VOLTBOOK / GTU DIPLOMA ELECTRICAL

Electrical Wiring Estimating and Contracting

DETAILED OUTCOME-BASED PRACTICAL MANUAL

COURSE CODE	SEMESTER	PRACTICALS	EFFECTIVE FROM
DI03009011	3	26	2024-25

Prepared from the Suggested Course Practical List in the current GTU DI-series syllabus, effective 2024-25.

The organization follows the familiar outcome-based pattern used in legacy DTE laboratory manuals. All instructional text is independently written for this edition. This is not an official GTU, DTE or CTE publication.

Student name: _____

Enrollment no.: _____ Batch: _____

Institute: _____

UNIVERSITY-DRAFTED FIGURE EDITION 6.0 / 20 JULY 2026

Certificate

This is to certify that _____, enrollment number _____, has satisfactorily completed the prescribed practical work for Electrical Wiring Estimating and Contracting (DI03009011) during the academic term _____ under the supervision of the department.

Laboratory faculty	Head of department	Principal
Signature and date	Signature and date	Signature and date

Preface

This manual turns the current syllabus practical list into a usable student record. Each practical includes an original experiment-specific vector diagram and is arranged from objective and outcomes through prerequisite theory, setup, resources, safety, procedure, observations, interpretation, questions, references and a 25-mark assessment rubric.

Students should complete pre-lab preparation before the session and record actual readings during the session. Faculty may adapt component values, instrument ranges, software versions and local assessment requirements without changing the intended practical outcome.

Diagram drafting benchmarks were reviewed from Aurora's Electrical Circuits and Simulation manual, MITS Electronic Devices and Circuits manual, Sree Vahini's Electrical Measurements manual, and MSBTE Electrical Estimating and Contracting practice. Edition 6.0 applies stricter university drafting: complete current paths, IEC-style junctions and terminals, protection, instrument coils, test points, load terminals and measurement notes. Every figure is newly drawn and aligned to the current GTU practical title.

Official syllabus reference

Open the referenced GTU syllabus PDF

Programme outcomes and course outcomes

Programme outcomes

Code	Outcome
PO1	Basic and discipline-specific knowledge: apply mathematics, science and engineering fundamentals.
PO2	Problem analysis: identify and analyze well-defined engineering problems using standard methods.
PO3	Design/development of solutions: develop solutions for well-defined technical problems.
PO4	Engineering tools, experimentation and testing: use modern tools and interpret test results.
PO5	Engineering practices for society, sustainability and environment: apply safe and responsible practice.
PO6	Project management: apply engineering management principles individually and in teams.
PO7	Lifelong learning: recognize the need for independent learning in changing technology.

Course competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

Course outcomes

CO	Course outcome
CO1	Identify wiring systems and apply relevant wiring rules and safety requirements.
CO2	Prepare domestic wiring layouts and estimates.
CO3	Interpret industrial wiring and prepare estimates.
CO4	Prepare estimates for overhead and underground distribution work.
CO5	Prepare estimates for electrical service connections.

Practical outcome to course outcome matrix

The mapping below is for learning guidance. Faculty should use the assessment scheme prescribed by the institute.

No.	Suggested practical	Mapped CO
1	Demonstrate different types of electrical wires and cables	CO1
2	Identify and use different wiring tools	CO1
3	Estimate wiring requirements for a simple domestic installation	CO2
4	Plan and lay out domestic wiring as per standards	CO2
5	Estimate and cost industrial electrical wiring requirements	CO3
6	Prepare an estimation report for an overhead distribution system	CO4
7	Compare service connection methods and estimate cost	CO5
8	Determine conductor size based on load requirements	CO2
9	Select and rate a main switch and distribution board	CO2
10	Test wiring accessories and explain their applications	CO1
11	Analyze wiring faults and suggest rectification	CO1
12	Prepare an estimate for a small commercial building	CO2
13	Design and estimate an office lighting layout	CO2
14	Conduct earthing and grounding measurements	CO1
15	Prepare a cost estimation report for an industrial project	CO3
16	Analyze and compare different wiring systems	CO1
17	Analyze a simple industrial control-panel wiring setup	CO3
18	Prepare a cost estimate for underground cable laying	CO4
19	Calculate load distribution and sub-circuit planning for a small building	CO2
20	Prepare a domestic installation cost-estimation case study	CO2
21	Prepare an electrical test report for a domestic installation	CO2
22	Prepare an electrical test report for an industrial installation	CO3
23	Prepare a basic cost estimate for an overhead distribution line	CO4
24	Calculate the cost of an underground distribution system for given data	CO4
25	Prepare a cost estimate for an overhead service connection	CO5
26	Compute the cost of an underground service connection for a small commercial setup	CO5

