Lecture Plan -1

Doc. No.: DCE/0/15
Revision :00
Semester:-4th Course Code:- EE-212-F

Subject: - T & D Section: A

S. No.	Topic :- INTRODUCTION TO POWER SYSTEM	Time Allotted:-
1.	**Introduction** Modern electric power systems have three separate components - generation, transmission and distribution. Electric power is generated at the power generating stations by synchronous alternators that are usually driven either by steam or hydro turbines. .	5 min
2	**Division of the Topic** -Introduction to generation,transmission,distribution -Description of generating stations -Description of Transmission Lines -Description of Distribution System	35 min
3.	**Conclusion** In this lecture, a brief idea of generation, transmission and distribution of electrical power is Given. Nonetheless, it gives a reasonable understanding of the system for a beginner going to undertake the course on power system.	5 min
4	**Questions / Answers** **Q1**. What are the important conventional methods of power generation in out country? **A1**.(a) Coal based thermal plants, (b)Hydel plants © nuclear plants. .	5min

Assignment to be given:- NIL
Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -2

Semester:-4th Course Code:- EE-212-F

Subject:-T&D Section: A

S. No.	Topic :- STRUCTURE OF A POWER SYSTEM	Time Allotted:-
1.	**Introduction** **A power plant generates electricity** at approximately 25,000 volts. Transmission lines can carry higher voltages than the plant generates – up to 765,000 V - so a transformer steps up the voltage for the transmission lines. Higher voltages mean less current for the same amount of power, so wires can be smaller and cost less, but higher voltages need more insulation, which is more costly and limits the voltages carried by transmission lines.	5 min
2	**Division of the Topic** generating plant transmission system subtransmission system distribution system	35 min
3	**Conclusion** Most of the major industrial customers have their own transformers to step down the 66 kV supply to their desired levels. The motivation for these voltage changes is to minimize transmission line cost for a given power level. Distribution systems are designed to operate for much lower power levels and are supplied with medium level voltages.	5 min
4	**Questions / Answers** **Q1**..What are the basic structure of power system? **A1**. 1) generating plant 2) transmission system 3) subtransmission system 4) distribution system	5min

Assignment to be given:- Nil

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15

Revision :00

Lecture Plan -3

Semester:-4th Course Code:- EE-212-F

Subject:-T & D Section: A

S. No.	**TOPIC:** indoor and outdoor substations, equipment for substations, layout, auxiliary supply.	**Time Allotted:-**
1.	**Introduction** Basically an electrical substation consists of number of incoming ckt. and outgoing ckt. connected to a common Bus-bar systems. A substation receives electrical power from generating station via incoming transmission lines and delivers elect. power via the outgoing transmission lines.	5 min
2	**Division of the Topic** -Element of substation -Types of substation -Substation layout -Types of supply	35 min
3.	**Conclusion** Substations generally have switching, protection and control equipment, and transformers. In a large substation, circuit breakers are used to interrupt any short circuits or overload currents that may occur on the network. Smaller distribution stations may use recloser circuit breakersor fuses for protection of distribution circuits.	5 min
4	**Questions / Answers** **Q1.** Explain types of substation.` **A1.1)** Transmission substation 2) Distribution substation 3) Collector substation 4) Converter substations	

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Assignment to be given:- Numerical related to positive ,negative and zero sequence.

Reference Reading:-

1. Electrical Power System – C.L.Wadhwa

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -4

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: A

S. No.	TOPIC: Radial, ring mains and network distribution system	Time Allotted:-
1.	**Introduction** The main function of an **electrical power distribution system** is to provide power to individual consumer premises. Distribution of electric power to different consumers is done with much low voltage level.	5 min
2.	**Division of the Topic** Radial Distribution System Loop/Ring Distribution System Network Distribution System	35 min
3.	**Conclusion** A power distribution system includes all parts of an electrical system between the power source and the customer's service entrance. The power source may be either a local generating plant or a high-voltage transmission line feeding a substation that reduces thehigh voltage to a voltage suitable for local distribution.	
4	**Questions / Answers** **Q1.** What are the main parts of distribution system? A1. Distribution substation, Primary distribution feeder, Distribution Transformer, Distributors, Service mains.	5 min 5min

