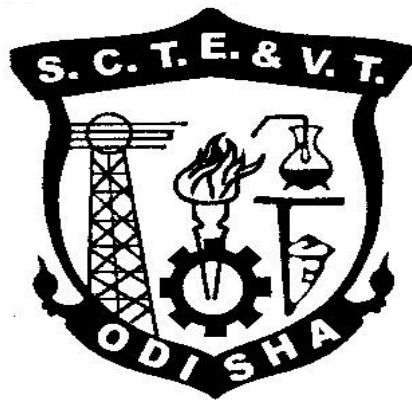


STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 5th Semester (Electrical-PT)(wef 2020-21)									
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
Theory									
Th.1		Entrepreneurship & Management	4		-	20	80	3	100
Th.2		Electrical Measurement & Instrumentation	4	-	-	20	80	3	100
Th.3		Utilization of Electrical Energy & Traction	4	-	-	20	80	3	100
Th.4		Energy Conversion-II	4	1		20	80	3	100
		<i>Total</i>	16	1		80	320	-	400
Practical									
Pr.1		Electrical Machine Lab-II	-	-	6	50	100	3	150
Pr.2		Simulation Practice on MATLAB			6	25	50	3	75
Pr.3		Student Centered Activities(SCA)			3				
		<i>Total</i>	-	-	15	75	150	-	225
		Grand Total	16	01	15	155	470	-	625
Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%									
SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.									
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester									

CURRICULLUM OF 5TH SEMESTER
For
DIPLOMA IN ELECTRICAL-PT ENGINEERING
(Effective from 2020-21 Sessions)



**STATE COUNCIL FOR TECHNICAL
EDUCATION & VOCATIONAL TRAINING,
ODISHA, BHUBANESWAR**

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY

(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**

- Concept /Meaning of Entrepreneurship
- Need of Entrepreneurship
- Characteristics, Qualities and Types of entrepreneur, Functions
- Barriers in entrepreneurship
- Entrepreneurs vrs. Manager
- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

4. **Management Principles**

- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

5. **Functional Areas of Management**

- a) Production management
 - Functions, Activities
 - Productivity
 - Quality control
 - Production Planning and control
- b) Inventory Management
 - Need for Inventory management
 - Models/Techniques of Inventory management
- c) Financial Management
 - Functions of Financial management
 - Management of Working capital
 - Costing (only concept)
 - Break even Analysis

- Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
- d) Marketing Management
- Concept of Marketing and Marketing Management
 - Marketing Techniques (only concepts)
 - Concept of 4P s (Price, Place, Product, Promotion)
- e) Human Resource Management
- Functions of Personnel Management
 - Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages
6. **Leadership and Motivation**
- a) Leadership
- Definition and Need/Importance
 - Qualities and functions of a leader
 - Manager Vs Leader
 - Style of Leadership (Autocratic, Democratic, Participative)
- b) Motivation
- Definition and characteristics
 - Importance of motivation
 - Factors affecting motivation
 - Theories of motivation (Maslow)
 - Methods of Improving Motivation
 - Importance of Communication in Business
 - Types and Barriers of Communication
7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
 - Relations with Peers, Superiors and Subordinates
 - TQM concepts: Quality Policy, Quality Management, Quality system
 - Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)
8. **Legislation**
- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
- b) Features of Factories Act 1948 with Amendment (only salient points)
- c) Features of Payment of Wages Act 1936 (only salient points)
9. **Smart Technology**
- Concept of IOT, How IOT works
 - Components of IOT, Characteristics of IOT, Categories of IOT
 - Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

Th2. ELECTRICAL MEASUREMENT & INSTRUMENTATION

Name of the Course: Diploma in Electrical Engineering(PT)			
Course code:		Semester	4 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment :	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE :

The subjects deal with the methods of measuring voltage, current, power, energy, frequency, power factor & line parameters, and principle of operation of the instruments used for such measurements. Also it provides the methods to extend the range of low range instruments to measure higher values. A power measurement includes measurement of DC power, AC single phase power and AC three phase power. Also accuracy, precision, resolution and errors and their correction are very important and have been fully discussed. Since the whole system is a combination of analog and digital system in Industry, the topics of both the system have been studied along with the topics of sensors, their characteristics and their interfacing with analog and digital system under this subject.

