



## C.U.SHAH UNIVERSITY – WADHWAN CITY

**FACULTY OF:** - Technology and Engineering (Diploma Engineering)

**DEPARTMENT OF:** - Electrical Engineering

**SEMESTER:** - VI

**CODE:** - 2TE06SGP1

**NAME** – Switchgear and Protection (SGP)

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total Marks
							Sessional Exam		University Exam		Internal		University		
							Marks	Hours	Marks	Hours	Pr	TW	Pr	TW	
2TE06SGP1	Switchgear and Protection(SGP)	04	00	04	06	05	30	1.5	70	03	-----	20	30	-----	150

### Objectives:-

- To Develop The Basic Knowledge of Electrical Power System.
- Understanding of Working Principle, Construction and Applications of Circuit Breakers, Relays, Instrument Transformers Etc.
- Basic Knowledge of Protective Equipments, Schemes and Safety Norms.

**Prerequisites:** - Causes and Effects of Faults and Abnormal conditions of Electrical Equipments

### Course Outlines:-

Sr. No.	Course Contents	No of Hours
1	<b>Fundamentals of Power System Protection</b> Basic Elements of Power System, Switch Gear And Protection, Faults And Abnormalities In Power System, Short Circuit Currents, Harmful Effects of Short Circuit Faults on Power System, Necessity For Protection System, Fault Clearing Process, Basic Requirements of Protection System, Protection Zones, Types of Protection.	5
2	<b>Circuit Interrupting Devices</b> Necessity of Circuit Interrupting Devices, Different Types of Circuit Interrupting Devices Like Fuse, Isolator, Circuit Breaker, Load Break Switch, Earthing Switch Isolators:- Isolators And Its Working, Types of Isolators, Application of Isolators Fuses :- Introduction, Desirable Characteristic of Fuse Elements, Fuse Element Materials, Important Terms Related To Fuse, Types of Fuses, Low Voltage Fuses, High Voltage Fuses, Current Carrying Capacity of Fuse Element Circuit Breakers:-Introduction, Operating Principle of Circuit Breaker, Arc Phenomenon, Principles of Arc Extinction, Methods of Arc Extinction, Important Terms, Classification of Circuit Breakers, Oil Circuit Breakers, Types of Oil Circuit Breakers, Plain Break Oil Circuit Breakers, Arc Control Oil Circuit Breakers, Low Oil Circuit Breakers, Maintenance of Oil Circuit Breakers, Air Break Circuit Breaker, Air Blast Circuit Breakers, Types of Air Blast Circuit Breakers, Sulphur Hexafluoride (SF <sub>6</sub> ), Vacuum Circuit Breaker, Problems of Circuit Interruption, Circuit Breaker Ratings, Difference Between Isolator And Circuit Breaker, Difference Between Fuse And Circuit Breaker.	12
3	<b>Protective Relays</b> Introduction, Fundamental Requirements of Protective Relaying, Classification of Protective Relays, Important Terms, Types of Protective Relay, Electromagnetic	10

	Attraction Relays, Induction Relays, Permanent Magnet Moving Coil Relay, Thermal Relay, Gas Operated Relay – Buchholz Relay, Relay Timing, Time/ P.S.M. Curve, Calculation of Relay Operating Time, Functional Relay Types, Induction Type Over Current Relay (Non Directional), Induction Type Directional Power Relay, Induction Type Directional Over Current Relay, Distance or Impedance Relays, Definite – Distance Type Impedance Relay, Time Distance Impedance Relay, Differential Relays, Current Differential Relay, Voltage Balance Differential Relay, Static Relay, Microprocessor Based Relay, Testing of Relay, Maintenance of Protective Relays.	
4	<b>Instrument Transformers</b> A Review of Construction, Characteristics of CT and PT, Necessities of Protective Transformers, Polarity Marking of C.T. And P.T And Their Specifications, Connection Diagram of C.T. And P.T In A Single Phase And Three Phase Protective Systems.	5
5	<b>Protective Schemes</b> Abnormalities And Faults In A Power System And Its Effects, Over Current Protection, Directional Over Current Protection, Differential Protection, Protection Schemes For Alternator, Protection of Transformers, Protection of Bus Bars, Protection of Feeders And Transmission Line, Protection of Motors.	14
6	<b>Protection against Over Voltage</b> Voltage Surge, Causes of Over Voltages, Internal Causes of Overload Voltages, Lightning, Mechanism of Lightning Discharge, Types of Lightning Strokes, Harmful Effects of Lightning, Protections Against Lightning, The Earthing Screen, Overhead Ground Wires, Lightning Arresters, Types of Lightning Arresters, Surge Absorber.	6

#### List of Experiments:-

- To Study about Different Types of Fuses.
- To Study about Different Types of Circuit Breakers.
- To Study about Different Types of Protective Relays.
- To Obtain Time-Current Characteristic of Overload Relay.
- Demonstration and application of Buchholz Relay.
- To Test Thermal Overload Relay for Protection of Motor.
- To Check The Polarity of C.T. & P.T. And Connect It With The Relay.
- To Apply The Balance Current Protection Scheme Using Appropriate Switch Gear.
- To Find The Fusing Factor of A Given Fusing Material.
- To Operate Air Break C.B In A Simulated Condition.
- To Read And Interpret The Protection Scheme For An Alternator In Power Station (From Industrial Visit).
- To Read And Interpret Various Protective Scheme Used For Transmission Lines (From Industrial Visit).
- To Read And Interpret Various Protective Scheme Used For Feeder (From Industrial Visit)
- To Draw Schematic Diagram of Protective Schemes For 66 KV/ 132 KV/220 KV Substation (From Industrial Visit)

#### Learning Outcomes:-

- Understand The Causes of Abnormal Operating Conditions (Faults, Lightning And Switching Surges) of The Apparatus of System.
- Understand The Working And Characteristics of Relays And Circuit Breaker.
- Knowledge of Different Types Protection Schemes.

### **Books Recommended:-**

- Switchgear and Protection of Power System, by **Sunil.S.Rao** , Khanna Publication
- Electrical Power System, by **V.K. Mehta**, S. Chand & Company Ltd.
- Switchgear And Protection, by **J.B.Gupta**, Katson Publication
- Electrical Power System, by **C.L. Wadhwa** , New Age International Publication
- Fundamental of Power System Protection by **S.R.Bhide & Y.G.Paithankar**, PHI Publication
- Electrical Power by **S.L.Uppal**, Khanna Publication
- Fundamental of Electrical Engineering by **Dr.S.K.Bhattachariya**, Tata Mc Hill New Delhi.