Industry skills and laboratory guidance

Industry-relevant skills

- Reading plans and preparing load schedules
- Cable and protective-device selection
- Quantity take-off and rate analysis
- Inspection, testing and documentation of installations

Guidelines for instructors

1. Confirm the practical outcome, risk controls, apparatus readiness and emergency arrangements before the session.
2. Demonstrate only the critical connection, software or measurement steps; require students to reason through the remaining work.
3. Check circuit polarity, earthing, isolation, ranges and ratings before energization.
4. Assess both process and result. Give credit for safe practice, honest data, teamwork and technically sound interpretation.
5. Adapt values and equipment to local facilities while preserving the mapped course outcome.

Instructions for students

1. Read the practical, write the prediction and prepare the setup before entering the laboratory.
2. Record instrument identification, range, least count and component ratings before use.
3. Enter raw readings directly with units. Strike through errors once; do not erase or fabricate data.
4. Switch OFF and verify isolation before changing a connection. Report damage, heating, smell or unstable readings immediately.
5. Attach graphs, code listings, drawings, estimates and technical evidence behind the relevant practical.

Progressive assessment rubric

Each practical is assessed out of 25 marks. The practical-specific rubric repeats at the end of every experiment.

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Suggested interpretation

Total	Level	Interpretation
21-25	Excellent	Independent, accurate, safe and well interpreted
16-20	Good	Sound performance with minor correction
11-15	Satisfactory	Outcome achieved with guidance
0-10	Needs improvement	Repeat preparation or practical work as directed

Safety acknowledgement

I understand that institute rules and faculty instructions take priority over this manual. I will not energize, modify or touch a circuit without authorization.

Student signature and date	Faculty signature and date

Continuous assessment record

Practical	Date	Marks /25	Faculty initials
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
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14			
15			
16			
17			
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19			
20			
21			
22			
23			
24			
25			
26			
TOTAL		/650	

Experiment index

PRACTICAL 01

Demonstrate different types of electrical wires and cables

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate different types of electrical wires and cables.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

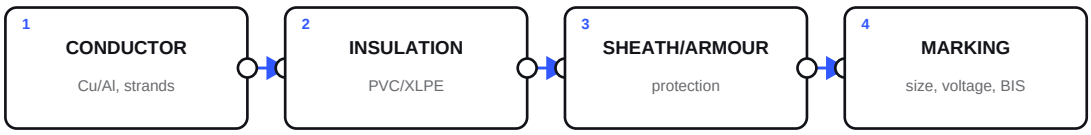
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the labelled constructional, single-line or system diagram below and add the verified ratings, terminal designations and functional details for the item observed.

FIG. H.1 - WIRE AND CABLE IDENTIFICATION VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Collect only instructor-approved de-energized samples, models, data sheets or trainer modules.
2. Read markings and nameplate information; record type, material, rating, construction and relevant standard symbol.
3. Inspect each item and identify terminals or functional parts without dismantling sealed or energized equipment.
4. Explain the operating principle and match each type to a suitable application.
5. Compare advantages, limitations, failure modes and safe handling requirements in the observation table.
6. Have the instructor verify the identification and record the final conclusion.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate different types of electrical wires and cables'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 02

Identify and use different wiring tools

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Identify and use different wiring tools.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the labelled constructional, single-line or system diagram below and add the verified ratings, terminal designations and functional details for the item observed.

