MODULE – I

WIRING ACCESSORIES AND ILLUMINATION ENGINEERING

Estimate

An estimate shows the description and quantity of material required for an electrical wiring of house/motor/workshop…etc.

1.1.1 ESSENTIAL ELEMENTS OF WIRING

1. Screw Drivers

A screw driver is a hand tool that is designed to loosen or tighten or to keep the screws o=in position. Screw drivers are made in many sizes. Its size usually varies from 4mm to 600mm

2. Pliers

Pliers are used for holding or gripping small screws or bolts in position where it is inconvenient or unsafe to use hands. They are also used or bending and cutting the wires.

3. Nose Pliers

Nose pliers are made as the name implies, with a thin nose or jaws. they are used for bending and holding thin wires.

4. Diagonal Cutting Pliers

They are special type of pliers and are exclusively used for cutting and stripping of electrical wires, where the wires terminate into holders, switches, sockets…etc.

5. Hammers

It is a tool which is used for fastening something on the surface. The two types of hammers are

a) Ball pen hammer

b) Claw hammer

6. Hack Saw and Wooden Saw

Hack saw is especially designed for cutting metals like conduits, cables… etc. only two types of hack saws are used in ordinary practice. They are

1. Solid or common hack saw
2. The adjustable hack saw

7. Chisel

Chisel is a tool which is used for shaping a piece of wood, stone or metal by chipping away the unwanted parts. Two types of chisel are

1. Wooden chisel
2. Cold chisel

8. Hand Drill

Hand drill is used to make a hole in a piece of material.

9. Center Punch

It is used to mark the location of holes to be drilled.

10. Files

They are used to remove small amounts of material from the surface of a piece of metal or other hard substances. It has parallel rows of cutting edges or teeth on its surfaces

11. Pipe Vise

It is device to hold pipes and cylindrical bars firmly with 'V' shaped jaws.

12. Wrenches

It is device used for turning or twisting nuts or bolts. It consists of a slot, socket, pins or movable jaws for gripping nuts.

13. Voltage Tester

It is a device which is used to find whether a conductor is live or not.

15. Wire Stripper

It is used to remove the insulation of a cable without any scratches or cuttings on the conductor.

Wires and Cables

A conductor without insulation (bare conductor) is known as a wire. A wire or bare conductor covered with suitable layer or layers of insulation is known as a cable.

1.1.2 Types of Wires and Cables

The following are the various types of wires and cables used in wiring system and are classified as

1) According to insulation

a) Vulcanized Indian Rubber cables (VIR)

b) Cab type sheathed / tough rubber

c) Polyvinyl Chloride cables and wires

d) Lead sheath cables

e) Weather proof cables

f) Flexible cables

2) According to number of cores

a) Single core cable

b) Double core cable

c) Three core cable

d) Four core cable

3) According to conductor material used

a) Copper conductor cable

b) Aluminium conductor cable

4) According to the voltage gradient

a) Low tension/low voltage cables (below 1000V)

b) High tension/ High voltage cables (up to 11 kV)

c) Super tension cables (up to 33kV)

i) H – type cables

ii) SL – type cable

iii) HSL – type cables

d) Extra high tension cables (between 33kV & 133kV)

e) Extra super tension cables (between 220kV & 400kV)

i) Oil filled

ii) Gas filled

5) According to the insulation used for winding of machines

a) Single cotton covered

b) Double cotton covered

c) Enamel coated wires

Classification according to Core

a) Single Core Cable (SCC)

A single core cable consists of one copper or aluminium conductor insulated with VIR or PVC or TRS insulation. It may consist of one or two layers of insulation according to the place of application and current carrying capacity.

b) Double Core Cable (DCC)

A DCC consists of two insulated copper conductors covered with another insulation

c) Three Core Cable

a three core cable consists of three insulated copper conductor covered with another insulation as in figure.

d) Four Core Cable

A four core cable consists of four insulated conductor covered with another insulation layer.

