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Program	Engineering
Specialization	Electrical Installations and Equipment
Course Number	<b>020303111</b>
Course Title	Electrical power transmission and distribution networks
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

□ **Brief Course Description:**

This Course covers ; calculation of networks parameters " R-L-C" for 1- phase and 3- phase networks, equivalent circuits for transmission lines, representation of lines, types of conductors & cables.

Calculation of; power, voltage drop, efficiency and voltage regulation for transmission & distribution networks. Towers, insulators, AC & DC distribution networks, Substations; types, equivalents & devices.

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□ **Course Objectives:**

The student should be able to ;

1. Name & describe the components of power system.
2. Know the materials used in, cables, towers and overhead lines.
3. Determine the span between two towers & factors effecting it.
4. Detect the faults in system components.
5. Describe and maintain substations.
6. Describe the different types of distributors & feeders.
7. Calculate; the voltage, voltage drop, current, power & efficiency of transmission & distribution networks.

□ Detailed Course Description:

Unit Number	Unit name	Content	Time Needed
1.	<b>Overhead Transmission lines</b>	<ul style="list-style-type: none"> <li>▪ Introduction.</li> <li>▪ Parameters and characteristics (r-L-C)</li> <li>▪ Conductors used in overhead lines; clamp &amp; joint. Equilibrium of suspended wire, conductor sloop, wind and ice load on conductors, ampacity.</li> <li>▪ Corona phenomenon in overhead lines</li> <li>▪ Skin effect phenomenon of conductors</li> </ul>	
2.	<b>Lumped parameters of transmission lines &amp; equivalent circuits</b>	<ul style="list-style-type: none"> <li>▪ Short transmission lines and its equivalent circuit</li> <li>▪ Medium transmission lines and its equivalent circuits</li> <li>▪ Long transmission line identification</li> <li>▪ Sending values versus to receiving values of lines.</li> <li>▪ Vectorial diagram for each type of transmission lines</li> </ul>	
3	<b>Towers and poles</b>	<ul style="list-style-type: none"> <li>▪ Types of towers and poles according to its material.</li> <li>▪ Span between two towers &amp; the factors affecting it.</li> <li>▪ Tower head determination.</li> <li>▪ Single circuit towers.</li> <li>▪ Double circuit towers.</li> <li>▪ The sag of conductor &amp; factors affecting it</li> </ul>	

<b>4</b>	<b>Insulators</b>	<ul style="list-style-type: none"><li>▪ General</li><li>▪ Material properties.</li><li>▪ Types of insulators; cap and pin insulators, long rod insulators, post type, barrel type, insulator sets</li><li>▪ Electrical characteristics</li></ul>	
<b>5</b>	<b>High voltage cables</b>	<ul style="list-style-type: none"><li>▪ Introduction; structure, voltage ratings, uses of cables, AC&amp;DC cables</li><li>▪ Cables type</li><li>▪ The components of polymeric cable; conductors, insulation system, containment and protection.</li><li>▪ Medium voltage distribution cables; conductors; insulation system, containment and protection</li><li>▪ Testing of cables; special testing, routing testing &amp; site testing</li><li>▪ Cable manufacture; stages of cable manufactures; methods of core manufacture</li></ul>	

6	<b>Electrical substations and components</b>	<ul style="list-style-type: none"> <li>▪ The power transformers; types, winding arrangements, cooling, oil considerations</li> <li>▪ Commissioning, faults and maintenance of power transformers</li> <li>▪ Tap change and automatic voltage control, commissioning and maintenance</li> <li>▪ Switch gear control systems; interlocking, synchronizing and auto switching</li> <li>▪ Circuit breakers; types, commissioning and maintenance</li> </ul>	
7	<b>Substation power supplies</b>	<ul style="list-style-type: none"> <li>▪ Accumulative batteries; function &amp; importance</li> <li>▪ Battery system fundamentals</li> <li>▪ Battery commissioning</li> <li>▪ Methods of battery charging</li> <li>▪ DC relays and trip coils</li> </ul>	
8	<b>Electrical distribution systems</b>	<ul style="list-style-type: none"> <li>▪ AC &amp; DC Two – wires systems; (voltage drop, currents power losses &amp; materials weight) calculations</li> <li>▪ AC&amp;Dc three wires systems; (voltage drop, currents, power losses &amp; materials weight) calculations</li> <li>▪ Three- phase four – wires system ;( voltage drop, currents, power losses &amp; materials weight) calculations.</li> <li>▪ Comparison between previous systems</li> </ul>	

<b>9</b>	<b>Transmitted Electrical Power and Losses</b>	<ul style="list-style-type: none"> <li>▪ Apparent power</li> <li>▪ Active power</li> <li>▪ Reactive power; causes, results, compensation, generation and consumption</li> <li>▪ Power losses; active power losses, reactive power losses and efficiency of transmission lines</li> </ul>	
<b>10</b>	<b>Electrical diagrams of generation &amp; distribution stations</b>	<ul style="list-style-type: none"> <li>▪ Primary diagram ( one line diagrams)</li> <li>▪ Secondary diagrams</li> <li>▪ Operation diagrams</li> <li>▪ Bus bars systems; single bus bars system, divided single bus bars system, double bus bar system and ring bus bars system</li> </ul>	

**Evaluation Strategies:**

		Percentage	Date
1. Exams	First Exam		--/--/----
	Med- Term Exam	20%	--/--/----
	Assignments	30%	
	Final Exam	50%	--/--/----

**Teaching Methodology:**

1. Lectures
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□ **Textbook:**

Electrical Power Transmission & distribution; Luces M.Faul- Kenberry, 1996.

□ **References:**

1. Electrical Power Technology; D. Tyler, 1998.
2. Power system commissioning g & maintenance; K. Harker, 1998.
3. High voltage Engineering & testing; H.M. Ryan, 2001.
4. Distribution switchgear; S.Stewart, 2004.
5. Advanced in High Voltage Engineering; M. Haddad & D. Warne, 2004.