FIG. H.2 - WIRING-TOOL SELECTION VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Collect only instructor-approved de-energized samples, models, data sheets or trainer modules.
2. Read markings and nameplate information; record type, material, rating, construction and relevant standard symbol.
3. Inspect each item and identify terminals or functional parts without dismantling sealed or energized equipment.
4. Explain the operating principle and match each type to a suitable application.
5. Compare advantages, limitations, failure modes and safe handling requirements in the observation table.
6. Have the instructor verify the identification and record the final conclusion.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Identify and use different wiring tools'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 03

Estimate wiring requirements for a simple domestic installation

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Estimate wiring requirements for a simple domestic installation.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.3 - TYPICAL BUILDING WIRING LAYOUT FOR ESTIMATION

VERIFY VALUES BEFORE USE

Mark dimensions, routes, circuit numbers and mounting heights

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Estimate wiring requirements for a simple domestic installation'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 04

Plan and lay out domestic wiring as per standards

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Plan and lay out domestic wiring as per standards.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.4 - TYPICAL BUILDING WIRING LAYOUT FOR ESTIMATION

VERIFY VALUES BEFORE USE

Mark dimensions, routes, circuit numbers and mounting heights

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Plan and lay out domestic wiring as per standards'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 05

Estimate and cost industrial electrical wiring requirements

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Estimate and cost industrial electrical wiring requirements.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO3: Interpret industrial wiring and prepare estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

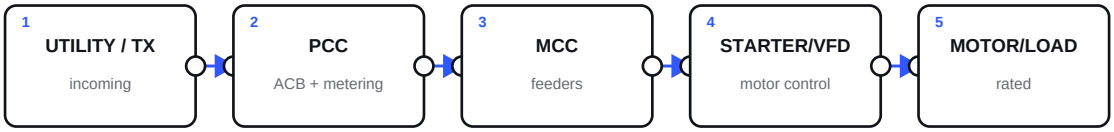
Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.5 - INDUSTRIAL INSTALLATION SINGLE-LINE VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Estimate and cost industrial electrical wiring requirements'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 06

Prepare an estimation report for an overhead distribution system

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare an estimation report for an overhead distribution system.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO4: Prepare estimates for overhead and underground distribution work.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

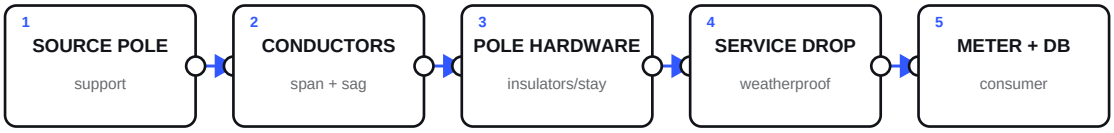
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the labelled constructional, single-line or system diagram below and add the verified ratings, terminal designations and functional details for the item observed.

FIG. H.6 - OVERHEAD DISTRIBUTION / SERVICE ESTIMATE

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Define the study boundary, required evidence and the current technical sources or approved site to be used.
2. Prepare a checklist covering configuration, ratings, equipment, protection, control, safety and environmental aspects.
3. Collect observations without touching live equipment; photographs require site and instructor permission.
4. Verify key facts against a utility, manufacturer, standard or other authoritative technical source.
5. Prepare a labelled diagram and a concise comparison table; include calculations where the syllabus outcome requires them.
6. Write findings, limitations and recommendations, then list the sources and date accessed.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare an estimation report for an overhead distribution system'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 07

Compare service connection methods and estimate cost

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Compare service connection methods and estimate cost.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO5: Prepare estimates for electrical service connections.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

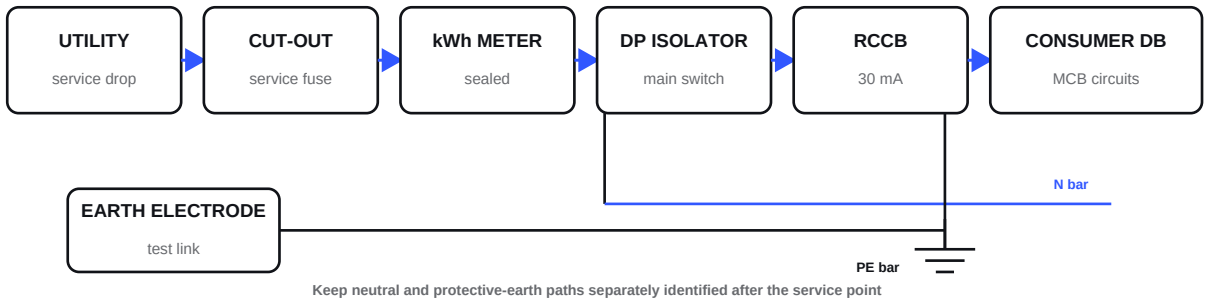
- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.7 - OVERHEAD SERVICE CONNECTION SINGLE-LINE DIAGRAM