Classification According to Conductor Material

a) Copper Conductor Cable

Copper conductor has extensively been used for cables, because it is comparatively high electrical conductivity. The resistivity of pure copper at 20^0 is $1.786x10^{-8}\Omega m$. it has very good mechanical properties (strong, hard, durable and ductile…etc.). It can be soldered and welded. The specific weight of copper at 20^0c is 8.9g/cc. the copper conductors may be annealed or hard-drawn. Annealed copper conductors are comparatively soft and are suitable

for cables. Hard drawn copper conductors have high tensile strength and are used as overhead conductors.

b) Aluminium Conductor Cable

The next best conductor material is aluminium, and is almost replacing copper in all fields. The electrical conductivity of aluminium is only about 2/3 of that of copper. It is lighter in weight (0.285 that of copper) for same resistance for a given length aluminium required will be 1.61 times that of copper in volume and 1.26 times that of copper in diameter. However aluminium is cheaper material and is available in abundance. Steel re-inforced aluminium conductors are used for overhead transmission.

Domestic Wiring

A network of cables connecting various electrical accessories for distribution of electrical energy from the supplier meter board to the various electrical energy consuming devices, such as lamps, fans, radio…etc and other domestic appliances through controlling and safety devices is known as wiring system.

The supplier (KSEB) service cable, feeding an installation terminates at service fuses. The energy meter remains the property of the supplier. The point at which the consumers' wiring is connected into the supplier is known as point of commencement of supply or consumers terminals. From consumers terminals onwards the supply cables are under the control of consumers and so lay as per his choice.

Systems of Wiring

The following are the different types of wiring systems

1. Cleat wiring

2. Wooden casing and caping

3. CTS or TRS wiring

4. Lead (metal) sheathed wiring

5. Conduit wiring

    a) Surface or open type

    b) Recessed or Concealed type

The following points to be considered before deciding any type of wiring

1. Durability

The wires selected must be durable and it must be able to withstand wear and tear due to weather.

2. Safety

It is one of the important points to be considered. The system selected should be such that poor workmanship may not produce dangerous results

3. Cost

The system adopted must be economical to suit the individual concerned.

4. Appearance

The appearance of wiring is an important point bearing on the architectural beauty and from the aesthetic point of view. Concealed conduit wiring is the proper choice.

5. Accessibility

The repair or extension of the wiring should be feasible.

General Rules for Wiring

The following rules should be kept in mind while executing the electrical wiring work:

1. The current rating of the cable or conductor should be slightly greater (at least 1.5 times) than the load current.
2. Every live wire line should be protected by a fuse of suitable rating as per load requirements.
3. Every sub-circuit should be connected with fuse on distribution board.
4. All metal coverings used for the protection of earth must be connected to earth.
5. No switch or fuse is used in earth or neutral conductor.
6. Every apparatus should be provided with a separate switch.
7. No additional load should be connected to the existing installation until it has been satisfied that the installation can safely carry the additional load.
8. All the switches and starters should be accessible to the operator.
9. A caution notice should be fixed on all equipment.
10. In any building light wiring and power wiring should be kept separately.

11. When the installation has been completed it should be tested before giving the supply and the leakage in the wiring should not exceed 1/5000 of the maximum current of the load.
12. In three phase 4 wire installation the load should be distributed almost equally on the all phases
13. In case of three phase 4 wire system, on the main board, indication of 3 phases should be done in **Red, Yellow and Blue**. **Neutral** should be indicated by **Black**.

DIFFERENT TYPES OF WIRING METHODS

Cleat Wiring

In this system of wiring cable are supported and gripped between porcelain cleats 6mm above the wall of roof. The porcelain cleats are made in halves. The pert is base which is grooved to accommodatethe cables; the other part is the cap which is put over the base. The lower cleat or base and upper cover, after placing cables between them are then screwed wooden gutties. The gutties are previously fixed into walls or roof at an interval of 30 – 60 cm.

Advantages

1. It is the cheapest system
2. Installation and dismantling is easy
3. Less skilled persons are required.
4. Inspections are easy
5. Alterations and additions can be easily done

Disadvantages

1. It is purely temporary wiring system
2. Appearance is not good
3. Cables are exposed to atmosphere and there is a possibility of mechanical injury
4. The system should not be used in damp places, otherwise installation get damaged

Wooden Casing and Capping Wiring

This is the one of the earliest systems of wiring. It consists of rectangular blocks made from seasoned and knots free wood. The casing has usually two or three U shaped grooves, into which the VIR or PVC cables are layed in such a way that the opposite polarity cables are layed in different grooves. The casing is covered by means of a rectangular strip of the same width as that of casing known as capping and is screwed to it. This system of wiring is suitable for low voltage installation. The casing must be kept at least 3.2 mm apart from the walls or ceiling by means of porcelain pieces.