Assignment to be given:- NIL

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -5

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: A

S. No.	TOPIC comparison of various types of ac and dc systems	Time Allotted:-
1.	**Introduction** When comparing AC and DC distribution, there is an assumption that we are comparing two alternative approaches. However, there are actually at least 5 power distribution designs that are commonly discussed during these comparisons, each with different efficiencies, costs, and limitations.	5 min
2	**Division of the Topic** -Advantage of DC system - Advantage of AC system - Disadvantage of DC system - Disadvantage of DC system	35 min
3.	**Conclusion** Power distribution to Information Technology equipment in a data center or network room can be accomplished using AC or DC power. AC power is typically distributed at the local mains voltage of 120 V, 208 V, or 230 V. DC power is typically distributed at the telecommunications standard voltage of 48 V.	5 min
4	**Questions / Answers** **Q1.** Which quantities are compared? **A1**. 1) Efficiency. 2) Electric and magnetic radiated field characteristics. 3) Complexity, as reflected by each systems piece-parts cost.	5min

Assignment to be given:-Nil

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -6

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	TOPIC: Calculation of line parameters	Time Allotted:-
1.	**Introduction** An electric transmission line can be represented by a series combination of resistance,inductance and shunt combination of conductance and capacitance.	5 min
2	**Division of the Topic** -Inductance of two-wire transmission line -Flux linkage of one conductor in a group of conductors -Inductance of 3-phase unsymmetrical spaced transmission line -Composite Conductors -Bundled conductor	35 min
3.	**Conclusion** **The basic difference between a composite** Conductors and Bundled conductor is that sub-conductors of a bundled conductor are separated From each other by a distance of almost 30 cms and the wire of Composite Conductor touch each other.	5 min
4	**Questions / Answers** Q1 . Define GMD. A1 GMD of a point w.r.t a no of points is the GMD between that point and each of other point. Q2 Write the advantage of bundle conductors. A2 1) Reduced reactance 2) Reduced voltage gradient 3) Reduced corona loss 4) Reduced surge impedance	5min

Assignment to be given:- Assignment II given as enclosed

Reference:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -7

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	TOPIC: Ferranti effect, proximity effect	Time Allotted:-
1.	**Introduction** the Ferranti effect is an increase in voltage occurring at the receiving end of a long transmission line, above the voltage at the sending end. This occurs when the line is energized, but there is a very light load or the load is disconnected.	5 min
2	**Division of the Topic** - Ferranti effect -Proximity effect -Skin effect	35 min
3.	**Conclusion** Proximity Effect is a phenomenon which is observed in conductors carrying alternating current. When a conductor carries ac power, the constantly varying magnetic field induces eddy currents in the nearby conductors..	5 min
4	**Questions / Answers** **Q1** What is skin effect? **A1** Skin Effect refers to the tendency of alternating current(AC) to flow along the outer surface(skin) of the conductor rather than through the entire cross-section of the conductor. Q2 What is the cause of Skin effect? A2 Skin Effect is caused due to eddy currents form due to the magnetic fields created when current flows through the conductor.	5min

Assignment to be given:- Numerical based on L-L-G faults

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -8

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	**Topic:-** models of short	**Time Allotted:-**
1.	**Introduction** The transmission lines which have length less than 80 km are generally referred as short transmission lines.For short length, the shunt capacitance of this type of line is neglected and other parameters like electrical resistance and inductor of these short lines are lumped.	5 min
2	**Division of the Topic** -Equivalent circuit -Phasor diagram -Calculation of parameters	35 min
3.	**Conclusion** Any electrical network generally has two input terminals and two output terminals. If we consider any complex electrical network in a black box, it will have two input terminals and output terminals. This network is called two – port network.	5 min
4	**Questions / Answers** Q1 What is Transmission line? A1A transmission line is a set of conductors being run from one place to another supported on transmission towers. Q2 What is the length of short transmission lines? A2 less than 80 km.	5min

Assignment to be given:- Numerical on short transmission line

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Lecture Plan -9

Doc. No.: DCE/0/15
Revision :00

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	TOPIC: models of medium transmission lines	Time Allotted:-
1.	**Introduction** The transmission line having its effective length more than 80 km but less than 250 km, is generally referred to as a medium transmission line. Due to the line length being considerably high, admittance Y of the network does play a role in calculating the effective circuit parameters, unlike in the case of short transmission lines	5 min
2	**Division of the Topic** -Nominal - T -Nominal –π Equivalent circuit -Phasor diagram -Calculation of parameters	35 min
3.	**Conclusion** In case of a nominal Π representation, the lumped series impedance is placed at the middle of the circuit where as the shunt admittances are at the ends. In the nominal T model of a medium transmission line the lumped shunt admittance is placed in the middle, while the net series impedance is divided into two equal halves and and placed on either side of the shunt admittance.	5 min
4	**Questions / Answers** **Q1** What are the two different models. **A1**. 1)Nominal Π representation. 2)Nominal T representation. ’ **Q2** What is the length of medium transmission lines? A2 more than 80 km but less than 250 km	

