Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru.

Course Title	:ESTIMATION SIMULATION LAB	Course Code	:**15EE57P**
Semester	: V	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **0:2:4** (in Hours)	Credits	: **3 Credits**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**
Programme: ELECTRICAL AND ELECTRONICS ENGINEERING.			

Pre-requisites	: Knowledge about–Analog and Digital Electronics, Concepts of power circuit and control circuits, working principle of electric motors and their applications, working principles of transformers and their ratings, circuit breakers, isolators, switches.
Course Objectives	**:** To know the components used in Domestic wirings, erection of towers and substations. To provide systematic training on drawings of Single-Line Diagrams of Towers, Substations and prepare materials required.

Course Outcomes:

On successful completion of the Course, the student will be able to:

1. *Understand the meaning of specification, estimation, standardization, tender and earthing.*
2. *Estimate service connections for over head and underground and prepare schedule of materials*
3. *Design lighting installations and prepare schedule of materials.*
4. *Design power installations and prepare schedule of materials.*
5. *Prepare schedule of materials of distribution lines and transformers.*

LIST OF GRADED EXERCISES:

<table>
<tr><th>SL No.</th><th>LIST OF GRADED EXERCISES</th><th>Hours</th></tr>
<tr><td>1</td><td>Design an Electrical Installation for the Residential building.
• Total Connected lighting load is 800 Watts.
(Refer the Layout plan for load segregation).
• Electrical pole is 10 Mtrs away from the building.

Generate a Single Line diagram for the above electrical Installation mentioning the cable sizes (1ph+N+PE), protection devices used at the Mains.

Calculate the size of the Over head Aluminum cable required and generate the complete bill of Materials</td><td>06</td></tr>
<tr><td>2</td><td>Design an Electrical Installation for the Residential building with AEH Connection for the given load matrix.
<table>
<tr><td>Location</td><td>Light</td><td>Fan</td><td>5 A socket</td><td>15 A socket</td></tr>
<tr><td>Front verandah</td><td>1</td><td></td><td>1</td><td></td></tr>
<tr><td>Drawing room</td><td>1</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>Dining room</td><td>1</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Bed room</td><td>1</td><td>1</td><td>1</td><td></td></tr>
<tr><td>Kitchen</td><td>1</td><td></td><td>1</td><td>1</td></tr>
<tr><td>Bath room</td><td>1</td><td></td><td></td><td>1</td></tr>
</table>
Generate the electrical network and show distinctly the various sub circuits on the installation plan; calculate the size of the wire required for each sub circuits.

Calculate the size of the cable required in Under Ground system and Generate the complete bill of Materials</td><td>12</td></tr>
<tr><td>3</td><td>Design an Electrical network for the Workshop with the following loads.
i. 1 No. drilling machine: 3 Ph, 440V, 1 Hp
ii. 2 Nos. Lathes: 3 Ph, 440V, 2 Hp each</td><td>06</td></tr>
</table>

	iii. 1 No. Grinding machine: 3 Ph, 440V, 1 Hp iv. 1 No. Milling machine: 3 Ph, 440V, 10 Hp (Refer the Layout plan for the position of machines) Assume the power factor as 0.8 and the efficiency of the machines are 85% with DOL starters. Calculate the size of the cables used in each motor feeder section along with its protection devices. Generate the complete bill of materials and segregate feeder wise.	
4	Hostel building in a Polytechnic has 3 floors. The First and Second Floors are similar to Ground Floor and there are 20 Rooms and 14 bathrooms /Toilets in each floor. o Each room is having 2 Light points, One Fan point and One 5 Amps socket point. o Each bathroom/Toilet has One Light point. • Common room in each floor has 4 Light points, 2 Fan points and 2 Nos of 5 Amps Socket outlet. • Corridor and Stair case has 11 Light points for each floor. • Ground floor has 8 Outdoor lighting points. Design an Electrical Network for the hostel building, indicating the ratings of each protection devices used at the Mains and at the Switchboard level.	**12**
5	Size the Service Mains cable for the Exercise 4.	**06**
6	A small factory having 3 phase four wire 415 volts supply comprises of the following: • Sixty lightings points in the factory of 100 watts each • One 8 kW motor with 0.8 p.f and four 8 kW motors with 0.7 p.f. • 15 lighting points in the office of 150 watts each • 5 heating points in the office with 2 kW load on each outlet • Six socket outlets in the office for 0.5 kW motor. Prepare a schematic diagram along with the sub-circuit arrangement and control equipments.	**06**
7	Consider an industrial site having 3 phase four wire 415 volts supply, comprises of the following load groups • Load group 1: 3 phase four wire; total 450 kW power with 0.8 p.f • Load group 2: 3 phase four wire; total 100 kW power with 0.7 p.f The engineer is asked to maintain a unity power factor at the Main Low voltage	**12**

