

ELECTRICAL ESTIMATING AND CONTRACTING**Course Code : 314325**

Programme Name/s : Electrical Engineering/ Electrical Power System
Programme Code : EE/ EP
Semester : Fourth
Course Title : ELECTRICAL ESTIMATING AND CONTRACTING
Course Code : 314325

I. RATIONALE

This course thoroughly explores important aspects of wiring installations, covering planning of electrical installation and contracts, adherence to electrical bylaws, understanding supply systems, implementing effective installation methods, and mastering the estimation of electrical wiring, installations, and contracting. This course provides students with holistic knowledge to pursue careers as contractors and entrepreneurs and empowers them to successfully execute a wide range of electrical wiring installation projects with confidence and proficiency.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Carry out estimation and costing of various electrical wiring installations.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Prepare generic tender document, quotation, comparative statement, and supply order.
- CO2 - Prepare estimate of domestic and commercial electrical installations.
- CO3 - Prepare estimate of industrial electrical installations.
- CO4 - Prepare estimate of public lighting installations.
- CO5 - Prepare estimate of overhead and underground distribution lines.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

| Course Code | Course Title | Abbr | Course Category/s | Learning Scheme | | | | | Credits | Assessment Scheme | | | | | | | | | | | | Total Marks | | | | |
|-------------|---------------------------------------|------|-------------------|--------------------------|-----|-----|-----|-----|---------|-------------------|----------------|--------|-----|----|-------|------------------|-------|----|-------|-------------|-------|-------------|-----|--|--|--|
| | | | | Actual Contact Hrs./Week | SLH | | | NLH | | | Paper Duration | Theory | | | | Based on LL & TL | | | | Based on SL | | | | | | |
| | | | | | | | | | | | | | | | | Practical | | | | | | | | | | |
| | | | | | | | | | | | | CL | TL | LL | FA-TH | SA-TH | Total | | FA-PR | | SA-PR | | SLA | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Max | Max | Max | Min | Max | Min | Max | Min | Max | Min | | | | | | | | | | | | | | | | | |
| 314325 | ELECTRICAL ESTIMATING AND CONTRACTING | EEC | DSC | 3 | - | 4 | 1 | 8 | 4 | 3 | 30 | 70 | 100 | 40 | 25 | 10 | 25# | 10 | 25 | 10 | 175 | | | | | |

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

| Sr.No | Theory Learning Outcomes (TLO's) aligned to CO's. | Learning content mapped with Theory Learning Outcomes (TLO's) and CO's. | Suggested Learning Pedagogies. |
|-------|--|---|---|
| 1 | <p>TLO 1.1 Apply the principles of NEC 2023 during preparation of the given document.</p> <p>TLO 1.2 State the purpose of preparation of the given type(s) of estimates.</p> <p>TLO 1.3 State the purpose of awarding the given type(s) of contracts.</p> <p>TLO 1.4 Prepare tender documents, quotations, and bills for the specified work.</p> | <p>Unit - I Estimates and Contracts</p> <p>1.1 National Electrical Code 2023 (NEC 2023): Scope and features, Types of electrical installation- Non industrial and industrial, Standard value of voltages and their limits, Fundamental principles for electrical installations, Safety in electrical work, permit to electrical work, safety instruction and safety practices</p> <p>1.2 Estimating and costing: Purpose, Qualities of good estimator, essential elements of estimating and costing, Meaning and purpose of- Rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate, Factors to be considered while preparation of detailed estimate and economical execution of work.</p> <p>1.3 Contracts: Concepts, types, roles, and qualities of good contractor</p> <p>1.4 Tender and Quotation: Types of tenders, tender notice, preparation of tender document, and method of opening of tender, Government e-Market Place (GeM), features and benefits of GeM, Quotation, quotation format, comparison between tender and quotation, Comparative statement, format of comparative statement. Order format, placing of purchasing order, Principles of execution of works, planning, organizing and completion of work, Billing of work.</p> | Lecture Using Chalk-Board Presentations |
| 2 | <p>TLO 2.1 Interpret the given electrical installation plan and electrical diagrams.</p> <p>TLO 2.2 Estimate materials required for the given domestic installations.</p> <p>TLO 2.3 Estimate materials required for the given commercial installations.</p> <p>TLO 2.4 Estimate materials required for given type of service connection.</p> | <p>Unit - II Domestic and Commercial Installations</p> <p>2.1 Electrical Drawing: Electrical symbols used in electrical diagrams as per NEC 2023, multiline and single line representation of conductors, Electrical diagrams, their Classification. Methods of representation for the wiring diagram- multiline and single line representation, conversion of multiline representation into single line and vice versa. Necessity and reading of Civil Engineering building drawing. Interpretation of electrical installation plan and electrical diagrams.</p> <p>2.2 Design of Domestic Installations: Steps to be followed for design and estimation of domestic installations. Design consideration of electrical installation in domestic installations. Design, drawing, estimation, and costing of a domestic installation having maximum 5 kW load.</p> <p>2.3 Design of Commercial Installations: Steps to be followed for design and estimation of commercial installations. Design consideration of electrical installation in commercial installations. Design electrical installation scheme of small commercial installations of classrooms in educational institutions, small shops, and dispensaries.</p> <p>2.4 Service Connection: Underground and overhead, it's diagram and description. Calculation of material required for underground and overhead service connection.</p> | Lecture Using Chalk-Board Presentations Case Study Flipped Classroom Site/Industry Visit |