Advantages

1. It provides good insulation as conductors are apart
2. It provides good mechanical strength.
3. Easy to inspect by opening the capping

Disadvantages

1. It is a costly system now a days because it needs seasoned knot free wood.
2. There is a risk of fire
3. The labour cost is more, because it requires skilled carpenters
4. This system can’t be used in damped places

CTS OR TRS Wiring

CTS cables are available in single core, twin core or three core with circular or oval in shape. CTS cables are sufficiently chemical proof. The cables are run or carried on well seasoned, perfectly straight and well varnished (on 4 sides). Teak wood batten of thickness at least 10mm. the width of the batten depends upon the number and size of cables to be carried by it. The batten is available in widths of 6,13,19,25,31,38,44,50,56,63,69 and 75mm. the wooden battens are fixed to the walls or ceilings by means of gutties, the wooden screws are fixed on the batten at an interval not exceeding 750mm.

Advantages

1. Its appearance is good if carried properly
2. Its life is sufficiently long
3. It can withstand the action of most chemicals such as acids and alkalies
4. Its installation is easy and quick compared to casing and capping
5. It is cheap compared to casing and capping, metal conduit and lead sheathed wiring.

Disadvantages

1. This system of wiring is not recommended in situations exposed to sun and rain, unless preventive steps are taken
2. It can't be used in damp places.
3. Good workmanship is required to make a sound job

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 as explained.

Advantage

1. It provides protection against mechanical injury
2. It can be used in damp situations

Disadvantages

1. It is costly system of wiring
2. It is not suitable where chemical corrosion may occur

Conduit Wiring System

It consists of VIR or PVC cables taken through rigid steel pipes known as conduits. Now-a-days PVC conduits are used which are cheaper than metal conduits. Conduit wiring may run over the surface of the walls and ceiling or may be concealed under the masonry work. Conduit wiring system can be classified into two: 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. Fixing of bends or elbows should be avoided as far as possible. All curves should be made bending the conduit by itself to permit easy drawing of cables.

Suitable inspection boxes should be provided to permit periodical inspection, drawing of cables and to facilitate removal of cables if necessary. The inspection boxes should be mounted flush with the wall. 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

Wiring Accessories

The wiring accessories includes different types of switches, sockets, lamp holders, ceiling roses, fuses, wooden batten, screws, link clips, round blocks, switch board, gutties, conduits, elbows, saddles, nails…etc.

1. Switches

A switch is an electrical device used to make or break an electric circuit. They are classified according to

i) Type of operation

a) 1- way switches

surface switches, flush switches, ceiling or pulling switches, grid switches, rotary switches, pushbutton switches

b) Two way switches

c) Two way center off switch

d) Double pole switch

ii) Type of base material used

a) Bakelite

b) porcelain

c. Iron clad switches

iii) Types of Shape used

a) Round

b) Square

c) Rectangular

iv Types of Colour

White, Black, Brown, Red, Green … etc

1. One -Way switches

It consist two terminal and is always connected in series with the load .ie, light, fan radio, tv..etc

a) Surface or Tumbler switches

They are projected from the wall. These are first fitted on the mounting block and then the block is fixed over the surface of the wall.

b) Flush switches

These switches do not project from the surface of the wall. These are used where high quality performance and appearance are desired. They are also known as piano type switches.

2. Two-way switches

They are consisting of four terminals, two of them being short circuited inside the switch permanently. These types are used where one point is to be controlled from two different places.

3. Two way center OFF switches

It is similar to two-way switches but having three operations. In the center it becomes off. These switches are used when two lamps are to be operated alternately.

4. Double Pole Main Switches

It is a combination of two one-way switches, which can be operated simultaneously because ON-OFF terminals of both switches are connected together by a handle. Such switches are used on distribution boards of every house wiring.