B. OBJECTIVES :

1. To acquire the knowledge of selecting various types of instruments for similar purpose like measurement of voltage, current, power factor, frequency etc.
2. To learn the connection of different types of electrical measuring instruments.
3. To learn the adjustment of different instruments.
4. To understand the working principle and construction of the electrical instruments.
5. To solve different numerical problems associated with the instruments based on their design Formula.
6. To acquire knowledge of the construction, characteristics and methods of usage of sensors and transducers.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Measuring instruments	05
2.	Analog ammeters and voltmeters	10

3.	Wattmeter and measurement of power	08
4.	Energy meters and measurement of energy	08
5.	Measurement of speed, frequency and power factor	07
6.	Measurement of Resistance, Inductance & Capacitance	08
7.	Sensors And Transducer	09
8.	Oscilloscope	05
	TOTAL	60

D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

1. MEASURING INSTRUMENTS

- 1.1 Define Accuracy, precision, Errors, Resolutions Sensitivity and tolerance.
- 1.2 Classification of measuring instruments.
- 1.3 Explain Deflecting, controlling and damping arrangements in indicating type of instruments.
- 1.4 Calibration of instruments.

2. ANALOG AMMETERS AND VOLTMETERS

- 2.1. Describe Construction, principle of operation, errors, ranges merits and demerits of:
 - 2.1.1 Moving iron type instruments.
 - 2.1.2 Permanent Magnet Moving coil type instruments.
 - 2.1.3 Dynamometer type instruments
 - 2.1.4 Rectifier type instruments
 - 2.1.5 Induction type instruments
- 2.2 Extend the range of instruments by use of shunts and Multipliers.
- 2.3 Solve Numerical

3. WATTMETERS AND MEASUREMENT OF POWER

- 3.1 Describe Construction, principle of working of Dynamometer type wattmeter. (LPF and UPF type)
- 3.2 The Errors in Dynamometer type wattmeter and methods of their correction.
- 3.3 Discuss Induction type watt meters.

4. ENERGY METERS AND MEASUREMENT OF ENERGY

- 4.1 Introduction
- 4.2 Single Phase Induction type Energy meters – construction, working principle and their compensation & adjustments.

4.3 Testing of Energy Meters.

5. MEASUREMENT OF SPEED, FREQUENCY AND POWER FACTOR

- 5.1 Tachometers, types and working principles
- 5.2 Principle of operation and construction of Mechanical and Electrical resonance Type frequency meters.
- 5.3 Principle of operation and working of Dynamometer type single phase and three phase power factor meters.

6. MEASUREMENT OF RESISTANCE, INDUCTANCE & CAPACITANCE

- 6.1 Classification of resistance
 - 6.1.1. Measurement of low resistance by potentiometer method.
 - 6.1.2. Measurement of medium resistance by wheat Stone bridge method.
 - 6.1.3. Measurement of high resistance by loss of charge method.
- 6.2 Construction, principle of operations of Megger & Earth tester for insulation resistance and earth resistance measurement respectively.
- 6.3 Construction and principles of Multimeter. (Analog and Digital)
- 6.4 Measurement of inductance by Maxwell's Bridge method.
- 6.5 Measurement of capacitance by Schering Bridge method

7. SENSORS AND TRANSDUCER

- 7.1. Define Transducer, sensing element or detector element and transduction elements.
- 7.2. Classify transducer. Give examples of various class of transducer.
- 7.3. Resistive transducer
 - 7.3.1 Linear and angular motion potentiometer.
 - 7.3.2 Thermistor and Resistance thermometers.
 - 7.3.3 Wire Resistance Strain Gauges
- 7.4. Inductive Transducer
 - 7.4.1 Principle of linear variable differential Transformer (LVDT)
 - 7.4.2 Uses of LVDT.
- 7.5. Capacitive Transducer.
 - 7.5.1 General principle of capacitive transducer.
 - 7.5.2 Variable area capacitive transducer.
 - 7.5.3 Change in distance between plate capacitive transducer.
- 7.6. Piezo electric Transducer and Hall Effect Transducer with their applications.