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|--------------|--|---|---|
| 3 | <p>TLO 3.1 Select wiring types for industrial installations.</p> <p>TLO 3.2 Draw an installation plan, wiring diagrams and single line diagrams for the given industrial installations.</p> <p>TLO 3.3 Describe given design considerations of an industrial installation.</p> <p>TLO 3.4 Carry out estimation for the given industrial installations.</p> | <p>Unit - III Industrial Installations</p> <p>3.1 Classification of industrial installations based on fire safety and power consumption, Difference between non-industrial and industrial installations, General characteristics of industrial installation, selection of wiring system.</p> <p>3.2 Wiring diagram and single line diagram for single phase and three phase motors. Installation plan.</p> <p>3.3 Design Considerations: Calculation of Motor current, deciding the cable size, deciding the size of Conduit, deciding the fuse rating, deciding distribution board and main switch/MCB, deciding the starter for Motors.</p> <p>3.4 Design electrical installation scheme and preparation of estimate of agricultural pump, flourmill and small industrial unit having total aggregate three -phase load less than 30 kW.</p> | <p>Lecture Using Chalk-Board</p> <p>Case Study</p> <p>Flipped Classroom</p> <p>Presentations</p> <p>Site/Industry Visit</p> |
| 4 | <p>TLO 4.1 Describe given terms related to public lighting installation.</p> <p>TLO 4.2 Select proper materials for streetlights installation.</p> <p>TLO 4.3 Select proper materials for High-mast lighting installation.</p> <p>TLO 4.4 Carry out estimation of streetlights and High-mast lighting.</p> | <p>Unit - IV Public Lighting Installation</p> <p>4.1 Classification of outdoor installations, streetlight/ public lighting installation, Terminology used according to NEC 2023 – Terms related to highway, lighting installation, photometric terms, luminaries etc. Aim of public lighting installation, classification of roads, standard layout of roads.</p> <p>4.2 Streetlight pole structures. Selection of equipment, sources used in streetlight installations. Cables, recommended types and sizes of cable. On off Control of equipment of streetlight installation.</p> <p>4.3 High-mast pole structure, selection of equipment, wiring diagram.</p> <p>4.4 Design, estimation and costing of streetlights and High-mast lighting.</p> | <p>Lecture Using Chalk-Board</p> <p>Presentations</p> <p>Case Study</p> <p>Flipped Classroom</p> <p>Site/Industry Visit</p> |
| 5 | <p>TLO 5.1 Compare the given types of distribution lines.</p> <p>TLO 5.2 Describe the given material required for distribution lines.</p> <p>TLO 5.3 Carry out estimates for the specified distribution lines.</p> | <p>Unit - V Distribution Lines</p> <p>5.1 Block Diagram of Electrical Power system, Types of Distribution lines - Primary and Secondary, Overhead and Underground, and it's comparison.</p> <p>5.2 Materials used for distribution line HT (11kV) and LT (415 V), Cables used for distribution line, factors determining selection of LT/ HT power cables, and cable termination methods.</p> <p>5.3 Design, estimation and costing of HT (11kV), LT (415 V) overhead line and underground cabling.</p> | <p>Presentations</p> <p>Lecture Using Chalk-Board</p> <p>Flipped Classroom</p> <p>Case Study</p> <p>Site/Industry Visit</p> |

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---|--------------|---|-----------------------|---------------------|
| LLO 1.1 Prepare a quotation from the given enquiry. | 1 | *Preparation of a quotation. | 2 | CO1 |
| LLO 2.1 Prepare a comparative statement from a minimum of three quotations. | 2 | *Preparation of a comparative statement. | 2 | CO1 |
| LLO 3.1 Prepare a purchase order from the comparative statement. | 3 | *Preparation of the purchase order. | 2 | CO1 |

