KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No.   : EE C202
Course Title   : Power System-I
Course Structure : 3-1-0
Course coordinator : Mr P Sankar
Instructors   : SVNL Lalitha, B. Rajaphanithi, N.Madhigandhan
,**M.Venugopal Rao, G. Durgaprasad Rao,**

1. Course Description:

      Electricity is modern society's most convenient and useful form of energy. The subject matter is divided into 5 chapters covering duly-recognized areas of theory and study.

      Unit 1: The chapters begin with different electrical energy sources and organization of power sector in India and typical parts of hydel, thermal, nuclear stations in a schematic single line diagram. The non-conventional method of power generation is included.

      Unit 2: This unit starts with classification of line conductors and to find transmission line parameters like inductance, resistance and capacitance.

      Unit 3: This unit deals with modeling of different power system components like synchronous machines, transmission lines, transformers and electrical utility. Unit ends with per unit representation of all above components.

      Unit 4: This unit deals with transmission line classification based on distance, to find ABCD parameters to study Surge Impedance Loading of Long Lines, Wave Length and Velocity of Propagation of Waves, Ferranti effect, Corona, factors affecting corona, critical voltages and power loss; Radio interference due to Corona.

      Unit 5: This unit deals with classification of different insulators to find sag, string efficiency and Methods for improvement, calculation of string efficiency, Capacitance grading and Static Shielding. It ends with underground cables classification, to calculate stress on sheath of cables.

2. Scope and Objective of the Course:

      The objective is to instill confidence and understanding of those concepts of generation of electric power, transmission and distribution that are likely to be encountered in the study and practice of electric power engineering. The coverage, however is quite comprehensive and spans a wide range of topics commonly encountered in electric power system engineering practice. In this regard, student after the completion of the course, should be able to solve electric utility and other industry based engineering problems

3. Books:
  (i) Textbook:
      a. **I. J. Nagarath and D.P Kothari** "Modern Power System Analysis, Tata Mc Graw-Hill publications, 2nd Edition".   ISBN: 0073404551
      b. **C. L. Wadhwa** "Electrical Power Systems, John. Wiley and Sons publications, 2nd Edition .ISBN: 0-470-21808-8

(ii) Reference Book:
   a. **J B Gupta** "A Course in Power Systems, S. K. Kataria & Sons publications,2005. ISBN:8188458538
   b. **Soni, Gupta and Bhatnagar** "A Course in Electric Power, Dhanpat Rai & Sons publications, 2001. ISBN: 0521453097
   c. **W.D.Stevenson** "Elements of Power System Analysis, McGraw Hill publications , 4th Edition, 1955. ISBN: 1594200696
   d. **S.N.Singh** "Electric Power Generation, Transmission & Distribution, PHI, 2003 ISBN: 8120335600

4. Syllabus:

UNIT – I

INTRODUCTION:
Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations. Choice of Electrical power generation.

ELECTRICAL POWER GENERATION: thermal power stations: layout, turbo-generators. Hydroelectric Stations: general arrangement and operation of hydroelectric plants and its function. Nuclear Power Stations: Principles of nuclear power station. An overview of non-conventional energy resources.

UNIT– II

TRANSMISSION LINE PARAMETERS:

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines.

UNIT – III

REPRESENTATION OF POWER SYSTEM COMPONENTS: Introduction, Single-phase solution of balanced three-networks, Modeling of synchronous machines, transmission lines, two winding transformers and loads, the one-line Diagram, Impedance and reactance diagram, Per Unit System, Selection of base and changing the base, advantages of PU system

UNIT – IV

TRANSMISSION LINE THEORY: Introduction, short transmission line, medium transmission line, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations, Surge Impedance Loading of Long Lines, Wave Length and Velocity of Propagation of Waves, Ferranti effect, Corona, factors affecting corona, critical voltages and power loss; Radio interference due to Corona

UNIT – V

INSULATORS: Types of Insulators, String efficiency and Methods for improvement, calculation of string efficiency, Capacitance grading and Static Shielding. Introduction to mechanical sag

UNDERGROUND CABLES: Types of cables, capacitance grading, capacitance of three core belted type cable, stress in a three-core cable, sheath effects, currents in bonded sheaths, electrical equivalent of sheath circuit.

5.Course Plan:

Lecture No.	Learning objective At the end of the session the student should be able to	Content	Reference
1	Know about How to generate electrical power generation	Introduction to electrical power generation	T1 Pg1-40
2	study different energy sources	Electrical energy sources	T1 pg13-25
3	know the current status of power sector in India	Organization of power sector in India	T1 pg29-31, pg40-43
4	study the working of thermal power station	Thermal power station	T1 pg 13-16
5	study the working of nuclear power station	Nuclear power station	T1 pg 19-24
6	study the working of Hydro electric power station	Hydel power station	T1 pg 17-19
7	motivate for utilization of NCES	Non conventional energy sources	T1 pg 25-29
8	Optimize the generation of power	Comparison and choice of electrical power generation	
9	Get overview on power system generation	Conclusion	
10	Calculate resistance for solid conductors	Types of conductors - resistance for solid conductors	T1 pg51-53
11	Calculate Inductance for single phase and three phase, single and double circuit lines	Inductance for single phase and three phase, single and double circuit lines	T1 pg 45-68
12	Calculate Inductance for single phase and three phase, single and double circuit lines	Inductance for single phase and three phase, single and double circuit lines	T1 pg45-68
13	Calculate G.M.D. and G.M.R for different structure of transmission lines	G.M.R and G.M.D	T1 pg 45-68
14	Calculate capacitance for 2 wire and 3 wire systems.	Capacitance for 2 wire and 3 wire systems.	T1 pg76-93
15	Calculate capacitance for 2 wire and 3 wire systems with effect of ground.	Effect of ground on capacitance	T1 pg 76-93