8. OSCILLOSCOPE

- 8.1. Principle of operation of Cathode Ray Tube.
- 8.2. Principle of operation of Oscilloscope (with help of block diagram).
- 8.3. Measurement of DC Voltage & current.
- 8.4. Measurement of AC Voltage, current, phase & frequency.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:			
Sl.No	Title of the Book	Name of Author	Publisher
1.	Electrical & Electronic Measurements and Instrumentation	R.K.Rajput	S.Chand
2.	Electric Measurement and Measuring instruments	A.K. Sawhney	Dhanpat Rai & Co
3.	Electrical and Electronics Measuring instruments and Measurement	J. B. Gupta	S K Kataria & Sons
4.	Electrical Measurement and Measuring instruments	E.W. Golding & H Widdis	Wheeler Publishing
5.	Industrial Instrumentation and Control	S K Singh	TMH Ltd.
6.	Electrical and Electronic Measurement and Instrumentation.	S K Bhattacharya	Vikas

Th.3 UTILIZATION OF ELECTRICAL ENERGY & TRACTION

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	Th.3	Semester:	5 th
Total Period:	60 Periods	Examination:	3 Hrs
Theory periods:	4 P / Week	Internal Assessment:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		

A. Rationale:

There is great demand for utilization of electrical power in various fields in the form of power for electrolysis, illumination, electrical heating, electrical welding, electrical traction and for electrical drives. Hence these aspects are taken care of, in the subject of utilization of electrical energy and traction to give exposure of the student.

B. Objectives:

The subject will facilitate the student :

1. To acquire knowledge of principle of ionic dissociation and electrolysis and loss involving in the process, usage of this process.
2. To acquire knowledge of types of electrical heating as employed in the electrical oven, induction furnaces and arc furnaces and dielectrically ovens.
3. To acquire knowledge of principle of arc welding and resistant welding,
4. To define various terms used in illumination engineering to design lighting schemes with specific attention to laws of illumination to explain the working and construction and use of fluorescent lamp, SV lamp, H.P. MV, Neon lamps and energy saving lamps.
5. To classify various types of industrial drives and their application.
6. To classify various methods of traction and traction motor with their control and types of braking.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1.	Electrolytic Process	08
2.	Electrical Heating.	08
3.	Principles of Arc Welding.	08
4.	Illumination.	12
5.	Industrial Drives.	10
6.	Electric Traction.	14
	TOTAL	60

D. COURSE CONTENTS:

1. ELECTROLYTIC PROCESS:

- 1.1. Definition and Basic principle of Electro Deposition.
- 1.2. Important terms regarding electrolysis.
- 1.3. Faradays Laws of Electrolysis.
- 1.4. Definitions of current efficiency, Energy efficiency.
- 1.5. Principle of Electro Deposition.
- 1.6. Factors affecting the amount of Electro Deposition.
- 1.7. Factors governing the electro deposition.
- 1.8. State simple example of extraction of metals.
- 1.9. Application of Electrolysis.

2. ELECTRICAL HEATING:

- 2.1. Advantages of electrical heating.
- 2.2. Mode of heat transfer and Stephen's Law.
- 2.3. Principle of Resistance heating. (Direct resistance and indirect resistance heating.)
- 2.4. Discuss working principle of direct arc furnace and indirect arc furnace.
- 2.5. Principle of Induction heating.
 - 2.5.1. Working principle of direct core type, vertical core type and indirect core type Induction furnace.
 - 2.5.2. Principle of coreless induction furnace and skin effect.
- 2.6. Principle of dielectric heating and its application.
- 2.7. Principle of Microwave heating and its application.

3. PRINCIPLES OF ARC WELDING:

- 3.1. Explain principle of arc welding.
- 3.2. Discuss D. C. & A. C. arc phenomena.
- 3.3. D.C. & A. C. arc welding plants of single and multi-operation type.
- 3.4. Types of arc welding.
- 3.5. Explain principles of resistance welding.
- 3.6. Descriptive study of different resistance welding methods.

4. ILLUMINATION:

- 4.1. Nature of Radiation and its spectrum.
- 4.2. Terms used in Illuminations. [Lumen, Luminous intensity, Intensity of illumination, MHCP, MSCP, MHSCP, Solid angle, Brightness, Luminous efficiency.]
- 4.3. Explain the inverse square law and the cosine law.
- 4.4. Explain polar curves.
- 4.5. Describe light distribution and control. Explain related definitions like maintenance factor and depreciation factors.
- 4.6. Design simple lighting schemes and depreciation factor.
- 4.7. Constructional feature and working of Filament lamps, effect of variation of voltage

on working of filament lamps.