Assignment to be given:- Numerical on medium transmission line

Reference Readings:-

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -10

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	TOPIC: models of long transmission lines	Time Allotted:-
1.	**Introduction** A power transmission line with its effective length of around 250 Kms or above is referred to as a **long transmission line**. Calculations related to circuit parameters (ABCD parameters) of such a power transmission is not that simple, as was the case for a short transmission line or medium transmission line.	5 min
2	**Division of the Topic** Equivalent circuit -Phasor diagram -Calculation of parameters	35 min
3.	**Conclusion** a) Ignoring the shunt admittance of the network, like in a small transmission line model. b) Considering the circuit impedance and admittance to be lumped and concentrated at a point as was the case for the medium line model. .	5 min
4	**Questions / Answers** **Q2** What is the length of long transmission lines? A2 Above 250 km	5min

Assignment to be given:-Nil
Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -11

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: B

S. No.	TOPIC: capacity of synchronous condenser	Time Allotted:-
1.	**Introduction** a synchronous condenser (sometimes called a synchronous capacitor or synchronous compensator) is a device identical to a synchronous motor, whose shaft is not connected to anything but spins freely.	5 min
2	**Division of the Topic** -Synchronous Condenser -v curve - overexcited synchronous condenser	35 min
3.	**Conclusion** A synchronous condenser provides step-less automatic power factor correction with the ability to produce up to 150% additional vars. The system produces no switching transients and is not affected by system electrical harmonics **Questions / Answers**	5 min
4	**Q1 What is v curve?** **Ans** The variations of I with excitation are known as V curves because of their shape.	5min

Assignment to be given:-Nil

Reference Readings:-

1.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -12

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: C

S. No.	TOPIC: Sag and stress calculations	Time Allotted:-
1.	**Introduction** While erecting an overhead line, it is very important that conductors are under safe tension. If the conductors are too much stretched between supports in a bid to save conductor material, the stress in the conductor may reach unsafe value and in certain cases the conductor may break due to excessive tension	5 min
2	**Division of the Topic** -Calculation of Sag When supports are at equal levels. When supports are at unequal levels.	35 min
3.	**Conclusion** In order to permit safe tension in the conductors, they are not fully stretched but are allowed to have a dip or sag. The difference in level between points of supports and	5 min
4	**Questions / Answers** **Q1** What is sag? **A1** The difference in level between points of supports and the lowest point on the conductor is called sag.	5min

Assignment to be given:- NIL

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -13

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: C

S. No.	Topic: effect of ice and wind, dampers	Time Allotted:-
1.	**Introduction** The above formulae for sag are true only in still air and at normal temperature when the conductor is acted by its weight only. However, in actual practice, a conductor may have ice coating and simultaneously subjected to wind pressure. The weight of ice acts vertically downwards i.e., in the same direction as the weight of conductor.	5 min
2	**Division of the Topic** Sag Calculation Vibration Damper Stringing chart The set of curves in the sag template	40 min
3.	**Conclusion** The force due to the wind is assumed to act horizontally i.e., at right angle to the projected surface of the conductor. Hence, the total force on the conductor is the vector sum of horizontal and vertical forces	5 min

Assignment to be given:- NIL
Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -14

Semester:- 4 Course Code:-EE-212-F

Subject:-T & D Section: C

S. No.	TOPIC: INSULATORS	Time Allotted:-
1.	**Introduction** The insulators provide necessary insulation between line conductors and supports and thus prevent any leakage current from conductors to earth.	5 min
2	**Division of the Topic** -Pin type Insulator -Suspension type Insulator -)Strain Insulators -Shackle Insulators -Potential Distribution over Suspension Insulator String	35 min
3.	**Conclusion** The most commonly used material for insulators of overhead line is porcelain but glass, steatite and special composition materials are also used to a limited extent. Porcelain is produced by firing at a high temperature a mixture of kaolin, feldspar and quartz. It is stronger mechanically than glass, gives less trouble from leakage and is less affected by changes of temperature.	5 min
4	**Questions / Answer** Q1 What is insulator? A1 The insulators provide necessary insulation between line conductors and supports and thus prevent any leakage current from conductors to earth Q2 What are the type of insulators? A2: Pin type Insulator -Suspension type Insulator -Strain Insulators -Shackle Insulators	5min