	switch board. Calculate the rating of the compensation capacitor (kVAR) required. Realize the schematic and find the order & type of capacitor required.	
8	Pump house is having 2 No. of 5 H.P. Irrigation pump sets with Individual Star Delta starters is located adjacent to well Distance between the Electrical Pole and Pump house is 5 Meters and The pump is 10 Meters away from the Motor starter located in Pump house. Calculate the size of the Mains cable connecting the Mains and Motor starters. Also design the ratings of the Starters (OLRs) and the contactors (Y-Δ). Specify also the cable sizes required to connect Pump and Starters. Draw the Electrical schematics network .	**06**
9	Calculate the rating of the compensation capacitor (kVAR) required to improve the Power factor to Unity for the exercise 8. Realize the schematic and find the order & type of capacitor required	**06**
10	New polytechnic campus is given 60KW load. New 100KVA Transformer is to be installed 100mts away from the campus. Prepare materials required for installing new 100KVA transformer. Generate the electrical network and show distinctly the various sub circuits on the installation plan. Calculate the size of the underground cable required in Under Ground system from 100KVA transformer to college campus and Generate the complete bill of Materials	**06**

e-Resources: Any available open-source simulation software.

Any available open-source simulation software like

My Ecodial L 3.4

Or

Ecodial Advance International 4.X

http://www.schneider-electric.com/en/product-category/5100-software/?filter=business-4-low-voltage-products-and-systems

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	10
2	Understanding	20
3	Application/ Analysis	70
Total		**100**

Mapping Course Outcomes with Program Outcomes: (Course Outcome linkage to Cognitive Level)

		Experiment linked	PO Mapped	Cognitive Level
CO1	*Understand the meaning of specification, estimation, standardization, tender and earthing.*	1,2,3,4,5,6,7,8,9	2, 3, 8, 9, 10	R/A/C
CO2	*Estimate service connections for over head and underground and prepare schedule of materials*	1,2,3,4,5,6,7,8,9,10	2, 3, 8, 9, 10	U/A
CO3	*Design lighting installations and prepare schedule of materials*	1,2,3,4,5,6,7,8,9	2, 3,4, 8, 9, 10	U/A/C/E
CO4	*Design power installations and prepare schedule of materials.*	3,4,5,6,7,8,9	2, 3,4, 8, 9, 10	A/C
CO5	*Prepare schedule of materials of distribution lines and transformers.*	10	2, 3,4, 8, 9, 10	A/C

U-Understanding; A-application/ Analysis; App-Application

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Estimation Simulation Lab		**3**	**3**	**3**				**3**	**3**	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.

IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3

IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2

IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Delivery:

The laboratory Course will be delivered through Tutorial, laboratory interaction, group discussion, practical exercises, instructions, assignments and viva voice.

Tutorial - 1Hr:

Staff-in-charge will;

1. Explain the components used in simulation software.
2. Ask the students to draw the Single-line diagram manually.
3. Guide the students to draw the Single-line diagram using simulation software.