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|--|--------------|--|-----------------------|---------------------|
| LLO 4.1 Prepare tender document for purchase of electrical machines costing more than five lakhs. LLO 4.2 Use GeM portal for searching of software, tools/equipment for procurement. | 4 | Preparation of the tender document. | 2 | CO1 |
| LLO 5.1 Calculate total load for given domestic installation. LLO 5.2 Draw electrical installation plan from given civil engineering drawing. LLO 5.3 Calculate number of subcircuits, ratings of main switch and distribution board. LLO 5.4 Draw single line diagram of distribution board for given installation. LLO 5.5 Carry out estimation for above given domestic installation. | 5 | *Design an electrical installation system for one BHK domestic unit and carry out an estimation. | 8 | CO2 |
| LLO 6.1 Draw electrical installation plan from given civil engineering drawing using suitable drawing software. LLO 6.2 Draw single line diagram of distribution board for given installation using suitable drawing software. | 6 | *Domestic installation drawing using suitable software (mentioned in Practical No. 5). | 4 | CO2 |
| LLO 7.1 Calculate total load for given commercial installation. LLO 7.2 Draw electrical installation plan from given civil engineering drawing. LLO 7.3 Calculate number of subcircuits, ratings of main switch and distribution board. LLO 7.4 Draw single line diagram of distribution board for given installation. LLO 7.5 Carry out estimation for above given commercial installation. | 7 | *Design an electrical installation system for a commercial unit and carry out an estimation. | 8 | CO2 |
| LLO 8.1 Draw electrical installation plan from given civil engineering drawing using suitable drawing software. LLO 8.2 Draw single line diagram of distribution board for given installation using suitable drawing software. | 8 | *Commercial installation drawing using suitable software (mentioned in Practical No. 7). | 4 | CO2 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|--|--------------|---|-----------------------|---------------------|
| LLO 9.1 Calculate total load for given industrial installation. LLO 9.2 Draw electrical installation plan from given civil engineering drawing. LLO 9.3 Calculate size of cable, ratings of main switch and distribution board. LLO 9.4 Draw single line diagram of distribution board for given installation. LLO 9.5 Carry out estimation for above given industrial installation. | 9 | *Design an electrical installation system for small industrial installation and carry out an estimation. | 8 | CO3 |
| LLO 10.1 Draw single line diagram of distribution board for given installation using suitable drawing software. | 10 | Commercial installation drawing using suitable software (mentioned in Practical No. 9). | 2 | CO3 |
| LLO 11.1 Draw a layout diagram for streetlights installation from a given civil engineering drawing. LLO 11.2 Draw the details of a streetlight pole and layout as per NEC 2023. LLO 11.3 Select the size of cable by calculating voltage drop. LLO 11.4 Carry out the estimation for given streetlight installation. | 11 | *Design an electrical installation system for street lights of small premises and carry out an estimation. | 6 | CO4 |
| LLO 12.1 Draw layout diagram for low-tension (LT) line from given data. LLO 12.2 Carry out the estimation for low-tension (LT) line. | 12 | *Design an electrical installation system for a low-tension (LT) distribution line (415 volts) and carry out an estimation. | 6 | CO5 |
| LLO 13.1 Draw layout diagram for high-tension (HT) line from given data. LLO 13.2 Carry out the estimation for high-tension (HT) line. | 13 | Design an electrical installation system for a high-tension (HT) distribution line (11 kV) and carry out an estimation. | 6 | CO5 |
| Note : Out of above suggestive LLOs - <ul style="list-style-type: none"> * Marked Practicals (LLOs) Are mandatory. Minimum 80% of above list of lab experiment are to be performed. Judicial mix of LLOs are to be performed to achieve desired outcomes. | | | | |