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Compare service connection methods and estimate cost'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 08

Determine conductor size based on load requirements

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Determine conductor size based on load requirements.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

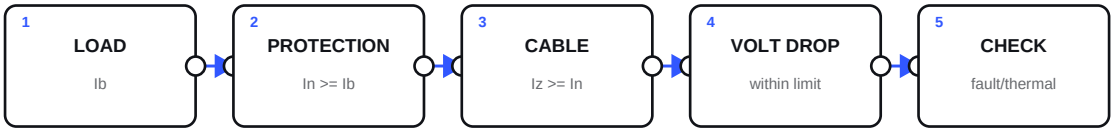
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.8 - CONDUCTOR-SIZE SELECTION WORKFLOW VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Determine conductor size based on load requirements'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 09

Select and rate a main switch and distribution board

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Select and rate a main switch and distribution board.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.9 - MAIN DISTRIBUTION SINGLE-LINE DIAGRAM VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Select and rate a main switch and distribution board'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 10

Test wiring accessories and explain their applications

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test wiring accessories and explain their applications.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

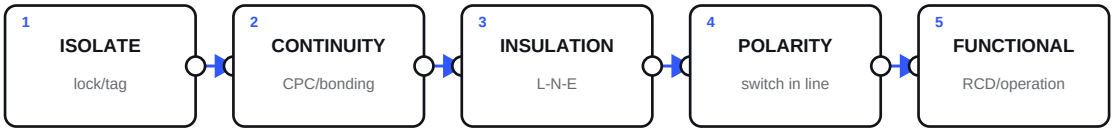
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.10 - INSTALLATION INSPECTION AND TEST SEQUENCE VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test wiring accessories and explain their applications'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 11

Analyze wiring faults and suggest rectification

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Analyze wiring faults and suggest rectification.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

Key relations / checks

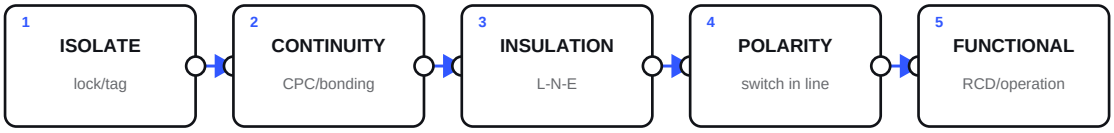
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.11 - INSTALLATION INSPECTION AND TEST SEQUENCE

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Analyze wiring faults and suggest rectification'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 12

Prepare an estimate for a small commercial building

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare an estimate for a small commercial building.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.12 - TYPICAL BUILDING WIRING LAYOUT FOR ESTIMATION

VERIFY VALUES BEFORE USE

Mark dimensions, routes, circuit numbers and mounting heights

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare an estimate for a small commercial building'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 13

Design and estimate an office lighting layout

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Design and estimate an office lighting layout.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.13 - TYPICAL BUILDING WIRING LAYOUT FOR ESTIMATION

VERIFY VALUES BEFORE USE

Mark dimensions, routes, circuit numbers and mounting heights

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Design and estimate an office lighting layout'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 14

Conduct earthing and grounding measurements

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Conduct earthing and grounding measurements.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