Assignment to be given:- NIL
Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2. Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -15

Semester:-4 Course Code:-EE-212-F

Section: B

Subject:-T & D Section-C

S. No.	TOPIC: voltage distribution over insulator string, equalizer ring.	Time Allotted:-
1.	**Introduction** the voltage applied across the string of suspension insulators is not uniformly distributed across various units or discs. The disc nearest to the conductor has much higher potential than the other discs. This unequal potential distribution is undesirable and is usually expressed in terms of string efficiency. **Division of the Topic**	5 min
2	- string efficiency. - Methods of Improving String Efficiency (i) By using longer cross-arms. (ii) By grading the insulators (iii)By using a guard ring	35 min
3.	**Conclusion** potential distribution in a string of suspension insulators is not uniform. The maximum voltage appears across the insulator nearest to the line conductor and decreases progressively as the cross arm is approached	5 min
4	**Questions / Answer** Q1 What is insulator? A1 The insulators provide necessary insulation between line conductors and supports and thus prevent any leakage current from conductors to earth Q2 What are the type of insulators? A2: Pin type Insulator -Suspension type Insulator -Strain Insulators -Shackle Insulators	5 min

Assignment to be given:- NIL

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -16

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	TOPIC: Types of cables and their construction, dielectric stress	Time Allotted:-
1.	**Introduction** Electric power can be transmitted or distributed either by overhead system or by underground cables. The underground cables have several advantages such as less liable to damage through storms or lightning,	5 min
2	**Division of the Topic** -Insulated Cable -Underground Cables -Construction of Cables -Classification of Cables -Dielectric Stress in Cable	35 min
3.	**Conclusion** dielectric stress is maximum at the conductor surface and its value goes on decreasing as we move away from the conductor. It may be noted that maximum stress is an important consideration in the design of a cable.	5 min
4	**Questions / Answers** **Q1 What are** types of screened cables? **A1** H-type cables S.L. type cables	5min

Assignment to be given:- NIL

Reference Readings:-

1.Switchgear protection-B.Ram
2. Electrical Power System – C.L.Wadhwa

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -17

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	TOPIC: grading of cables,capacitance of single phase and three pha	Time Allotted:-
1.	**Introduction** The process of achieving uniform electrostatic stress in the dielectric of cables is known as **grading of cables.** electrostatic stress in a single core cable has a maximum value (g_{max}) at the conductor surface and goes on decreasing as we move towards the sheath.	5 min
2	**Division of the Topic** -Grading of Cables - capacitance grading. - Intersheath Grading - Capacitance of 3-core Cable	35 min
3.	**Conclusion** The capacitance of a cable system is much more important than that of overhead line because in cables (*i*) conductors are nearer to each other and to the earthed sheath (*ii*) they are separated bya dielectric of permittivity much greater than that of air.	5 min
4	**Questions / Answers** **Q1 What is grading of cables?** **A1.** The process of achieving uniform electrostatic stress in the dielectric of cables is known as **grading of cables** **Q2.What are** the two main methods of grading of cables:**?** **A2** (i) Capacitance grading ***(ii)*** Intersheath grading**.**	5min

Assignment to be given:- NIL
Reference Readings:-

1. Switchgear protection – B.Ram
2. Electrical Power System – C.L.Wadhwa

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -18

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	**TOPIC:** relay classification, principal types of electromagnetic relays, i.e. attracted armature, induction disc, induction cup types.	**Time Allotted:-**
1.	**Introduction** A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays . A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts	5 min
2	**Division of the Topic** - attracted armature relay -Balanced beam relay -Induction disc relay -Induction cup relay	35 min
3.	**Conclusion** The operation of such relay depends on whether the operating torque /force is greater than the restraining force.	5 min
4	**Questions / Answers** Q1 Describe pick up level. A1 The value of the actuating quantity which is on the threshold above which the relay operates. Q2. Describe reset level. A2 The value of current and voltage below which a relay opens its contacts and comes to original position.	5min

