



**Government of Karnataka**  
**DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION**

<b>Programme</b>	Electrical and Electronics Engineering.	<b>Semester</b>	III
<b>Course Code</b>	20EE32P	<b>Type of Course</b>	Programme Core
<b>Course Name</b>	Transmission and Distribution	<b>Contact Hours</b>	8 hours/week 104 hours/semester
<b>Teaching Scheme</b>	L:T:P :: 3:1:4	<b>Credits</b>	6
<b>CIE Marks</b>	60	<b>SEE Marks</b>	40

**1.Rationale:**

Electric power transmission is the bulk movement of electrical energy from a power plant, to an electrical substation. Transmission network is the interconnected lines which facilitate this movement. Efficient transmission involves reducing the currents by stepping up the voltage prior to transmission, and stepping it down at a substation at the far end. Electric power distribution is the final stage in the delivery of electric power, it carries electricity from the transmission system to individual consumers through distribution substation. An Electrical Technician shall have the knowledge of the various T&D systems, components of the T&D systems and constructional features, simulate its performance, losses, distribution line maintenance and substations and shall prepare an estimation using estimation software.

**2. Course Outcomes/Skill Sets:** On successful completion of the course, the students will be able to

CO-01	Conduct performance analysis of a given transmission and distribution lines in a real/ simulated environment
CO-02	Describe the procedure to install, test and maintain transmission & distribution lines.
CO-03	Prepare the list of equipment/materials with specifications to install a given transmission and distribution system.

**3. Course Content**

Week	CO	PO*	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour /week	4 hours/week (2 hours/batch twice in a week)
1	1	1,4	1.Vectorial representation of AC quantities. Represent vectors in Rectangular, Trigonometric and Polar forms, Convert Rectangular form into Polar form and vice-versa and problems on R to P and P to R. Arithmetic operations on vectors, problems	Refer Table 1	1. Measure active power, reactive power, apparent power and power factor in a single-phase/ three-phase circuit using appropriate measuring instruments. Ensure improvement of PF by use of capacitor in single-phase/three phase circuit.
			2. Concept of active power, reactive power, apparent power and power factor in AC circuit.		Introduction to simulation software

			calculate active, reactive, apparent power and power factor in a given single/ 3phase phase AC circuit.  3a. Explain KCL and KVL 3b. Explain Thevenin's and Superposition theorem, application of theorems.		1. Verify KCL and KVL using simulation software.
2	1	1,4	1.Various systems for power transmission and distribution: 2 wire AC, 3 wire AC and 3 phase 4 wire AC systems. -Simple Problems -Compare HVAC and HVDC system.  <b>2.Line Constants and Performance:</b> -Classification of transmission lines based on distance. - Line constants -resistance, inductance and capacitance. -Short transmission line-equivalent circuit  3. Vector diagram of a short transmission line. -Equations for receiving end voltage, efficiency, voltage regulation and power factor. - simple problems	Refer Table 1	1.Simulate a given short transmission line-1   2. Simulate a given short transmission line-2. Find i. Sending end active and reactive power ii. Receiving end active and reactive power. iii. Voltage regulation and Transmission efficiency. compare simulation results with calculated values. <b>Ref.7(6)</b>
3	1	4	1. Skin effect, Ferrantic effect transposition of conductor and its necessity.   2. Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.  3.Explain Transmission and Distribution losses. <b>Ref.7(9,10,11)</b>	Refer Table 1	1.Simulation of Ferranti effect. <b>Ref.7(7)</b>   2.Solve problems on Transmission and Distribution losses. <b>Ref.7(8)</b>
4	1	4	1. Main components of overhead transmission lines (Supports, Cross arms and Clamps. Insulators, Conductors., Guys and Stays., Fuses and Isolating Switches, Continuous Earth Wire etc.).  2. Characteristics and applications of ACSR, AAC, AAAC conductors, types of ACSR and	Refer Table 1	1a. Identify Different components of Overhead Transmission lines. 1b. Identify various conductors viz., All aluminium conductor (AAC), AAAC, ACSR conductor.  2. Identify HT/LT line insulators •Install the shackle type insulator on HT overhead line • Install the pin type insulator on the LT overhead line.

