Safety factor = 2.

∴ 1/1.12 mm Cu conductor, 250V grade is choosen for sub-circuit 1.

Total load in sub-circuit = 2 in 380W.

Full load current = 1.65A

safety factor = 2 ⇒ 3.30A.

1/1.12mm, 250V grade Cu conductor is chosen for sub-circuit.2.

length of Cu conductor 1/1.12mm

~~Sub-circuit~~

Assumption!

Height of ceiling = 3.5 m

Height of Horizontal Run = 3m

Height of switch board / M.B / D.B = 1 / 5 m.

Length of PVC Conduit for sub-circuit-1.

from DB to L_1 = 1.5 + 2. = 3.5 m
" L_1 to SB_1 = 1.5 m
from L_1 to L_3 = 2+2 = 4 m
" L_3 to L_4 = 2+1.75 = 3.75 m
" L_4 to L_5 = 1.75 + 2. = 3.75 m
" L_5 to SB_2 = 1.5 = 1.5 m
" ~~L_5 to L_{10}~~ = from L_3 to F_1 = 0.5 + 1.75 m
" L_{10} to L_6 2 + 1.5 = 3.5 m
" L_{10} to SB_3 = 1.5 1.5 m.

Total length = ~~2+5 m~~ 23.75 m

Wastage 15%.
Grand Total ≈ ~~25 m~~ 28 m.

Length of PVC conduit for sub-circuit-2.

from DB to L_7 = 2 + 1.5 = 3.5 m
(Vertical rise already considered).

from L_7 to L_9 = 1.5 + 2.25

from L_7 to L_8 = 1.5 + 2.25.

from L_8 to F_2 = 0.5 + 2.
from L_8 to SB_4 = 1.5.

LS
from ~~SB~~ to Bath = 2.25 + 0.75.

Total = 18 m
wastage 15 %
Grand Total ≈ 21 m.

Length of 1/1.12 mm, 250V grade Cu conductor is almost 3 times the Total length of PVC pipe can be considered for length of phase wire and length of neutral wire is equal to length of pipe.

∴ = 125.25 m.
15% wastage
∴ Grand total = 145 m.

6 Length and size of power circuit conductor.

F.L current = $\frac{1000}{230}$ = 4.34 A.

safety factor = 2.

size = 7/1.12 mm, 250V grade, Cu cond,

Length of PVC pipe = LS
from DB to power socket = 24 + 3.5 + 4 + 1.5 + 1.5 + 5
= 16 m
↓ ↓
Vu VD

wastage = 15%.
Grand total ≈ 18.5 m

Length of conductor = ~~18.5 x 3~~ 2x16
~~48m~~ 32.

wastage 10%.
Grand total ≈ ~~52 m~~. 35m.

14 SWG GI
Length of earth wire. = Length of PVC pipe. 41.75

10% wastage.
Grand tot ≈ 46m ≈ 4.6 kg.

Estimation of material:

1) 16A, 250V, DP IC main switch, MCB typ. 1 = 1.

2) 3way, 16A/way, 250V, ICDB = 1.

3) 1/1.12mm, A, 250V grade Cu conductor = 145m.

4) 7/1.63m Cu Conductor, 250V grade = 6.5m.

5) 7/1.12m Cu Conduct, 250V grade = 35m.

4) Flush type switch = 10 + 2 = 12.

5) Earth wire ≈ 4.6 Kg
14 SWG, GI.