Key relations / checks

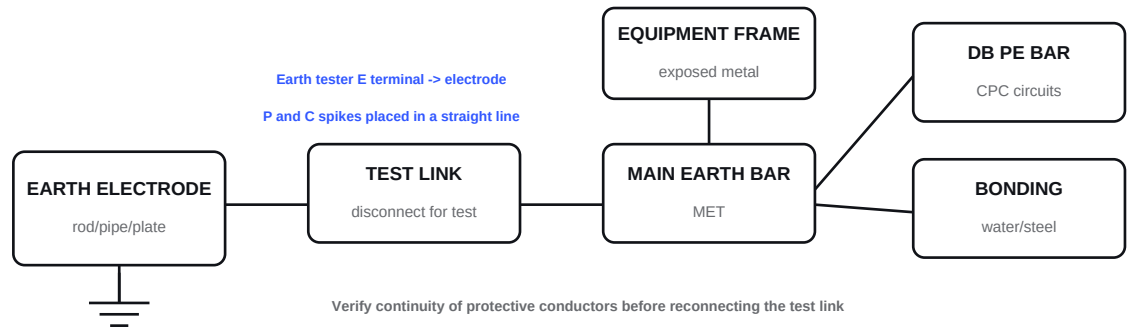
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.14 - INSTALLATION EARTHING, BONDING AND EARTH-RESISTANCE TEST POINTS

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Conduct earthing and grounding measurements'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 15

Prepare a cost estimation report for an industrial project

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare a cost estimation report for an industrial project.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO3: Interpret industrial wiring and prepare estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

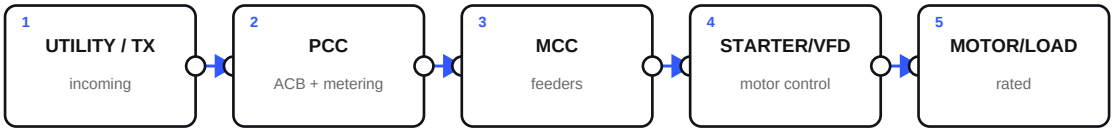
Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.15 - INDUSTRIAL INSTALLATION SINGLE-LINE VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare a cost estimation report for an industrial project'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 16

Analyze and compare different wiring systems

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Analyze and compare different wiring systems.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO1: Identify wiring systems and apply relevant wiring rules and safety requirements.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

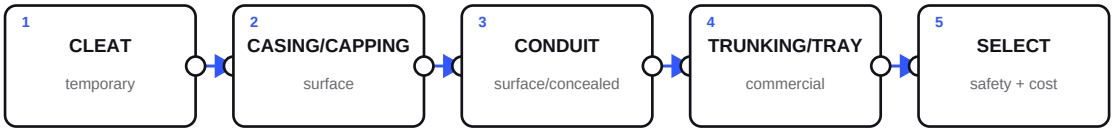
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.16 - WIRING-SYSTEM COMPARISON VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Collect only instructor-approved de-energized samples, models, data sheets or trainer modules.
2. Read markings and nameplate information; record type, material, rating, construction and relevant standard symbol.
3. Inspect each item and identify terminals or functional parts without dismantling sealed or energized equipment.
4. Explain the operating principle and match each type to a suitable application.
5. Compare advantages, limitations, failure modes and safe handling requirements in the observation table.
6. Have the instructor verify the identification and record the final conclusion.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Analyze and compare different wiring systems'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 17

Analyze a simple industrial control-panel wiring setup

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Analyze a simple industrial control-panel wiring setup.

B. Expected programme outcomes

PO1, PO2, PO4, PO5, PO6.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO3: Interpret industrial wiring and prepare estimates.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

The experiment verifies the stated circuit relationship by controlled measurement. Define reference polarities and current directions, use rated components, predict the result before energizing, and compare measured and calculated values using percentage error.