			their applications, compare ACSR, AAC, AAAC conductors. Insulators-suspension, Pin Type, Shackle Type, Disc Type, Guy Strain, Pins for Insulators.  3. Guy Assembly, G.I. Wire, GO Switches, 11kV Cross-arms, L.T. Line Spacers, spacing between conductor, concept of length of span, sag on overhead line, Guarding, Types of Guarding.		<ul style="list-style-type: none"> <li>• fasten jumper in cross-arm of pole with pin insulator</li> <li>• fasten the jumper in shackle type insulator</li> <li>• fasten the jumper in the suspension type insulator.</li> </ul>
5	1	4	<p><b>1. UNDERGROUND TRANSMISSION LINES:</b> -</p> <p>Classification of UG cables            -General construction of a single core UG cable            -Need of HT cables, advantages and disadvantages            -Selection of HT and LT underground cable.</p> <p>2. Construction of PVC, Construction of 3 core XLPE cables            -Advantages and Disadvantages of Underground Power Cable System.</p> <p>3. Scope of IS 7098-1 and IEC standards for various cables (IEC 60502-1, IEC 60502-2).</p>	Refer Table 1	<p>Comply with safety &amp; IE rules while working on LT/ HT cables.</p> <p>1a. Identify different types of HT/LT cables.            b. Identify different parts of various underground cables.            c. Select appropriate cable for given application.</p> <p>2a. Practice preparation of cables for termination and joining.            b. Demonstrate termination kits and practice on terminations of LT/HT cables.  <b>Ref.7(21)</b></p>
6	1,2	2,4	<p>1. Methods of laying UG cables. Faults in UG cable.  <b>Cable gland-</b> different types of cable gland, lug, types.</p> <p>2.Underground Cable Testing</p> <p>3. Bonding and grounding</p>	Refer Table 1	<p>1a. Identify various cable single and double glands. and lugs.            b. Test the underground cables for open, short circuit &amp; ground fault and also check insulation resistance</p> <p>2.Demonstrate bonding and grounding of raceways, cable assembly and panels.</p>
7	1	4	<b>1.Substation:</b> Meaning of substation, Necessity of substation, classification, comparison between outdoor and indoor substation.	Refer Table 1	<p><b>In grid map of Karnataka</b></p> <p>1a. Locate 765kV, 400kV, 220kV, 110kV &amp; 66kV Substations            b. Locate 400kV, 220kV, 110kV &amp; 66kV transmission lines.            c. Locate 400kV HVDC station and Transmission line.</p>

			<p>2. Code of practice related to substation. List the materials required for 66/11 KV substation with their specifications <b>Ref.7(23,24)</b></p> <p>3. Capacitor banks, specifications and calculation. <b>Ref.7(17,18, 19)</b> selection of capacitor bank.</p>		<p>2a. Read and Interpret Single line/Layout drawings with Equipment and Protection codes as per ANSI. 2b. Read and Interpret Layout drawings of 220kV, 110kV &amp; 66kV outdoor substations. Interpret various panel wiring drawings of substation equipment</p>
8	1	4	<p><b>Substation Energy meters:</b> - 1a. Error, precision, accuracy, sensitivity, resolution and tolerance. Types of errors- gross error, random error, systematic error environmental, observation error and instrumental error. 1b. Trivector energy meter <b>Ref.7(12)</b> -Common Meter Reading Instrument (CMRI) <b>Ref.7(14,15)</b> -Class of accuracy of energy meters.</p> <p>2. -Standards for electricity metering -Scope of <b>IS 15707</b> -Scope of <b>IEC 62052-11</b> -Distributed Digital Fault Recorder (DDFR). <b>Ref.7(16,17)</b></p> <p>3. Maintenance and up keeping of daily Log Sheet at various Substation and energy accounting.</p>	Refer Table 1	<p>1a. Demonstrate working of Trivector energy meter, Identify the class of accuracy of given energy meter. <b>Ref.7(12)</b></p> <p>1b. Practice on using MRI (Meter reading instrument)</p>
					<p>2a. Take meter reading by using USB / Optical cable.</p> <p>2b. Operation of SBM (Spot billing machine).</p>
9	1	2,4	<p><b>1. Distribution System:</b> Single line diagram of AC distribution system, Classification of AC distribution system, connection schemes of distribution system- radial, ring main and interconnected systems.</p> <p>2. Feeder, distributor and service main, characteristics of Feeder, distributor and service main.</p> <p>3. Concept of voltage drop in feeders/distributors - simple problem on DC distributor fed at one end.</p>	Refer Table 1	<p>Observe the various components of the <b>Distribution System</b> by visiting the MUSS and prepare report Obtain:</p> <ol style="list-style-type: none"> <li>Number of feeders connected</li> <li>Energy consumption of each feeder</li> <li>Number of DTC meters connected</li> <li>Percentage of distribution losses</li> <li>11kV Feeders Interruption Details</li> <li>Operation of 11 kV feeders supplying power to IP sets in open delta</li> </ol>