Conduction/ Execution- 2 Hr:

Each student must draw the Single-line diagram using simulation software and generate the complete bill of Materials

Course Assessment and Evaluation:

	What		To Whom	Frequency	Practical	Evidence Collected	Course Outcomes
Direct Assessment Method	CIE (Continuous Internal Evaluation)	I A Tests	Students	Two IA tests for Practical (Average marks of both the tests)	10	Blue Books	1 to 6
		Record Writing		Record Writing (Average of Marks allotted for each experiment.)	10	Lab Record	1 to 6
				Student Activity	05	3 pages Report	1 to 6
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End of the Course	50	Answer Scripts	1 to 6
Indirect Assessment Method	Student Feedback on course		Students	Middle of The Course	Feed Back Forms		1 to 6
	End of Course Survey			End of The Course	Questionnaire		1 to 6

***CIE** – Continuous Internal Evaluation ***SEE** – Semester End Examination

Note:

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

Suggested Student Activity (any one to be submitted with 3 pages report):

The following problems may be solved Analytically on Paper or using Spreadsheet (e.g. MS-Excel) or MATLAB or any available software, and submit complete solution;

1	New 5MVA, 66KV/11KV substation is to be established. Existing 66KV Double circuit transmission line is 10KM away from New substation. Generate the electrical network and show distinctly the various sub circuits on the installation plan. Calculate the size of the cable required in overhead system and number of transmission structure from 66KV Double circuit transmission to new substation and Generate the complete bill of Materials
2	Design 5MVA , 66KV/11KV substation. Generate the complete bill of Materials

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks **One activity on any one CO (course outcome) may be given to a group of FIVE students** **Grand Average/Total**						14/4 =3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Convensions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

Scheme of Valuation for SEE (Semester End Examination):

Sl. No.	Particulars	Marks
1.	Design and generate bill of materials for the given exercise	30
2.	Results	10
3.	Viva-Voce	10
Total		**50**

Model Question Bank:

Course Title: ESTIMATION SIMULATION LAB	Course Code: 15EE57P

1. Design an Electrical Installation for the Residential building for given connected load.

   Generate a Single Line diagram for the above electrical Installation mentioning the cable sizes (1ph+N+PE), protection devices used at the Mains.

   Calculate the size of the Over head Aluminium cable required and generate the complete bill of Materials

2. Design an Electrical Installation for the Residential building with AEH Connection for the given load matrix.

   Generate the electrical network and show distinctly the various sub circuits on the installation plan; calculate the size of the wire required for each sub circuits.

   Calculate the size of the cable required in Under Ground system and Generate the complete bill of Materials

3. Design an Electrical network for the Workshop with the following loads.

   i. 1 No. drilling machine: 3 Ph, 440V, 2Hp
   ii. 2 Nos. Lathes: 3 Ph, 440V, 3Hp each
   iii. 1 No. Grinding machine: 3 Ph, 440V, 2Hp
   iv. 1 No. Milling machine: 3 Ph, 440V, 5Hp

   (Refer the Layout plan for the position of machines)

Assume the power factor as 0.85 and the efficiency of the machines are 80% with DOL starters.

Calculate the size of the cables used in each motor feeder section along with its protection devices.

Generate the complete bill of materials and segregate feeder wise.

4. Design an Electrical network for the Workshop with the following loads.

   i. 1 No. drilling machine: 3 Ph, 440V, 1 Hp
   ii. 2 Nos. Lathes: 3 Ph, 440V, 5Hp each
   iii. 1 No. Grinding machine: 3 Ph, 440V,2Hp
   iv. 1 No. Milling machine: 3 Ph, 440V, 10 Hp

(Refer the Layout plan for the position of machines)

Assume the power factor as 0.75 and the efficiency of the machines are 80% with DOL starters.

Calculate the size of the cables used in each motor feeder section along with its protection devices.

Generate the complete bill of materials and segregate feeder wise.

