

August 2021

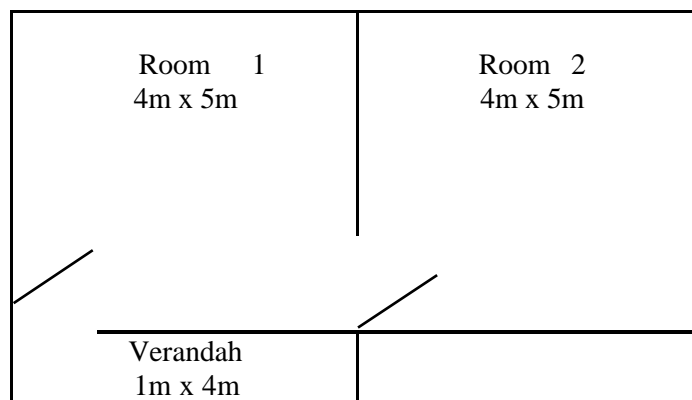
ELECTRICAL DESIGN, ESTIMATION & COSTING*Time Allowed: 1.5 Hours**Full Marks: 70***Answer to Question No. 1 is compulsory and Answer any two questions from the rest.**

1. A. Choose the correct answer from the given alternatives (any twenty): 2x20
- i. For what range is the underground service lines used?
 - A. Distance more than 25 m
 - B. Distance more than 100 m
 - C. Distance less than 1 km
 - D. Distance more than 1 km
 - ii. Which among these is a demerit of underground service mains?
 - A. Ugly appearance
 - B. Frequent fault occurrence
 - C. Costly
 - D. All of these
 - E. None of these
 - iii. Which IE rule is applicable to service mains?
 - A. Rule 30
 - B. Rule 33
 - C. Rule 77
 - D. Both (a) & (b)
 - E. All of these
 - iv. What is the specification of GI earth plate?
 - A. 60 cm * 60 cm * 3 mm
 - B. 60 cm * 60 cm * 6 mm
 - C. 60 cm * 60 cm * 4 mm
 - D. 60 cm * 60 cm * 5 mm
 - v. What is the reason for excess reading of the energy meter?
 - A. Defective wiring
 - B. Meter defects
 - C. Over voltage
 - D. Both (A) & (B)
 - E. All of these
 - vi. Which type of cable is used for underground service connections?
 - a. Low tension 3 ¼ core cable
 - b. Low tension 3 ½ core cable
 - c. Low tension 2 ¼ core cable
 - vii. What should be the height of the 'Roof Pole'?
 - a. Less than 5m
 - b. Less than 3m
 - c. More than 3m
 - d. More than 10m

- viii. What should be the spacing between the two conductors if the working voltage is 11 kV?
- 76 mm
 - 101 mm
 - 190 mm
 - 250 mm
- ix. What is an electrical schedule?
- A list or a plan of a building providing information of number of points in each room.
 - The list of all the electrical components required for a particular room
 - The list of electrical components along with their prices
 - Both (B) and (C)
- x. What is the maximum number of lighting points that can be connected in a circuit?
- 5
 - 10
 - 8
 - 12
- xi. What is the maximum load that can be connected in a circuit connecting only lighting points?
- 500 watts
 - 750 watts
 - 800 watts
 - 1000 watts
- xii. Which among these is a method of wiring?
- Joint box
 - Tee system
 - Loop in system
 - Only a and c
 - All of these
- xiii. For what voltage levels are the screwed conduit circuits used?
- Less than 250 V
 - For voltages between 250 V – 600 V
 - For voltages above 600 V
 - None of these
- xiv. Which material is used for wiring continuous bus bar?
- Aluminium
 - Copper
 - Both (A) and (B)
 - None of these
- xv. How many earth connections are required for the motor frame as per the IE rule 61?
- One
 - Two separate and distinct
 - Three separate and distinct
 - All of these
 - None of these
- xvi. What is the input current of a 2 hp single phase motor, 240 V at 70 % efficiency and 0.8 power factor?
- 6.95 A
 - 10.95 A
 - 13.52 A
 - 17.68 A