5. Bakelite or Porcelain Switches

The switches, so far discussed are usually made of Bakelite material. Some of the switch bases are manufactured with porcelain and the covers are of Bakelite or brass metal.

LAMP HOLDERS

A lamp holder is used to hold the lamp required for lighting purpose. Earlier brass holders were quite popular. But now-a-days these have been replaced by all insulated type. A lamp holder has either moulded or porcelain interior with a solid or spring plunger and easily wired terminals. The lamp holders may be classified as

1. Bayonet Cap
    - i. Batten holder
    - ii Bracket holder
    - iii Pendent holder
    - iv Water tight pattern
2. Switched bayonet cap lamp holders
3. Small bayonet cap holders
4. Goliath Edison screw lamp holders
5. Medium Edison screw lamp holders
6. Swivel lamp holders
7. Fluorescent lamp holders
8. Starter lamp holders

Batten Holders

They are employed where the lamp is to be fitted to the wall or roof. These are directly fitted with either on batten or on wooden board. Such lamp holders are bayonet type, ie, in such lamps holders the bulb is forced in and turned slightly and then lifts in that position. Now-a-days Bakelite batten holders are popular and safer.

Bracket holders

Such holders are used to give direct light on working area or in a room. This can't be fixed on the roof or made to hang. Usually these are fixed on walls and may be used in table lamps. The brackets used with such holders are usually made of brass.

Pendent holders

They are used when the lamp is to be suspended from the roof. Such a lamp holder is hanged vertically down ward from the ceiling with flexible cord. One end of which makes electrical connection with the ceiling rose, and other with the lamp holder and thus with lamp. These holders are also known as cored grip holders and are available in brass as well as Bakelite type.

Fluorescent tube light holders

They may be either bi-pin or bayonet cap type. But in bi-pin type, holders are generally used.

Lamp holder adapter. They are used to tap the power temporally from a lamp holder.

FUSES

Fuse is a wire of short length or thin strip of material having low melting point and is inserted in an electric circuit as protective device to the flow of an excessive current through the circuit. Under normal working condition the current flowing through the circuit is within safe limit but, when some faults , such as short as short circuit occurs or when load more than the circuit capacity , current exceeds the limiting value, the fuse wire gets heated, melts and beaks the circuit. It thus protects a machine or apparatus from being damaged due to excessive current.

Advantages

1. It is cheapest type of protection

2. It requires no maintenance

3. It interrupts enormous short circuit current without noise, flame, gas or smoking effect

4. The minimum time of operation can be made much smaller than that with CBs

5. It has current limit

Disadvantages

1. Time is lost in wiring or replacing fuses after operation

2. Discrimination between fuse in series can be obtained unless there is considerable difference in the relative sizes of the fuses concerned.

TYPES OF FUSES

1. Supply main fuse

This fuse is provided by the supplier and is fixed just after the service meter. The rating of supply main fuse will be as per lad current of the Consumer.

2. Consumer main fuse

This is another fuse of rating slightly less than that of supply main fuse provided by the consumer and placed after the consumer's main switch.

3. Sub circuit fuses

The total wiring system is divided into a no of sub- circuits or branch circuits. A separate fuse is provided for each branch circuit or branch circuit fuse

4. Point fuse

In good quality indoor wiring of buildings, every light and plug point is provided with its individual fuse, known as point fuse.

IMPORTANT DEFINITIONS

1. Minimum fusing Current

It is the minimum value of current at which the fuse element or fuse wire melts.

2. Current rating of the fuse

It is the current, which the fuse wire can normally carry without over heating or melting. Its value is always less than the value of minimum fusing current.

3. Fusing factor

The ratio of minimum fusing current to the current rating of fuse element is known as fusing factor and it is always greater than unity.

Fusing factor = $\frac{Minimum\ fusing\ current}{Current\ rating\ of\ fusing\ current}$

Earthing Conductor

It is of high conductivity copper and is of either stranded, flat strips or circular or rectangular bar. It is protected against mechanical injury. Bare conductor is against corrosion. Galvanized solid iron or steel wire or rod or any other suitable approved material can be used provided the conductivity is not less than the copper earthing conductor.