5. Design an Electrical network for the Workshop with the following loads.

i. 1 No. drilling machine: 3 Ph, 440V, 2Hp
ii. 2 Nos. Lathes: 3 Ph, 440V, 2 Hp each
iii. 1 No. Grinding machine: 3 Ph, 440V, 2Hp
iv. 1 No. Milling machine: 3 Ph, 440V, 15Hp

(Refer the Layout plan for the position of machines)

Assume the power factor as 0.9 and the efficiency of the machines are 88% with DOL starters.

Calculate the size of the cables used in each motor feeder section along with its protection devices.

Generate the complete bill of materials and segregate feeder wise.

6. Hostel building in a Polytechnic has 2 Floors. The First and Second Floors are similar to Ground Floor and there are 25 Rooms and 15 bathrooms /Toilets in each floor.

  - Each room is having 2 Light points, One Fan point and One 5 Amps socket point.
  - Each bathroom/Toilet has One Light point.
- Common room in each floor has 5 Light points, 2 Fan points and 2 Nos of 5 Amps Socket outlet.
- Corridor and Stair case has 15 Light points for each floor.
- Ground floor has 10 Outdoor lighting points.

Design an Electrical Network for the hostel building, indicating the ratings of each protection devices used at the Mains and at the Switchboard level.

7. A small factory having 3 phase four wire 415 volts supply comprises of the following:

- 70 lightings points in the factory of 100 watts each
- One 10 kW motor with 0.85p.f and four 10 kW motors with 0.75p.f.
- 25 lighting points in the office of 100 watts each
- 8 heating points in the office with 2.5 kW load on each outlet
- 10socket outlets in the office for 0.75 kW motor.

Prepare a schematic diagram along with the sub-circuit arrangement and control equipments.

8. Consider an industrial site having 3 phase four wire 415 volts supply, comprises of the following load groups

- Load group 1: 3 phase four wire; total 500kW power with 0.85p.f
- Load group 2: 3 phase four wire; total 150 kW power with 0.75p.f

The engineer is asked to maintain a unity power factor at the Main Low voltage switch board.

Calculate the rating of the compensation capacitor (kVAr) required.

Realize the schematic and find the order & type of capacitor required

9. Pump house is having 3Nos of 5 H.P. Irrigation pump sets with Individual Star Delta starters is located adjacent to well Distance between the Electrical Pole and Pump house is 6Metres and The pump is 15Metres away from the Motor starter located in Pump house.

Calculate the size of the Mains cable connecting the Mains and Motor starters.

Also design the ratings of the Starters (OLRs) and the contactors (Y-Δ).

Specify also the cable sizes required to connect Pump and Starters.

Draw the Electrical schematics network.

10. Calculate the rating of the compensation capacitor (kVAr) required to improve the Power factor to Unity for the exercise 9.

Realize the schematic and find the order & type of capacitor required

11. New polytechnic campus is given 70KW load. New 100KVA Transformer is to be installed 90mts away from the campus.

Prepare materials required for installing new 100KVA transformer.

Generate the electrical network and show distinctly the various sub circuits on the installation plan.

Calculate the size of the under ground cable required in Under Ground system from 100KVA transformer to college campus and Generate the complete bill of Materials

12. New 5MVA, 66KV/11KV substation is to be established. Existing 66KV Double circuit transmission line is 15KM away from New substation.

Generate the electrical network and show distinctly the various sub circuits on the installation plan.

Calculate the size of the cable required in overhead system and number of transmission structure from 66KV Double circuit transmission to new substation and generate the complete bill of Materials

13. Design 5MVA, 66KV/11KV substation. Generate the complete bill of Materials.

Estimation Simulation Lab Equipments Requirement:

Students Intake : 60

Students per Batch : 20

Sl. No.	Name of Equipment and Specification	Quantity Required
1	Computers with latest configuration	20 NOs.
2	Estimation simulations Related software's	10 NOs.
3	Printers	20NOs.

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