- 4.8. Explain Discharge lamps.
- 4.9. State Basic idea about excitation in gas discharge lamps.
- 4.10. State constructional features and operation of Fluorescent lamp. (PL and PLL Lamps)
- 4.11. Sodium vapor lamps.
- 4.12. High pressure mercury vapor lamps.
- 4.13. Neon sign lamps.
- 4.14. High lumen output & low consumption fluorescent lamps.

5. INDUSTRIAL DRIVES:

- 5.1. State group and individual drive.
- 5.2. Method of choice of electric drives.
- 5.3. Explain starting and running characteristics of DC and AC motor.
- 5.4. State Application of:
 - 5.4.1. DC motor.
 - 5.4.2. 3-phase induction motor.
 - 5.4.3. 3 phase synchronous motors.
 - 5.4.4. Single phase induction, series motor, universal motor and repulsion motor.

6. ELECTRIC TRACTION:

- 6.1. Explain system of traction.
- 6.2. System of Track electrification.
- 6.3. Running Characteristics of DC and AC traction motor.
- 6.4. Explain control of motor:
 - 6.4.1. Tapped field control.
 - 6.4.2. Rheostatic control.
 - 6.4.3. Series parallel control.
 - 6.4.4. Multi unit control.
 - 6.4.5. Metadyne control.
- 6.5. Explain Braking of the following types:
 - 6.5.1. Regenerative Braking.
 - 6.5.2. Braking with 1-phase series motor.
 - 6.5.3. Magnetic Braking.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of the Publisher
1.	<i>Utilization of Electrical Energy by Traction</i>	<i>G. C. Garg</i>	<i>Khanna Publisher</i>
2.	<i>Utilization of Electrical Energy</i>	<i>E. I. Taylor</i>	<i>TMH</i>
3.	<i>A Text book on Power system Engineering</i>	<i>Soni, Gupta and Bhatnagar</i>	<i>Dhanpat Rai & Sons</i>

Th.4 ENERGY CONVERSION – II

Name of the Course: Diploma in Electrical Engineering(PT)			
Course code:	Th.4	Semester:	5 th
Total Period:	75 Periods	Examination:	3 Hrs
Theory periods:	4 P / Week	Internal Assessment:	20
Tutorial:	1 P / Week	End Semester Examination:	80
Maximum marks:	100		

B. Rationale:

Modern industries are mostly equipped with AC machines. So the students are given a scope to gain the concepts of electrical machines like synchronous machines, 3-phase & 1- phase induction motors and fractional horse power motors and other special machines. The students are required to be familiar with constructional features, working principles, starting and speed control methods and performance characteristics with applications of the machines. Numerical solving makes the student to understand the feature more clearly.

C. Objectives:

After completion of this subject the student will be able:

1. To describe various parts, their material specification with suitable reasoning and working principle of synchronous machines, 3-phase & 1- phase AC motors and fractional horse power and other special machines.
2. To describe their operating principle and working characteristics, torque equation of three phase motors.
3. To describe the losses and efficiency of all machines.
4. To be familiar with starting and speed control of AC motors.
5. To develop problem solving ability on synchronous machines and 3-phase induction motor for better understanding about the concept of machines.
6. To be familiar with different testing methods carried out on such three phase machines.

D. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1.	Alternator (Synchronous Generator)	14
2.	Synchronous Motor	08
3.	Induction motor	14
4.	Single Phase induction motor	08
5.	AC commutator motors	06
6.	Special Electric Machine	05
7.	Three phase transformers	05
	Total	60

E. COURSE CONTENT:

1. ALTERNATOR:

- 1.1. Types of alternator and their constructional features.
- 1.2. Basic working principle of alternator and the relation between speed and frequency.
- 1.3. Terminology in armature winding and expressions for winding factors (Pitch factor, Distribution factor).
- 1.4. Explain harmonics, its causes and impact on winding factor.
- 1.5. E.M.F equation of alternator. (Solve numerical problems).
- 1.6. Explain Armature reaction and its effect on emf at different power factor of load.
- 1.7. The vector diagram of loaded alternator. (Solve numerical problems)
- 1.8. Testing of alternator (Solve numerical problems)
 - 1.8.1. Open circuit test.
 - 1.8.2. Short circuit test.
- 1.9. Determination of voltage regulation of Alternator by direct loading and synchronous impedance method. (Solve numerical problems)
- 1.10. Parallel operation of alternator using synchro-scope and dark & bright lamp method.
- 1.11. Explain distribution of load by parallel connected alternators.