Energy Meter

The electric energy meter is essentially a small electric motor. It is connected into the circuit so that the no of revolution of the disc is in direct proportion to the amount of electricity flowing through the circuit. The number of revolutions of the motor are counted and recorded on the dial through a system of gears. This system of gears and the dial is known as the register.

Energy meter are mainly of two types

1. DC energy meter
2. AC energy meter

DETERMINATION OF TOTAL LOAD

For determination of load of an installation the following ratings may be assumed, unless the values are known or specified.

1. Fluorescent lamps – 40W
2. Incandescent lamps, fans, socket outlets – 60W
3. Power socket outlets – 1000W

Determination of Number of Sub-circuits

The number of sub circuits are decided as per number of points to be wired and total load to be connected to the supply systems.

In one light and fan sub circuit the maximum load that can be connected is 800W

The Max number of points which can be wired is 10

In one power sub circuits the maximum load that can be connected is 3000W

The no of socket outlets which can be provided is 2

Determination of rating of main switch and distribution Board

The current rating of the main switch is decided as per total current of the circuit to be controlled by it. The no of ways and current rating of the distribution board is decided as per no of sub circuits to be connected to tit and current of the sub circuit having highest current rating.

Determination of size of conductor

There are three points which must be taken into account while determining the size of conductor for internal wiring for a given circuit.

1. Minimum size mainly for mechanical reasons
2. Current carrying capacity
3. Voltage drops

1. Minimum size of the cable

The conductor used in domestic wiring (except flexible and fitting wires), according to the regulation in our country, it must not be of size less than 1/1.12 mm in copper or 1/1.4 mm in aluminium. For flexible cords and fitting wires, a smaller lowest size is permissible, ie, 14/0.193 mm may be used.

2. Current carrying capacity

The wire or cable should be or size sufficient to carry the maximum circuit current continuously without heating

3. Voltage drop

Maximum voltage drop from supply terminal to any point on the installation is not to exceed the prescribed limit, ie, 2% of the supply voltage +1v for light load wiring, and 5% of declared supply voltage for power load wiring.

LAY OUT

1. Position of Main Switch Board

The supplier meter boards consist of energy meter and main fuse is placed as near the point of entry of the service cable as practical. The consumer's main board consisting of main switch and fuse is placed as near the supplier boards as possible. Meter board, meter and fuse is supplied, fixed and sealed by the supplier and two leads (1 phase and 1 neutral) are taken out from the meter to be connected to the consumer's main board. Supplier main board and consumer main board are fixed at the height of 1.5 m from the ground level.

Position of switches and Socket outlets

The most usual heights are 1.25m, 1.35 m, and 1.5 m above the floor. In nursery and children's hospital a much higher standard height is desired say, 1.6m to 1.8 m. in school 1.8m is good standard height. Switches and switch boards should be fitted by the side of usual place of entry.

3. Height and size of Lamp

The correct height, at which the lamps must be hung depends upon the size and shape of room and the class of shades used, and in large rooms and spaces 2.25 m or 2.5m is a good average height for ordinary pendent or brackets to give a general illumination in room. In a medium sized dwelling house 10W/m2 of floor area gives enough guide for the size of filament lamps, if the decoration of rooms are light and the lamps are only obscured by shades with a light finish. In bed rooms a lower average wattage per square meter is required. In case, use of fluorescent tubes is made, a considerably lower aggregate wattage will be sufficient.

Dining room

In a small and average sized dining room the right place for the light source is over the centre of the dining table. In large dining rooms an additional point is required for the service table in the form of either a pendent or bracket. One or two 5 A socket outlets and one 15A socket outlet point should be provided for portable lamps and other appliances.

Drawing rooms

For a drawing room no hard and fast rule can be mentioned, it depends on the disposition and style of the furniture and decoration. In a small or medium sized drawing room sufficient illumination will be obtained from a centre light, but in large rooms brackets are required and also socket outlet point for portable floor or table standards.