10	1,2	2,4	<p><b>1. OPERATION OF 11KV/440V DISTRIBUTION SYSTEM-</b></p> <p>-List Various components of the 11 kV power system (Components: e.g. transformers, Isolators, CTs, PTs, Circuit breakers, LA's, etc.)</p> <p>-List Various types of Panels &amp; Substation protection systems</p> <p>2a. Transformer parts and their function.</p> <p>2b. Specific health and safety precautions which must be taken when carrying out substation installation processes</p> <p>3. Construction of Aerial Bundled (AB) Cables, - advantages and disadvantages, - AB Cables for LT Lines. -, AB Cables for HT Lines</p>	<p>Observe the various components of the power system by visiting the 11 kV substation and prepare report</p> <p>1. List the job requirements as per the government policies and regulations</p> <p>2. Observe the various components of the power system by visiting the 11kV substation (Identify various substation equipment viz., isolators, over current relays, earth fault relay, differential relay, REF relay, lightning arresters, Surge counter, wave trap, Reactor, Capacitor bank, Circuit breakers - ACB, SF-6 and VCB etc.)</p> <p>3. List the materials required for the 11 kV installation</p> <p>4. Observe the substation erection and installation work</p> <p>5. Observe the operation of distribution transformer</p> <p>6. Check the poles set to proper depth, and are properly aligned</p> <p>7. Observe the erection of channel on the pole</p> <p>8. Observe the fixing of lightning arrester</p> <p>9. Check the installation of earth connection as per standard procedure</p> <p>10. Observe the lifting Observe the lifting of the transformer, to put it on the transformer bed in a safe and efficient manner</p> <p>11. Observe the connection of low voltage cables"</p> <p>12. Identify Aerial bundled cables for LT and HT</p>
			Refer Table 1	

			<b>1.Maintenance schedule for distribution Transformer</b> a. Explain the terms inspection, preventive maintenance and overhaul. b. Explain recommended schedule for inspection of Distribution transformers. c. Explain recommended schedule for preventive maintenance of Distribution transformers. d. Explain recommended schedule for overhaul of Distribution transformers. <b>Ref 7(22)</b>		
11	2	2,4	<b>2.Maintenance schedule for 11kV overhead lines</b> a. Explain recommended schedule for inspection of 11kV overhead lines b. Explain recommended schedule for preventive maintenance of 11kV overhead lines c. Explain recommended schedule for overhaul of 11kV overhead lines. <b>Ref 7(22)</b>	Refer Table 1	Visit the nearby substation prepare report on 1. Maintenance schedule for distribution Transformer 2. Maintenance schedule for 11kV overhead lines 3. Maintenance schedule for 11kV UG system as per standard format
			<b>3.Maintenance schedule for 11kV UG system</b> a. Explain recommended schedule for inspection of 11kV UG system b. Explain recommended schedule for preventive maintenance of 11kV UG system c. Explain recommended schedule for overhaul of 11kV UG system <b>Ref 7(22)</b>		
12	3	2,3	1. Prepare schedule of materials for providing single-phase OH and UG service connection for electrification of a residential building. 2.List the materials used in transmission lines with their specifications. Classify the types of towers. Prepare a table showing voltage level, ACSR conductor used,	Ref table 1	Prepare estimation manually/ using estimation simulation software

			number of discs insulators in suspension string and tension string		
			3. Prepare the schedule of materials for the 11 KV single circuit HT line for Rural Electrification."		
13	3	2,3	Estimate for Electrification of newly formed Residential Layout to an extent of 1045 KW including street light, water supply and STP installations. 1.Tapping and Extension 11KV line of (F-11) feeder of 66/11KV MUSS upto the Proposed Layout using Rabbit ACSR Conductor and 3*95 Sqmm XLPE HTUG Cable 2.Extension 11KV line Inside the Proposed Layout using Rabbit ACSR Conductor 3.Providing 11Mtrs Spun Pole Transformer Structure with allied Materials for erection of 3x250KVA and 1x100KVA 5 Star Rated Distribution Transformers on Concrete Bed. 4.Extension of LT Overhead line (3 Phase, 5Wire) inside the layout Premises and Providing Street Light Metering. 5. Calculate HT VR (voltage regulation) and LT VR.		Prepare estimation manually/ using estimation simulation software
<b>Total in hours</b>			<b>39</b>	<b>13</b>	<b>52</b>

