DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

III YEAR

M SCHEME

V SEMESTER

2015 – 2016 onwards

GENERATION, TRANSMISSION AND SWITCHGEAR

CURRICULUM DEVELOPMENT CENTRE

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

M - SCHEME

Course Name : Diploma in Electrical and Electronics Engineering

Subject Code : 33051

Semester : V Semester

Subject Title : **GENERATION, TRANSMISSION AND SWITCHGEAR**

TEACHING AND SCHEME OF EXAMINATION:

No. of weeks per Semester: 15 Weeks

Subject	Instruction		Examination			
			Marks			Duration
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examination	Total	
GENERATION, TRANSMISSION AND SWITCHGEAR	6	90	25	75	100	3 hrs

TOPICS AND ALLOCATION OF HOURS:

UNIT	TOPIC	TIME (Hrs)
I	Generation Of Electrical Power	16
II	A.C. And H.V.D.C Transmission	16
III	Line Insulators And Underground Cables	15
IV	Circuit Breakers And Over Voltage Protection	16
V	Protective Relays And Grounding	15
	Revision and Tests	12
	TOTAL	**90**

RATIONALE

Energy is the basic necessity for the economic development of a country. As a matter of fact, there is a close relationship between the energy used per person and his standard of living. The greater the per capita consumption of energy in a country, the higher is the standard of living of its people. The modern society is so much dependent upon the use of electrical energy that it has become a part of our life. So to have adequate knowledge in Electrical power generation and transmission it becomes necessary to include this subject.

OBJECTIVES

To Understand

- Conventional power plants-Layout and choice of site
- Renewable energy sources and power generation
- Grid system and Economics of power generation
- A.C Transmission-Supports, conductors, Effects, Regulation and Efficiency
- H.V.D.C Transmission
- Line Insulators and underground cables
- Circuit breakers, Fuses and Lightning arresters

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CONTENTS

UNIT	NAME OF THE TOPICS	HOURS
I	**GENERATION OF ELECTRICAL POWER** Introduction- Conventional methods of power generations – schematic arrangement and choice of site for Hydel, Thermal, Nuclear power plants-Advantages and Disadvantages-comparison of these power plants - Principle and types of co generation. Schematic arrangement of Diesel, Gas, Pumped storage schemes-Advantages and Disadvantages- Renewable Energy sources-Basic principle of Solar Energy, Grid Connected Solar PV System, Standalone Solar PV System, Hybrid Solar PV System, Wind Power Generation. Grid or Inter connected system-Advantages of Inter connected systems- Load Transfer through Inter connector-Load curves and Load duration curves-connected load-Average load-Maximum Demand Factor- Plant capacity factor-Load factor and its significance-Diversity factor-Tariff – Types- Factors influencing tariff, Simple problems - Load sharing between base load and peak load plants-Load Dispatching centre stand-alone system.	16
II	**A.C. AND H.V.D.C TRANSMISSION** **A.C. Transmission:** Introduction-Typical Layout of A.C. Power supply scheme various system of power Transmission-Advantages and Disadvantages of A.C Transmission- High Transmission Voltage-Advantages-Economic choice of Transmission voltage-Elements of a Transmission Line- Economic choice of conductor size-Kelvin's Law- Its limitation-over Head Line-Conductor materials and their properties-Line supports-its properties-Types of supports and their applications-spacing between conductors-length of span-Sag in over head lines-Calculation of Sag-When the supports are at equal and unequal levels- Problems- Effect of wind and ice loading over the line conductor (Qualitative treatment only) - constants of a Transmission line- Transposition of Transmission lines-Skin Effect- Ferranti Effect-Corona formation and corona loss-Factors affecting corona-Advantages and Disadvantages-Classification of O.H. Transmission lines- performance of single phase short Transmission line - voltage regulation and Transmission Efficiency-Problems. **H.V.D.C Transmission:** Advantages and Disadvantages of D.C Transmission-Layout Scheme and principle of High Voltage D.C Transmission-D.C link configurations (monopolar, Bipolar and Homopolar)-HVDC convertor Station	16