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Carry out market survey of electrical materials for comparison of quality and cost.
- Collect an electrical engineering drawing of the existing electrical installation. Interpret it. Prepare a report on it.
- Collect industrial installation plan and prepare estimation for the same using suitable software.
- Collect existing installation plan of distribution lines and prepare an estimation for the same.
- Collect the existing installation plan of the street lighting scheme and prepare an estimation for the same.
- Collect the existing installation plan of the High-mast lighting scheme and prepare an estimation for the same.
- Collect the existing installation plan of the low-tension (LT) line and prepare an estimation for the same.
- Collect the existing installation plan of the high-tension (HT) line and prepare an estimation for the same.
- Collect any tender document related to electrical installation and fill all related documents.
- Collect list of vendors and specifications of electrical goods from GeM portal.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

| Sr.No | Equipment Name with Broad Specifications | Relevant LLO Number |
|-------|--|---------------------|
| 1 | All In One Computer with following specifications. Processor - 13th Gen Intel® Core™ i5-13500T, OS-Windows 11 Pro, Graphics - Intel® Graphics, Memory - 8 GB: 1 x 8 GB, DDR4, Storage - 256 GB, M.2 2230, PCIe NVMe, SSD, Class 35, Display - 60.5-cm. display Full HD (1920X1080) | 1,6,8,10 |
| 2 | Laser jet multifunction printer | 1,6,8,10 |
| 3 | Any proprietary or open-source drawing Software | 6,8,10 |

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|---------------------------------------|-------------|----------------|-----------|-----------|-----------|-------------|
| 1 | I | Estimates and Contracts | CO1 | 5 | 2 | 4 | 4 | 10 |
| 2 | II | Domestic and Commercial Installations | CO2 | 12 | 2 | 8 | 8 | 18 |
| 3 | III | Industrial Installations | CO3 | 12 | 2 | 8 | 8 | 18 |
| 4 | IV | Public Lighting Installation | CO4 | 8 | 2 | 4 | 8 | 14 |
| 5 | V | Distribution Lines | CO5 | 8 | 2 | 0 | 8 | 10 |
| Grand Total | | | | 45 | 10 | 24 | 36 | 70 |

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Two unit tests of 30 marks will be conducted and average of marks obtained in these two unit tests will be considered. Each practical will be assessed for 25 marks and average of all marks obtained will be considered.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks for classroom learning. End semester assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

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| Course Outcomes (COs) | Programme Outcomes (POs) | | | | | | | Programme Specific Outcomes* (PSOs) | | |
|-----------------------|--|-----------------------|---------------------------------------|------------------------|--|-------------------------|-------------------------|-------------------------------------|-------|-------|
| | PO-1 Basic and Discipline Specific Knowledge | PO-2 Problem Analysis | PO-3 Design/ Development of Solutions | PO-4 Engineering Tools | PO-5 Engineering Practices for Society, Sustainability and Environment | PO-6 Project Management | PO-7 Life Long Learning | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | - | - | - | - | 1 | 1 | | | |
| CO2 | 3 | - | 3 | 2 | 1 | 1 | 1 | | | |
| CO3 | 3 | - | 3 | 2 | 1 | 1 | 1 | | | |
| CO4 | 3 | - | 3 | 2 | 1 | 1 | 1 | | | |
| CO5 | 3 | - | 3 | 2 | 1 | 1 | 1 | | | |

Legends :- High:03, Medium:02,Low:01, No Mapping: -
 *PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|-------------------------------|---|--|
| 1 | K.B.Raina, S.K.Bhattacharya | Electrical Design Estimating and Costing | New Age International Publisher, First, Reprint 2010, ISBN:13: 978-8122443585 |
| 2 | Surjit Singh, Ravi Deep Singh | Electrical Estimating and Costing | Dhanpat Rai and Sons, 2014 New Delhi, ISBN:1234567150995 |
| 3 | J.B. Gupta | A Course in Electrical Installation Estimating and Costing | S.K. Kataria and Sons; New Delhi Reprint Edition, 2013, ISBN: 13: 978-9350142790 |
| 4 | BIS | SP-30:2023, National Electrical Code, 2023 | Bureau of Indian Standards |
| 5 | BIS | IS: 732-1989, Code of Practice for Electrical Wiring Installation | Bureau of Indian Standards |

XIII. LEARNING WEBSITES & PORTALS

| Sr.No | Link / Portal | Description |
|-------|---|------------------------------------|
| 1 | https://www.electricaltechnology.org/2013/09/electrical-wiring.htm | Basics of Electrical wiring system |
| 2 | https://www.electrical4u.com/types-of-electrical-insulator-overhead-insulator/ | Distribution line materials |
| 3 | https://www.electrical4u.com/lamps-types-and-performance-comparison/ | Different types of lamps. |
| 4 | https://youtu.be/yhzhloBF_eo?si=Esgl05OzWNCOQaiD | High mast light wiring |
| 5 | https://www.youtube.com/watch?v=IoMXX6xctlg | Streetlight wiring |
| 6 | https://standardsbis.bsbedge.com/ | SP:30 NEC 2023 |
| 7 | https://gem.gov.in/ | GeM portal for procurement. |

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students