Key relations / checks

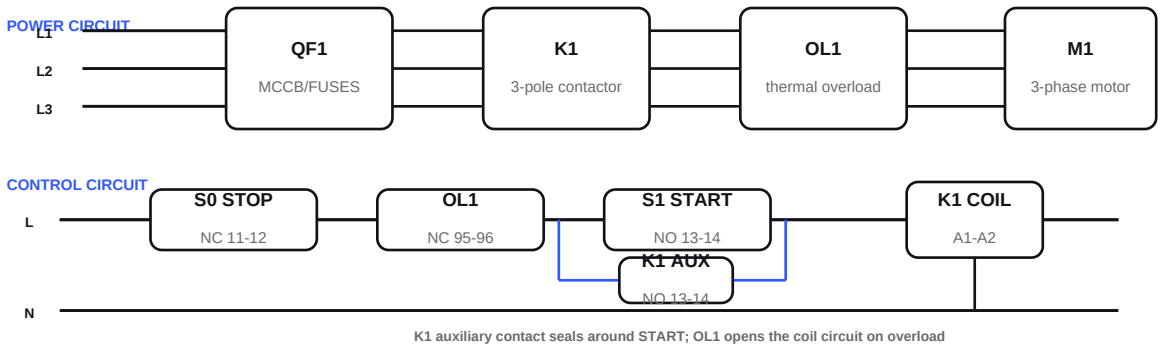
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.17 - DOL STARTER POWER AND THREE-WIRE CONTROL CIRCUITS

VERIFY VALUES BEFORE USE



K1 auxiliary contact seals around START; OL1 opens the coil circuit on overload

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Wiring sample / board	De-energized and instructor approved	1
Insulated hand tools	Sound condition	1 set
Continuity tester / DMM	Suitable CAT and range	1
Accessories / conductors	As shown in circuit	As req.
PPE	As required by lab rules	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Analyze a simple industrial control-panel wiring setup'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 18

Prepare a cost estimate for underground cable laying

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare a cost estimate for underground cable laying.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO4: Prepare estimates for overhead and underground distribution work.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.18 - UNDERGROUND CABLE ROUTE VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare a cost estimate for underground cable laying'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 19

Calculate load distribution and sub-circuit planning for a small building

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Calculate load distribution and sub-circuit planning for a small building.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.19 - MAIN DISTRIBUTION SINGLE-LINE DIAGRAM VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Calculate load distribution and sub-circuit planning for a small building'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 20

Prepare a domestic installation cost-estimation case study

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare a domestic installation cost-estimation case study.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.20 - TYPICAL BUILDING WIRING LAYOUT FOR ESTIMATION

VERIFY VALUES BEFORE USE

Mark dimensions, routes, circuit numbers and mounting heights

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare a domestic installation cost-estimation case study'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 21

Prepare an electrical test report for a domestic installation

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare an electrical test report for a domestic installation.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO2: Prepare domestic wiring layouts and estimates.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

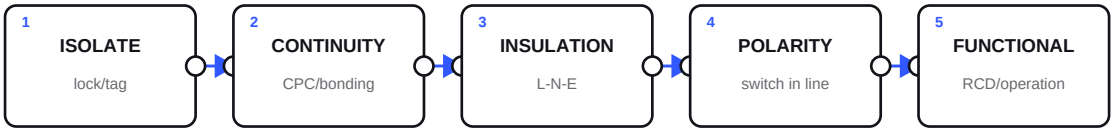
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the labelled constructional, single-line or system diagram below and add the verified ratings, terminal designations and functional details for the item observed.

FIG. H.21 - INSTALLATION INSPECTION AND TEST SEQUENCE VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Define the study boundary, required evidence and the current technical sources or approved site to be used.
2. Prepare a checklist covering configuration, ratings, equipment, protection, control, safety and environmental aspects.
3. Collect observations without touching live equipment; photographs require site and instructor permission.
4. Verify key facts against a utility, manufacturer, standard or other authoritative technical source.
5. Prepare a labelled diagram and a concise comparison table; include calculations where the syllabus outcome requires them.
6. Write findings, limitations and recommendations, then list the sources and date accessed.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare an electrical test report for a domestic installation'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 22

Prepare an electrical test report for an industrial installation

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare an electrical test report for an industrial installation.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO3: Interpret industrial wiring and prepare estimates.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

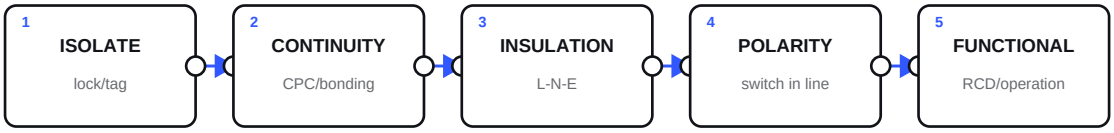
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the labelled constructional, single-line or system diagram below and add the verified ratings, terminal designations and functional details for the item observed.