2. SYNCHRONOUS MOTOR:

- 2.1. Constructional feature of Synchronous Motor.
- 2.2. Principles of operation, concept of load angle
- 2.3. Derive torque, power developed.
- 2.4. Effect of varying load with constant excitation.
- 2.5. Effect of varying excitation with constant load.
- 2.6. Power angle characteristics of cylindrical rotor motor.
- 2.7. Explain effect of excitation on Armature current and power factor.
- 2.8. Hunting in Synchronous Motor.
- 2.9. Function of Damper Bars in synchronous motor and generator.
- 2.10. Describe method of starting of Synchronous motor.
- 2.11. State application of synchronous motor.

3. THREE PHASE INDUCTION MOTOR:

- 3.1. Production of rotating magnetic field.
- 3.2. Constructional feature of Squirrel cage and Slip ring induction motors.
- 3.3. Working principles of operation of 3-phase Induction motor.
- 3.4. Define slip speed, slip and establish the relation of slip with rotor quantities.
- 3.5. Derive expression for torque during starting and running conditions and derive conditions for maximum torque. (solve numerical problems)

- 3.6. Torque-slip characteristics.
- 3.7. Derive relation between full load torque and starting torque etc. (solve numerical problems)
- 3.8. Establish the relations between Rotor Copper loss, Rotor output and Gross Torque and relationship of slip with rotor copper loss. (solve numerical problems)
- 3.9. Methods of starting and different types of starters used for three phase Induction motor.
- 3.10. Explain speed control by Voltage Control, Rotor resistance control, Pole changing, frequency control methods.
- 3.11. Plugging as applicable to three phase induction motor.
- 3.12. Describe different types of motor enclosures.
- 3.13. Explain principle of Induction Generator and state its applications.

4. SINGLE PHASE INDUCTION MOTOR:

- 4.1. Explain Ferrari's principle.
- 4.2. Explain double revolving field theory and Cross-field theory to analyze starting torque of 1-phase induction motor.
- 4.3. Explain Working principle, Torque speed characteristics, performance characteristics and application of following single phase motors.
 - 4.3.1. Split phase motor.
 - 4.3.2. Capacitor Start motor.
 - 4.3.3. Capacitor start, capacitor run motor.
 - 4.3.4. Permanent capacitor type motor.
 - 4.3.5. Shaded pole motor.
- 4.4. Explain the method to change the direction of rotation of above motors.

5. COMMUTATOR MOTORS:

- 5.1. Construction, working principle, running characteristic and application of single phase series motor.
- 5.2. Construction, working principle and application of Universal motors.
- 5.3. Working principle of Repulsion start Motor, Repulsion start Induction run motor, Repulsion Induction motor.

6. SPECIAL ELECTRICAL MACHINE:

- 6.1. Principle of Stepper motor.
- 6.2. Classification of Stepper motor.
- 6.3. Principle of variable reluctance stepper motor.
- 6.4. Principle of Permanent magnet stepper motor.
- 6.5. Principle of hybrid stepper motor.
- 6.6. Applications of Stepper motor.

7. THREE PHASE TRANSFORMERS:

- 7.1. Explain Grouping of winding, Advantages.
- 7.2. Explain parallel operation of the three phase transformers.
- 7.3. Explain tap changer (On/Off load tap changing)
- 7.4. Maintenance Schedule of Power Transformers.

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:			
Sl.No	Title of the Book	Name of Author	Publisher
1	Electrical Technology – II	B. L. Thareja and A. K. Thareja	S.Chand
2	A Textbook of Electrical Machines	K R Siddhapura, D B Raval	Vikas
3.	Electrical Technology	J. B. Gupta	S.K.Kataria and Sons
4.	Electric Machine	Ashfaq Husain	Dhanpat Rai and Sons
5.	Electrical Machine	S. K. Bhattacharya	TMH
6.	Electrical Machines	D P Kothari, I J Nagrath	Mc Graw Hill

Pr.1 ELECTRICAL MACHINE LAB-II

Name of the Course: Diploma in Electrical Engineering(PT)			
Course code:	Pr.1	Semester	5 th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Term Work	50
Maximum marks:	150	End Semester Examination:	100

A. RATIONALE:

The sole objective of the subject is to be familiar with machines and different parts. To perform practice of the experiments and become fit to meet the challenges in practical implementation.

