Electrical Engineering, IV-Semester

EE-4005 Power System-I

COURSE OBJECTIVE

The objective of this course is to get an overview of the power systems and its changing landscape. It covers the characteristics of various power system loads, analysis of transmission line along with its performance.

COURSE CONTENT

An overview of Electrical Energy Generation General background, structure and components of power network. Power generation – Introduction to conventional, non-conventional & distributed generation, Effect of transmission voltage on power system economy. Selection of size of feeder. Comparison of isolated versus interconnected power system. Problems associated with modern large interconnected power system. Power Plant Economics - Load curves, base load, peak load, load factor, demand factor, diversity factor, capacity factor, utilization factor, cost of electricity, capital cost, fuel and operation cost.

Transmission Line Components & Under Ground Cabling:

Inductance resistance and capacitance of transmission line, Calculation of inductance for 1-**Φ** and 3-**Φ, Single and double circuit line, Concept of GMR and GMD, Symmetrical &**

asymmetrical conduction configuration, Calculation of capacitance for 2 wire and 3 wire systems, Effect of ground or capacitance, Capacitance calculation for symmetrical and asymmetrical 1-phase and three phase, Single and double circuit line, Charging current, Transposition of line, Composite conductor, Skin and proximity effect, bundle conductor. Underground Cable Comparison of cables and overhead transmission lines, Classification of cables, requirement of cable construction, capacitance of single and multi-core cable, economic core diameter, dielectric stress in cable, Grading of cables, ionization of Heating of cables, Phenomena of dielectric losses and sheath loss in cables, Thermal resistance of cables.

Transmission systems & performance of transmission line:

Various systems of transmission, effect of system voltage, comparison of conductor materials

required for various overhead systems. Short, Medium & long transmission line and their **representation, Nominal T, Nominal Л, Equivalent T and equivalent Л, network models, ABCD**

constants for symmetrical &asymmetrical network, Mathematical solution to estimate regulation & efficiency of all types of lines. Surge Impedance, loading, Interpretation of long line equation and its equivalent equation. Tuned power lines. Power flow through transmission line, Circle diagram, Method of voltage control, Static & rotating VAR generator, transformer control.

Insulator & Mechanical design, types of conductors used in overhead transmission line, Types of line supports and towers, Distribution of conductors over transmission towers, Spacing between conductors, Length of span and sag tension calculation for transmission line, Wind & ice loading, support of line at two different levels, string chart, Sag template, Stringing of conductor, Vibration and Vibration dampers. Insulator Materials used for transmission line insulations, Types of insulator for overhead transmission line failure of insulator, Voltage distribution of suspension insulator, String efficiency, Shielding and grading.

Voltage control & Distribution system:

AC single phase, 3 phase, 3 wire & 4 wire distribution, Kelvin's law for most economical size of conductor Substation layout showing substation equipment, bus bar single bus bar and sectionalized bus bar, main and transfer for bus bar system, sectionalized double bus bar system, ring mains.

COURSE OUTCOME

Student after successful completion of course must possess an understanding of Power generation, Transmission Line Components, Underground Cables, transmission lines and their representation, conductors and insulators.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

1. John Grainger and William Stevenson, Power system Analysis, McGraw Hill.
2. C.L. Wadhwa, Electrical Power System Analysis, New Age International.
3. D.P. Kothari, I.J. Nagrath, Power System Engineering TMH II Ed. Reprint 2009.