FIG. H.22 - INSTALLATION INSPECTION AND TEST SEQUENCE VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Define the study boundary, required evidence and the current technical sources or approved site to be used.
2. Prepare a checklist covering configuration, ratings, equipment, protection, control, safety and environmental aspects.
3. Collect observations without touching live equipment; photographs require site and instructor permission.
4. Verify key facts against a utility, manufacturer, standard or other authoritative technical source.
5. Prepare a labelled diagram and a concise comparison table; include calculations where the syllabus outcome requires them.
6. Write findings, limitations and recommendations, then list the sources and date accessed.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare an electrical test report for an industrial installation'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 23

Prepare a basic cost estimate for an overhead distribution line

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare a basic cost estimate for an overhead distribution line.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO4: Prepare estimates for overhead and underground distribution work.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

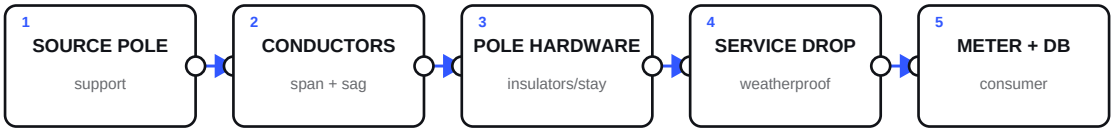
- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.23 - OVERHEAD DISTRIBUTION / SERVICE ESTIMATE

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare a basic cost estimate for an overhead distribution line'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 24

Calculate the cost of an underground distribution system for given data

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Calculate the cost of an underground distribution system for given data.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO4: Prepare estimates for overhead and underground distribution work.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.24 - UNDERGROUND CABLE ROUTE VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Calculate the cost of an underground distribution system for given data'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 25

Prepare a cost estimate for an overhead service connection

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Prepare a cost estimate for an overhead service connection.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO5: Prepare estimates for electrical service connections.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

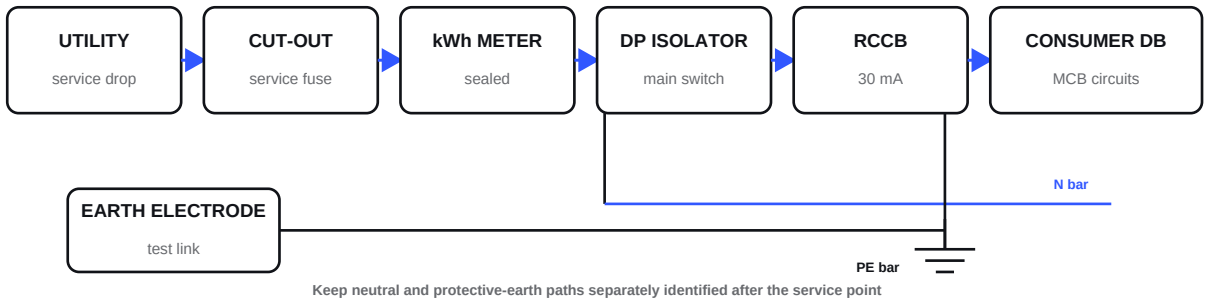
- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.25 - OVERHEAD SERVICE CONNECTION SINGLE-LINE DIAGRAM

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Prepare a cost estimate for an overhead service connection'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 26

Compute the cost of an underground service connection for a small commercial setup

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Compute the cost of an underground service connection for a small commercial setup.

B. Expected programme outcomes

PO1, PO2, PO3, PO5, PO6, PO7.

C. Expected competency

Plan, test, estimate and cost safe, standards-compliant electrical installations.

D. Expected course outcome

CO5: Prepare estimates for electrical service connections.

E. Practical learning outcomes

1. Interpret the supplied plan, load data and installation requirements.
2. Select compliant conductors, protection, accessories and installation method.
3. Prepare a checked quantity schedule and cost abstract with stated assumptions.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Acknowledge sources, state assumptions and contribute responsibly to team work.