16	Calculate capacitance for symmetrical single and three phase, single and double circuit lines.	Capacitance calculations for symmetrical single and three phase, single and double circuit lines.	T1 pg 76-93
17	Calculate capacitance for asymmetrical single and three phase, single and double circuit lines.	Capacitance calculations for asymmetrical single and three phase, single and double circuit lines.	T1 pg 76-93
18	Calculate transmission line parameters	Conclusion	
19	Draw complete diagram of a power system representing all three phase network.	Single-phase solution of balanced three-networks	T1 pg 95-98
20	Model synchronous machine	Modeling of synchronous machines	T1 pg 108-121
21	Model transformers	Modeling of transformers	T1 pg 99-103
22	Model different loads	Modeling of loads	T1 pg 121-125
23	Model transmission line	Modeling of transmission lines	T1 pg
24	Represent power system by means of simple symbols	one-line Diagram, Impedance and reactance diagram	T1 pg98-99
25	Study the importance of per unit system.	Per Unit System, Selection of base and changing the base, advantages of PU system	T1 pg 99-103
26	Draw an impedance diagram on a per unit basis.	Problems on per unit system to calculate reactance of all power system components	T1 pg 122-127
27	Representation of power system components	Conclusion	T1 pg 97-127
28	Find ABCD parameters and regulation of Short transmission line	Short transmission line	T1 pg 128-136
29	Find ABCD parameters and regulation of medium transmission line	Medium transmission line	T1 pg 137-139
30	Find ABCD parameters and regulation of long transmission line	Long transmission line	T1 pg 139-147
31	Derive surge impedance loading condition	Surge Impedance Loading of Long Lines	T1 pg 143-147
32	Derive wave length and velocity of propagation of waves for SIL	Wave Length and Velocity of Propagation of Waves	T1 PG 143-147
33	Study corona, Ferranti	Ferranti effect, Corona,	T1 pg 150-

	effect	factors affecting corona	151, T2 Pg 135-145
34	Derive critical voltage and power loss	critical voltages and power loss; Radio interference due to Corona	T2 pg 135-146
35	Find regulation using ABC D parameters	Conclusion	
36	Determine string efficiency	Types of Insulators, String efficiency	T2 pg 169-183
37	Determine string efficiency	Problems on string efficiency	T2 pg 169-183
38	Improve string efficiency	Methods for improvement of string efficiency	T2 pg 169-183
39	Improve string efficiency	Capacitance grading, Static Shielding	T2 pg 169-183
40	Determine sag for a transmission line supported between two poles	Mechanical sag	T2 150-168
41	Study different types of cables and their construction	Types of cables, capacitance grading	T2 184-221
42	Calculate Capacitance of three core belted type cable	Capacitance of three core belted type cable	T2 184-221
43	Identify effects of sheath with different voltage levels	sheath effects	T2 184-221
44	Find Electrical equivalent of sheath for different cables	Electrical equivalent of sheath circuit	T2 184-221
45	Find Electrical equivalent of sheath for different cables	Conclusion	

6.Self learning material:

S.NO.	SELF LEARNING TOPIC	REFERENCE
1	Choice of electrical power generation	M.M. El-Wakil , "Power plant technology"
2	Overview of non conventional energy resources	M.M. El-Wakil , "Power plant technology"
3	Capacitance calculation for symmetrical single and three phase, single double circuit lines	M.L.Soni, P.V.Gupta, U.S.Bhatnagar, Power System Engineering
4	Reactance diagram of power system	W.D.Stevenson "Elements

	components	of Power System Analysis"
5	Selection of base and advantage of P.U. system	W.D.Stevenson "Elements of Power System Analysis"
6	Corona	C.L. Wadhwa, "Electrical Power Systems"
7	Factor effecting corona	C.L. Wadhwa, "Electrical Power Systems"
8	Radio interference due to corona	C.L. Wadhwa, "Electrical Power Systems"
9	Types of insulators	J B Gupta "A Course in Power Systems
10	Mechanical sag calculation	J B Gupta "A Course in Power Systems
11	Types of cables	J B Gupta "A Course in Power Systems

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	10	10	10-08-2010 9.30 to 10.20 A.M	CSE001,004, 005,101,102, 105,106,201, 204,205,301, 509, NSH
Test-2	50 Min	10	10	14-09-2010 9.30 to 10.20 A.M	CSE001,004, 005,101,102, 105,106,201, 204,205,301, 509, NSH
Assignement submission		5	5	Continuous	
Assignment Test	50 Min	5	5	26-10-2010 9.00 to 10.20 A.M	CSE001,004, 005,101,102, 105,106,201, 204,205,301, 509, NSH
Quiz	30 Min	5	5	26-10-2010 9.00 to 10.20 A.M	CSE001,004, 005,101,102, 105,106,201, 204,205,301, 509, NSH
Regular Lab Evaluation	Continuous	0	0		
Comprehensive Lab Exam	3 Hrs	0	0		

Comprehensive Exam	3 Hrs	60	60		
Attendance for Theory & Tutorial		5	5	Continuous	
Attendance for Lab		0	0	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

10.Tutorial: Tutorial will be conducted by the respective in charge faculty. The tutorials are planned to supplement the material taught in the lectures and clear doubts. Student must attend registered section for tutorial in the respective classroom. Class assignment, class tests and other evaluation components will also be conducted during tutorials. Students must actively participate in the tutorial and come prepared for it.

Course Coordinator