**\*PO= Program Outcome as listed and defined in year 1 curriculum and CO-PO mapping with strength (Low/Medium/High) has to be mapped by the course coordinator. (Above only suggestive).**

**Table 1:** Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl No.	Week	Activity
1	1	<p>I.</p> <ol style="list-style-type: none"> <li>1. Convert a given vector in rectangular form to polar form.</li> <li>2. Convert a given vector in polar form to rectangular form.</li> <li>3. Perform arithmetic operations on given vectors.</li> </ol> <p>II</p> <ol style="list-style-type: none"> <li>1. solve problems on KCL and KVL</li> <li>2. Solve problems on Thevenin's theorem.</li> <li>3. Solve problems on the Superposition theorem.</li> <li>4. calculate active, reactive, apparent power and power factor in a given single/ 3phase phase AC circuit.</li> </ol>
2	2	<p>Compare the relative amounts of Conductor Material in the Overhead System necessary for following systems of transmission.</p> <ol style="list-style-type: none"> <li>1.Two-Wire D.C. system with one conductor earthed</li> <li>2.Single-phase 2-wire system with mid-point earthed</li> <li>3.Single-phase, 3-wire system</li> <li>4.Two phase, 4-wire system</li> <li>5.Two-phase, 3-wire system</li> </ol>
3	3	<p>I. Study Process Flow Chart for Construction of Transmission Lines and</p> <ol style="list-style-type: none"> <li>1.Explain initial survey</li> <li>2.Explain detailed survey</li> <li>3.Explain the Right of way</li> <li>4. List the factors to be considered for selections of poles for erection of transmission lines</li> </ol> <p>II</p> <ol style="list-style-type: none"> <li>1. Explain String efficiency and methods of improving string efficiency.</li> </ol>
4	4	<p>Study Ujwal DISCOM Assurance Yojana (a flagship scheme of the Government of India, aimed at reducing the aggregate technical and commercial (AT&amp;C) losses of state-owned distribution companies (DISCOMs) by 6%, from 21% in FY15 to 15% in FY19)</p> <ol style="list-style-type: none"> <li>1.Explain the methodology involved in estimating T&amp;D losses and Aggregate Technical and commercial losses.</li> </ol>
5	5	<ol style="list-style-type: none"> <li>1.Explain Technical Specifications for 1.1 kV grade, Aluminium/Copper conductor, Power cables.</li> <li>2. Explain Technical Specifications for 6.35/11 kV (Uo/U) Voltage Grade, 3-Core, 185 Sq. mm Aluminium Cable.</li> </ol>
6	6	<p>Explain the factors considered for selection of underground cables for a given application and list Operating limitations with cables.</p>
7	7	<p>Study Niranthara Jyothi Yojana (NJY) of GOK and</p> <ol style="list-style-type: none"> <li>1.Explain the objective of this scheme</li> <li>2.Benefits achieved through this yojana</li> <li>3.List steps taken by government of Karnataka to flatten load curve</li> </ol>

8	8	1.Explain Duties of shift Engineer substation. 2. Explain Testing and Commissioning of Substation DC System.
9	9	I. Study Distribution & Power Transformer Metering with condition Monitoring and Alarms  1.List the functions and specification of Distribution Transformer Metering Terminal 2.Explain how distribution transformer parameters (oil level, oil tem and winding temp. etc.) are monitored in real time. 3.List the software solution providers for Distribution & Power Transformer Metering with condition Monitoring. 4.Explain the benefits of real time monitoring of transformer
10	10	Explain commissioning of the distribution line using Aerial bunched cables.
11	11	<b>I Maintenance schedule for LT line and Service connection</b> 1. Explain recommended schedule for inspection of LT line and Service connection 2. Explain recommended schedule for preventive maintenance of LT line and Service connection. 3. Explain recommended schedule for overhaul of LT line and Service connection  <b>II. Study the latest technological changes in this course and present the impact of these changes on industry</b> <b>Case study on “High voltage distribution system (HVDS) implementation in BESCOM”.</b>
12	12	Study the latest technological changes in this course and present the impact of these changes on industry <b>Case study on “Installation of auto reclosures on 11 kV feeders in BESCOM ”</b>
13	13	Study the latest technological changes in this course and present the impact of these changes on industry <b>Case study on “Reduction in Distribution Transformer failure rate in BESCOM ”</b>