	(Schematic diagram only)	
III	**LINE INSULATORS AND UNDERGROUND CABLES** **Line Insulators:** Introduction - Line Insulator materials-Properties of Insulators-Types & causes of failure of Insulators-Testing of Insulators-Potential Distribution over suspension Insulator string-String Efficiency - Methods of improving string efficiency- problems. **Underground cables:** Introduction-Advantages and requirement of cables-construction- of a three core cable-Insulating materials for cables-properties of Insulating materials used in cables-classification of cables-cables for three phase service-construction of Belted cable, screened cable, Pressure cables-Laying of underground cables-Direct laying, Drawing system, Advantages and Disadvantages-Grading of cables- capacitance grading, Inter sheath grading (No derivation and Problems)-cable faults-O.C, S.C and Earth faults.	15
IV	**CIRCUIT BREAKERS AND OVER VOLTAGE PROTECTION** Switch gear-Essential features of Switch gear-faults in a Power system (definition only). **Circuit Breakers** Basic principle of circuit Breaker -Arc Phenomenon-methods of Arc extinction-Arc voltage -Restriking voltage and recovery voltage-Rate of rise of restriking voltage-current chopping-Interruption of capacitive current -resistance switching-C.B ratings – Breaking capacity, making capacity, short time rating - Auto reclosing in circuit Breakers - Classification of Circuit Breakers – Construction and Working principle of Oil Circuit Breaker, Air blast Circuit Breaker, E.L.C.B, Miniature circuit breaker (M.C.B) , Residual current circuit breaker , SF6 and vacuum Circuit Breaker D.C breaking -Problems of D.C breaking-Schematic for HVDC CB producing current zero. Fuses-Desirable characteristics-Fuse Element materials-current rating of fuse elements-fusing current-Cut off current-L.V fuses-Rewirable fuse, HRC cartridge fuse, HRC fuse with tripping device - H.V. fuses & cartridge type, liquid type and metal clad-fuses-Comparison of fuse and circuit breaker. **Over voltage protection:** Voltage surge- causes of over voltage-Lightning-Types of lightning strokes -Direct stroke, indirect stroke-Harmful Effects of lightning - Protection against lightning-Earthing screen, overhead ground Wires, Lightning arresters- Expulsion type, Gapless arrester.	16

V	**PROTECTIVE RELAYS AND GROUNDING** **Protective relays:** Basic principled-Fundamental requirements of protective relaying- Primary and back up Protection-relay characteristics-relay timing - Instantaneous relay -Inverse time relay and Definite time lag relay- Inverse definite minimum time relay classification of relays-Construction, Principle of operation and applications of Induction type over current relay Directional and Non directional), Distance relay, Differential relay, Negative sequence relay, Induction type reverse power relay, Earth leakage relay. Static relays- Basic elements of static relay **Grounding:** Introduction-Equipment grounding- system grounding- ungrounded grounding, Resistance grounding Reactance grounding, resonant Neutral system-Necessity of Neutral grounding -methods-solid grounding-Earthing Transformer.	15

TEXT BOOK

S.No	Name of the Book	Author	Publisher	Edition
1	Principles of Power System	V.K.Metha	S.Chand & Company, New Delhi	4th Edition Reprint 2007

REFERENCE BOOK

Sl. No	Name of the Book	Author	Publisher	Edition
1	Electrical Power System	CLWadhawa	New Age International, New Delhi	Fourth Edition, 2009
2	A Course in Electrical Power	Soni, Gupta	Dhanpath Rai &Co (P) Ltd, New Delhi	
3	Electrical Power	S.L Uppal	Khanna Publishers, New Delhi	
4	A Course in Electrical Power	J.B. Gupta	Kaison Publishing House	Reprint 2004
5	HVDC Power Transmission System & Technology	KR. Padiyar	New Age International, New Delhi	Reprint 2005
6	Digital Protection – Protective Relaying from Electromechanical to Microprocessor	LP Singh	New Age International	Second Edition 1997
7	Power System Protection and Switchgear	B Ram & DN Viswakarma	TMH 1995	Reprint 2000