G. Prerequisite theory

An estimate converts a compliant electrical design into quantities and cost. Begin with the connected load and diversity assumptions, divide the installation into suitable sub-circuits, select conductor and protective-device ratings, prepare a bill of quantities, then apply current unit rates, labour, contingencies and taxes as directed by the institute.

Key relations / checks

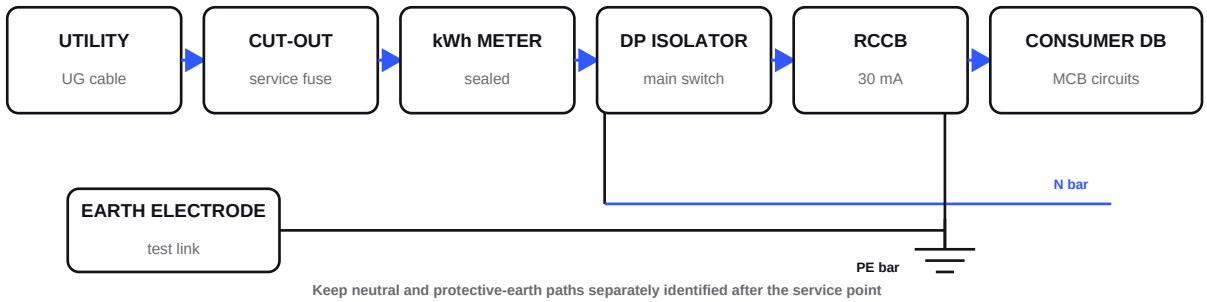
- Design current Ib = demand/assigned voltage
- Select In >= Ib and cable capacity Iz >= In
- Total cost = material + labour + permitted overheads and taxes

H. Experimental setup / drawing

Use the layout or single-line diagram below as the design basis. Add project dimensions, routes, circuit numbers, conductor sizes, protection and earthing.

FIG. H.26 - UNDERGROUND SERVICE CONNECTION SINGLE-LINE DIAGRAM

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Given plan / data	Instructor-issued, dimensioned	1
Rules and data sheets	Current approved references	As req.
Rate source	Current SOR or verified quotation	1
Calculator / spreadsheet	Formulae visible and checked	1
Drawing tools	Scale, symbols and labels	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Work on 230/415 V equipment only on an approved isolated trainer under direct supervision.

K. Procedure

1. Study the given plan, supply system, occupancy, connected loads and any stated diversity or demand factors.
2. Mark load points and prepare a load schedule grouped by lighting, socket, motor or special-purpose circuits.
3. Calculate design current and divide the installation into compliant sub-circuits.
4. Select conductor size, wiring method, protection, isolation, earthing and distribution equipment; record assumptions.
5. Measure route lengths from the drawing and include allowance for drops, bends, terminations and wastage as directed.
6. Prepare the bill of quantities with description, unit, quantity, rate and amount using a current approved rate source.
7. Add labour and permitted overheads, check arithmetic, and submit a labelled single-line/layout drawing with the estimate.

L. Observations and calculations

State route-length allowances, demand/diversity assumptions, rate source and date. Add sheets when the quantity schedule is longer.

Item / circuit	Specification	Quantity	Rate	Amount

LOAD, CIRCUIT AND CONDUCTOR-SIZE CALCULATIONS

COST ABSTRACT / CHECK TOTAL

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Compute the cost of an underground service connection for a small commercial setup'? Answer: _____
2	Which assumptions, demand factors and rate source were used in the estimate? Answer: _____
3	How would a change in wiring method or route length affect quantity and cost? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. J. B. Gupta, A Course in Electrical Installation Estimating and Costing
2. National Electrical Code of India and applicable BIS wiring standards
3. Current GTU syllabus DI03009011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct interpretation of data, scope and standards	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Technical method, calculations and documentation	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

Final submission checklist

1. Every practical has a date, mapped outcome, actual readings or evidence, calculations and a signed conclusion.
2. Circuit diagrams, programs, graphs, estimates, reports and test sheets are attached where required.
3. Instrument ranges, component ratings, source dates and safety precautions are recorded.
4. Technical sources are acknowledged and all assumptions are stated.
5. Faculty feedback and required corrections have been completed.

FACULTY REMARKS