Bed room lights

In bed room one light is necessary a few cm in front of the dressing table, hanging at a height of about 2m from the floor between the dressing table and he person using it. If only one light is to be provided in bed room, then two-way switching is essential, one near the door and the other by the bedside. A second light is usually required over the bed for reading, which should be fairly close to the wall. In the bed rooms which are fitted with basins, a third light is required over the basin. In bed rooms two 3.5A socket outlets and one 15A socket outlet should be provided.

Kitchen and Scullery Light

In kitchen light should be provided as hanging down close in front of the cooking burner. A second light, however may be provided where light is required and not necessarily in center of the room. In sculleries the light should be provided over the sink. In kitchen two 15 A sockets out lets and one 5A socket outlet should be provided.

Bath room lights

Special precautions should be taken selecting position and character of point and switches to avoid danger. The light should be a well glass fitting or an equivalent totally enclosed fitting fixed directly on the ceiling and out of reach of a person standing on the edge of the bath. The switch should be either outside the door or incase it is to be provided inside. Flesh type, preferably, switch should be used in bathrooms.

Stair Case lights

In lighting the stair case it should be remembered that some light at any rate should always fall directly on the bottom of each flight of stairs so that the rises are not in shadows. The stair case light point is controlled from two points, one near the bottom and other near the top of the stair case.

Estimate the quantity of material and its cost for surface conduit system of wiring of S4 Electrical class room. Provide **one power socket** as per the given plan. Length is 16 m and Width is 8m and Ceiling height is 3.5m.

Solution;

The number of sub-circuits, size of cable, length of conduit and cable can be calculated as follows.

a) No of sub-circuits

Total wattage of tube lights 3X40 =
Total wattage of fans 3X60 =
Total wattage of socket points 4X60 =
10 nos …… watts

The total number of outlets are 10 and total load is ……. watts (less than 800watts), therefore one sub-circuit is required. **An additional sub-circuit should be provided for the power socket**. Therefore, total number of sub circuits are two.

b) Size of cable

Current through sub-circuit = $\frac{Total\ power}{voltage} = \frac{.....}{230} = ...A$. The minimum size of the cable required in sub circuit is $1mm^2$ copper cable. A 15 A, 250 V flush type DP main switch is sufficient.

c) Length of the conduit

Length from roof to Main switch board = …..
Main switch board to Distribution board= …..
Distribution board to Switch board 1 = …..+…..+…..= …..
Switch board 1 to switch board 2 = …..+…..+….. = …..
From top of the switch board 1 to Tube 1 = …..
From Tube 1 to Tube 2 = …..
From Tube 1 to Switch board 3 = …..+….. =
From top of the switch board 3 to Fan 3 = …..+…..=
Conduit requires to Power socket = …..+…..+…..+…..+…..=

Total length of the conduit = …..m
10% for wastage and connection = …..m
Therefore, required length of conduit = …..+…..=

d) Cable length

According to approximate method, the cable required is about three times of the length of the conduit.
∴ Total length of the cable = 3 × ….= ….m

e) Length of the earth wire

Normally length will be equal to the total length of the conduit. But here we have to calculate the length
From main switch board to SB1 = …..+…..+…..=
From SB1 to SB2 = …..+…..+…..=
From SB1 to SB3 = …..+…..+…..=
Total length = …..+…..+…..= m
10% for wastage and connection = m
∴ Total length of the earth wire = …..+…..=

f) Labour cost

Meter board is equal to 2 points
Distribution board is equal to 2 points
Light and fan …. points
Socket …. points
Total ….points

Labour cost @Rs 300 per point = 300 × …. = ……..

No	Material Specification	Qty	Rate		Cost
			Rs	Per	
1	DP Main Switch 15A, 250 V flush type			Each	
2	Flush type fuse unit			Each	
3	PVC conduit 18mm			M	
4	1 mm^2 copper cable			M	
5	Switches 5A, 250V, one-way flush type			Each	
6	Switch 15A, 250 V, one-way flush type			Each	
7	3-pin sockets 5A, 250V			Each	
8	3-pin sockets 15A, 250V			Each	
9	Ceiling rose			Each	
10	Switch board			Each	
11	Junction box			Each	
12	Round box			Each	
13	Saddles			Box	
14	Nails			Box	
	Total				
	Labour cost				
	Grand Total				

The total cost required for wiring S4 electrical class room is ……..rupees.