#### 4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
<b>Total CIE Marks</b>					<b>60</b>
<b>Semester End Examination (Practice)</b>			<b>180</b>	<b>100</b>	<b>40</b>
<b>Total Marks</b>					<b>100</b>

## 5. Format for CIE written Test

Course Name	<b>Transmission and Distribution</b>	Test	I/II/III	Sem	III/IV
Course Code	<b>20EE34P</b>	Duration	80 Min	Marks	30

**Note:** Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

## 6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
Average Marks= (8+6+2+2)/4=4.5							5

**Note:** Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

## 7. Reference:

Sl. No.	Description
1	Transmission, distribution and utilization – vol 3 B.L Thereja and A.K.Theraja.
2	Principles of Power System" by V. K. Mehta, Rohit Mehta S. Chand Publishers, 4th Revised edition 2008
3	Electrical Power Generation Transmission and Distribution by S.N.Singh, PHI Publication
4	Transmission and Distribution of Electric Power by J.B Gupta Katsons Publications.
5	Electric Power Distribution Automation by M.K Khedkar, University Science Press (Laxmi Publications)

6	<a href="https://www.youtube.com/watch?v=Knpt6zcK CU">https://www.youtube.com/watch?v=Knpt6zcK CU</a>
7	<a href="http://vp-dei.vlabs.ac.in/Dreamweaver/objective9.html">http://vp-dei.vlabs.ac.in/Dreamweaver/objective9.html</a>
8	<a href="https://www.easycalculation.com/physics/electromagnetism/eletrical-power-transmission-line-power-loss.php">https://www.easycalculation.com/physics/electromagnetism/eletrical-power-transmission-line-power-loss.php</a>
9	<a href="https://electricalnotes.wordpress.com/2014/03/01/calculate-technical-losses-of-distribution-line/">https://electricalnotes.wordpress.com/2014/03/01/calculate-technical-losses-of-distribution-line/</a>
10	<a href="https://blog.se.com/energy-management-energy-efficiency/2013/03/25/how-big-are-power-line-losses/">https://blog.se.com/energy-management-energy-efficiency/2013/03/25/how-big-are-power-line-losses/</a>
11	<a href="https://blog.se.com/access-to-energy/2018/06/29/effective-power-distribution-and-asset-monitoring-can-shelve-off-losses-in-transformer-services/">https://blog.se.com/access-to-energy/2018/06/29/effective-power-distribution-and-asset-monitoring-can-shelve-off-losses-in-transformer-services/</a>
12	<a href="https://instrumentationforum.com/t/working-principle-of-trivector-meter/6996">https://instrumentationforum.com/t/working-principle-of-trivector-meter/6996</a>
13	<a href="https://www.youtube.com/watch?v=ZP-Gv ERN7k">https://www.youtube.com/watch?v=ZP-Gv ERN7k</a> , <a href="https://www.youtube.com/watch?v=SgMhJQdVONQ">https://www.youtube.com/watch?v=SgMhJQdVONQ</a>
14	<a href="https://dhbvn.org.in/staticContent/tender/mm/specification/spec-cmri-453.pdf">https://dhbvn.org.in/staticContent/tender/mm/specification/spec-cmri-453.pdf</a>
15	<a href="https://www.youtube.com/watch?v=SgMhJQdVONQ">https://www.youtube.com/watch?v=SgMhJQdVONQ</a>
16	<a href="https://www.aimil.com/products/digital-fault-recording-systems">https://www.aimil.com/products/digital-fault-recording-systems</a>
17	<a href="https://www.gegridsolutions.com/multilin/catalog/ddfr.htm">https://www.gegridsolutions.com/multilin/catalog/ddfr.htm</a>
18	<a href="https://www.watelectrical.com/what-is-a-capacitor-bank-working-and-its-calculation/">https://www.watelectrical.com/what-is-a-capacitor-bank-working-and-its-calculation/</a>
19	<a href="https://www.gegridsolutions.com/hvmv equipment/catalog/high volt capacitor.htm#Ov7">https://www.gegridsolutions.com/hvmv equipment/catalog/high volt capacitor.htm#Ov7</a>
20	<a href="https://www.metartec.com/DataEditorUploads/R8%20-%20Capacitor%20banks%20and%20accessories.pdf">https://www.metartec.com/DataEditorUploads/R8%20-%20Capacitor%20banks%20and%20accessories.pdf</a>
21	<a href="https://www.youtube.com/watch?v=oKhKFALKDAE">https://www.youtube.com/watch?v=oKhKFALKDAE</a>
22	<a href="https://kptcl.karnataka.gov.in/storage/pdf-files/epra/mmdsystem.pdf">https://kptcl.karnataka.gov.in/storage/pdf-files/epra/mmdsystem.pdf</a>
23	<a href="https://kptcl.karnataka.gov.in/storage/pdf-files/epra/Maintenance%20Schedule.pdf">https://kptcl.karnataka.gov.in/storage/pdf-files/epra/Maintenance%20Schedule.pdf</a>
24	<a href="https://kptcl.karnataka.gov.in/storage/pdf-files/epra/HAND%20Book%20Of%20manitenance%20Schedule%20For%20Staions%20&amp;Transsion%20Lines.pdf">https://kptcl.karnataka.gov.in/storage/pdf-files/epra/HAND%20Book%20Of%20manitenance%20Schedule%20For%20Staions%20&amp;Transsion%20Lines.pdf</a>
25	Electrical Design Estimating and Costing. K.B.Raina & K.Battacharya. Khanna Publications
26	Electrical Installation Estimating and Costing. J.B.Gupta, S.K.Kataria and Sons