- xvii. Which starter is used for slip ring induction motors of high ratings?
A. DOL starter
B. Rotor resistance starter
C. Autotransformer starter
D. All of these
E. None of these
- xviii. What is the size of the cable made up of copper conductors used for a 10 hp 500 V DC motor?
A. 7 / 0.915 mm
B. 1 / 2.8 mm
C. 3 / 0.915 mm
D. Both (b) & (c)
E. All of these
- xix. Which method is used for the lighting calculations?
A. Watts per square meter method
B. Lumen or light flux method
C. Point to point method
D. All of these
E. None of these
- xx. What will be the utilisation factor for an indirect lighting scheme?
A. 0.25 – 0.5
B. 0.5 – 0.75
C. 0.1 – 0.25
D. 0.75 – 0.99
- xxi. How is the ballast resistance connected with the choke?
A. Parallel
B. Series
C. Can be connected in either way
D. Both (a) & (b)
E. None of these
- xxii. Which lamp is used in the outdoor illumination of buildings and airport runway?
A. Halogen lamp
B. Gaseous discharge lamp
C. Sodium vapour lamp
D. All of these
- xxiii. What will be the maximum leakage current, if a domestic installation uses 20 points of 40 watt lamps and 5 fans of 100 watts each? Use voltage = 240 V
A. 0.002 A
B. 0.0011 A
C. 0.003 A
D. 0.005 A
- xxiv. What are the types of conduits available?
A. PVC conduit
B. Flexible conduit
C. Heavy gauge steel screwed conduit
D. All of these
E. None of these
- xxv. Which insulating material is used for low voltage cables?
A. Impregnated paper
B. Rubber
C. Silk and cotton
D. Vulcanised Indian rubber

2. a) State some of the rules for general wiring.
 b) Determine the size of conductor for a two-core cable required to carry the maximum current of 60 Amps: Given: length of cable is 60m, declared supply voltage 240 volts. (7+8)
3. A hall having dimension 15m x 6m x 4.5 m height, is to be fitted with fan points & light points.
 - a) Draw the electrical circuit diagram showing position of switch boards, distribution board and accessories with necessary connections in looping-in system.
 - b) Estimate the quantity of material for PVC wiring system for the above installation. Make your own assumptions for the light & fan points and other missing data. (7+8)
4. a) Define Utilisation factor, Space/Height ratio & Maintenance factor in relation to designing general lighting.
 b) An illumination of 75 Lux is required in a room 12 m x 8 m in size. The lamps may be hung 4 m from floor level. Taking an Utilisation factor of 0.5, lamp efficiency 15 lumens/watt and a candle power depreciation of 20%, estimate the nos., rating & disposition of lamps. (7+8)
5. a) State some important considerations regarding Motor Installation Wiring.
 b) A 10HP, 415 volts, 3 ph, 50 Hz Induction Motor is to be installed in a workshop having floor area 25 m x 10 m. Show the layout of wiring and estimate the quantity required. The wiring is to be surface-conduit. (7+8)
6. One 3 HP & one 7.5 HP, 400 v, 3 ph motors are to be installed in a small workshop. The workshop has 3ph., 4wire supply. The supply is taken to motors from a power distribution fuse board. Draw the schematic wiring diagram of the motors starting from the incoming main switch, showing all equipment and their ratings. Make a complete list of wiring materials required for the installation. Assume the motors are located at 2m & 4m away from the main switch board. (7+8)
7. Electrical wiring is to be done to a small house as shown in the following figure with lights, fans and sockets. Each room is to have three lights, one fan and one 5A Socket. The verandah has one light point.
 - (a) Draw the wiring plan of the house showing the positions of amps, fans, sockets, Switch Boards, DB and Main Switch.
 - (b) The wiring is to be carried out with single core, PVC insulated, stranded copper wire in PVC Casing Capping. Make a complete list of materials required for the wiring of the house assuming the height of the building is 3m. 7+8



8. Estimate the materials required for providing 240 volt, 1 ph connection to a single storied building (load 1 kw) from a 415 v 3 phase, 4wire overhead line. The nearest pole is 6m away from the building. Make your own assumptions for missing data. (15)
9. a) Derive the output equation of a single phase transformer.
 b) Why core stepping is done in a transformer?
 c) Calculate the gross core area required for a 1ph, 2winding, 230v, 50hz, 100VA transformer, given that maximum flux density in the core $B=1 \text{ wb/m}^2$, stacking factor for core lamination=0.9, number of turns /volt=4.6. (6+3+6)

10. Calculate the overall dimensions of core & yoke of a 100kva, 50Hz, 1ph core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6times the width of largest stampings. Assume: emf/turn=10v, max flux density=1.1 wb/m²,window space factor=0.27, current density 3A/mm²,stacking factor=0.9.The net iron area is 0.56d²,width of largest stamping=0.85d. (15)
11. Determine the gross area of core & yoke & number of turns of HV & LV windings per phase & cross sectional area of conductors of a 160kva,11000/433 volt, 50Hz, 3phase, delta-star core type transformer. Assume: Emf/turn 5.7v, Bm 1.35wb/m², current density 2.5A/mm², stacking factor 0.9. (15)
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