Assignment to be given:- NIL

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -19

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	Topic :- Over -current, instantaneous over current relays	Time Allotted:-
1.	**Introduction** Overcurrent protection is that protection in which the relay picks up when the magnitude of current exceeds the pickup level.The basic element in overcurrent protection is an overcurrent relay.	5 min
2	**Division of the Topic** Description of Overcurrent relay Description of instantaneous Overcurrent relay	35 min
3.	**Conclusion** Instantaneous over current relay is one in which no intentional time delay is provided for the operation. The time of operation of such relays is approximately .1 sec.	5 min
4	**Questions / Answers** Q1 Classify the various types of overcurrent relays. A1 1)Instantaneous overcurrent relay 2)Inverse time current relay 3) Inverse definite minimum timeovercurrent relay 4)very Inverse current relay 5) Extremely Inverse relay **Q2** Explain Reset time. A2 The time which elapses between the instant when the actuating quantity Becomes less than the reset value to the instant when the relay contact returns to its normal position**.**	5min

Assignment to be given:- Nil
Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -20

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	Topic :- Phenomenon, critical voltage, power loss of corona	Time Allotted:-
1.	**Introduction** One of the phenomena associated with all energized electrical devices, including high-voltage transmission lines, is corona. The localized electric field near a conductor can be sufficiently concentrated to ionize air close to the conductors. This can result in a partial discharge of electrical energy called a corona discharge, or corona.	5 min
2	**Division of the Topic** What is corona Source of Corona Types Of Corona Critical voltage Power loss of corona	35 min
3.	**Conclusion** Corona is a phenomenon associated with all transmission lines. Under certain conditions, the localized electric field near energized components and conductors can produce a tiny electric discharge or corona that causes the surrounding air molecules to ionize, or undergo a slight localized change of electric charge.	5 min
4	**Questions / Answers** **Q1 What is corona?** **A 1 Electric transmission lines can generate a small amount of sound energy as a result of corona.** **Q2 What is Merz-Price protection?** **A2** A current will flow through the operating coil of the relay and it will operate. This form of protection is known as Merz-Price protection.	5min

Assignment to be given:- Nil

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -21

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	Topic :- reduction in losses, radio-interference	Time Allotted:-
1.	**Introduction** The local electric breakdown of air or the corona is quite common on the high voltage power transmission line hardware. The operating stress is ideally lower than the corona inception levels, however, due to some manufacturing defects, damages caused during the transportation and installation, deposition of contaminants like dust particles or water droplets etc. .	5 min
2	**Division of the Topic** -Revision of corona -reduction in losses -Radio interference	35 min
3.	**Conclusion** **The Radio Interference (RI) from electric power transmission line hardware, if not controlled, poses serious electromagnetic interference to system in the vicinity.**	
	Questions / Answers **Q1 What are the** types of distance relay? A1 1) **Definite distance relay**. **2) Time distance relay**.	5 min
4	Q2 What is Time Distance Impedance Relay? **A2 This delay automatically adjusts its operating time according to the distance of the relay from the fault point. The time distance impedance relay not only be operated depending upon voltage to current ratio, its operating time also depends upon the value of this ratio.**	5min

Assignment to be given:- Nil

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

Doc. No.: DCE/0/15
Revision :00

Lecture Plan -22

Semester:-4th Course Code:-EE-212-F

Subject:-T & D Section: D

S. No.	Topic :- HVDC transmission – types of links, advantages and limitations. **Introduction**	Time Allotted:-
1.	A high-voltage, direct current (HVDC) electric power transmission system uses direct current for the bulk transmission of electrical power, in contrast with the more common alternating current (AC) systems.[1] For long-distance transmission, HVDC systems may be less expensive and suffer lower electrical losses.. **Division of the Topic**	5 min
2	Introduction of HVDC Types of links Advantages Disadvantages limitations	35 min
3.	**Conclusion** HVDC allows power transmission between unsynchronized AC transmission systems. Since the power flow through an HVDC link can be controlled independently of the phase angle between source and load, it can stabilize a network against disturbances due to rapid changes in power. HVDC also allows transfer of power between grid systems running at different frequencies, such as 50 Hz and 60 Hz.	5 min
4	**Questions / Answers** Q What are **Advantages of HVDC Transmission**? A. Undersea cables, where high capacitance causes additional AC losses. Endpoint-to-endpoint long-haul bulk power transmission without intermediate 'taps', for example, in remote areas.	5min

Assignment to be given:-Nil

Reference Readings:-

1. Electrical Power System – C.L.Wadhwa
2.Switchgear Protection and Power System-Sunil S.Rao

5min