### **8.1 CIE-4 Skill Test Scheme of Evaluation**

<b>SL. No.</b>	<b>Particulars/Dimension</b>	<b>CO</b>	<b>Marks</b>
1	Portfolio evaluation of Practice Sessions(1-6weeks)		10
2	1.Identify Aerial Bunched Cables used in distribution systems. 2.Identify various conductors (ACSR, AAC, AAAC)	2	10
3	Demonstrate Installation of the pin type insulator on LT overhead line.	2	15
4	Test the underground cables for open, short circuit & ground fault and also check insulation resistance. Explain the scope of IEC-60502-1 and IEC-60502-2	20 5	25
5	Demonstrate simulation of a given three-phase short transmission line 1. Manual calculation and simulated values (Voltage and power at the receiving end). 2. Manual calculation and simulated values (Voltage regulation and transmission efficiency).	05+10 05+10	1 30
6	Viva-voce		10
<b>Total Marks</b>			<b>100</b>

### **8.2 CIE-5 Skill Test Scheme of Evaluation**

<b>SL. No.</b>	<b>Particulars/Dimension</b>	<b>CO</b>	<b>Marks</b>
1	Portfolio evaluation of Practice Sessions (7-12 Week)		10
2	Presentation on substation visit <b>OR</b> distribution line maintenance . a. Report b.Presentation	2 10+20	30
3	Prepare estimation for the given problem manually <b>OR</b> using estimation simulation software	3	30
4	Calculate the size of capacitor bank required at given substation		10
5	Interpret given layout drawings of (220kV, OR 110kV OR 66kV) outdoor substations.	2	10
6	Viva-Voce		10
<b>Total Marks</b>			<b>100</b>

### **8.3 SEE Scheme of Evaluation**

<b>SL. No.</b>	<b>Particulars/Dimension</b>	<b>CO</b>	<b>Marks</b>
1	Report of Substation visit and Distribution line maintenance.		10
2	1.Identify different types of HT/LT cables 2. Identify the type of HT/LT line insulators 3. Identify various sizes of copper wires and cable insulation FR/FRLS/FRLSH.	2	15
3	Demonstrate termination of LT/HT cables <b>OR</b> Demonstrate cable glanding	2	35
4	Verify the case study for correct Observation and recommend suggestions for the Case on operation of <b>11KV/440V</b> distribution system. <b>OR</b> Verify the case study for correct Observation and recommend suggestions for the Case on <b>distribution line maintenance</b>	2 10+05	20
5	Viva voce		20
<b>Total Marks</b>			<b>100</b>

**9. Equipment/software list with Specification for a batch of 20 students**

Sl. No.	Particulars	Specification	Quantity
1	Trivector energy meter		1
2	Common Meter Reading Instrument (CMRI)		1
3	Distributed Digital Fault Recorder (DDFR)		1
4	SBM (Spot billing machine)		1
5	Capacitor Banks		1
6	GNU Octave/ SCI LAB /PSCAD /MATLAB software		20
7	Electrical Estimation software		20