In the beginning the faculties have to illustrate all the tools and instruments required/ used in conducting the experiments.

B. OBJECTIVES:

After completion of this Laboratory the student will be able to:

1. To be familiar with constructional features of 3-phase and 1-phase AC machines.
2. Starting, Speed control of 3-phase and 1-phase motors.
3. To determine efficiency, regulations of different machines.
4. To draw and study performance characteristics.
5. To be familiar with relays used in power system.

C. LIST OF EXPERIMENTS:

1. Study of (Manual and Semi automatic) Direct on Line starter, Star-Delta starter, connection and running a 3-phase Induction motor and measurement of starting current.
2. Study of (Manual and Semi automatic) Auto transformer starter and rotor resistance starter connection and running a 3-phase induction motor and measurement of starting current.
3. Study and Practice of connection & Reverse the direction of rotation of Three Phase Induction motor.
4. Study and Practice of connection & Reverse the direction of rotation of Single Phase Induction motor.
5. Heat run test of 3-phase transformer.
6. OC and SC test of alternator and determination of regulation by synchronous impedance method.
7. Determination of regulation of alternator by direct loading.
8. Parallel operation of two alternators and study load sharing.

9. Measurement of power of a 3-phase Load using two wattmeter method and verification of the result using one 3-phase wattmeter.
10. Connection of 3-phase energy meter to a 3-phase load.
11. Study of an O.C.B.
12. Study of induction type over current / reverse power relay.
13. Study of Buchholz's relay.
14. Study of an earth fault relay.

Pr.2 SIMULATION PRACTICE ON MATLAB

Name of the Course: Diploma in Electrical Engineering(PT)			
Course code:	Pr.2	Semester	5 th
Total Period:	90	Examination :	3 hrs
Lab. periods:	6 P / week	Sessional:	25
Maximum marks:	75	End Semester Examination ::	50

A. COURSE CONTENT (in terms of specific objective)

1. Introduction to MATLAB programming:

- 1.1. Functions and operation using variables and arrays.
 - 1.1.1. To learn algebraic, trigonometric and exponential manipulation.
 - 1.1.2. To learn Arithmetic, Relational and Logic operator.
- 1.2. Matrix formation and its manipulation.
- 1.3. Vector manipulation:
 - 1.3.1. Use of linspace to create vectors.
 - 1.3.2. To create, add and multiply vectors.
 - 1.3.3. Use of sin and sqrt functions with vector arguments.
- 1.4. Plotting:
 - 1.4.1. Two dimensional Plots and sub plots
 - 1.4.2. Label the plot and printing.
- 1.5. Write and execute a file to plot a circle, impulse, step, ramp, sine and cosine functions. .

2. Introduction to SIMULINK:

- 2.1. Use of Commonly used blocks, Math operation block and Display block from SIMULINK library.
- 2.2. Use of logical and relational operator block.
- 2.3. Use of Sim-Power system block to use Electrical sources, elements and Power electronics devices.
- 2.4. SIMULATION:
 - 2.4.1. Verification of Network theorems.
 - 2.4.2. Simulation of a half wave uncontrolled rectifier.
 - 2.4.3. Simulation of 1-phase full bridge controlled rectifier.

2.4.4. Simulation of step-down chopper.

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of Publisher
1.	MATLAB and Simuilink for Engineers	Agam Kumar Tyagi	Oxford
2.	Getting started with MATLAB	Rudra Pratap	Oxford
3.	MATLAB Demystified	K K Sarma	Vikas

EQUIPMENT LIST

1. 3-phase Squirrel Cage Induction Motor
2. 3-phase Slip Ring Induction Motor
3. DC Shunt Motor coupled with Alternator set with Synchronization panel of Two Alternators
4. 1-phase Capacitor Start Capacitor Run Motor
5. 3-phase Transformer
6. 1-phase Transformer
7. 3-phase wattmeter
8. 1-phase wattmeter
9. 3-Phase Variac
10. DOL starter
11. Star-Delta Starter
12. Rotor Resistance starter
13. Auto Transformer Starter
14. 3-Point Starter
15. Field Regulator
16. DC Voltmeter
17. DC Ammeter
18. AC Voltmeter
19. AC Ammeter
20. 3-Phase Resistive Load Box
21. 3-Phase Energy meter
22. Demonstrational model of Oil Circuit Breaker
23. Reverse Current Relay kit
24. Demonstrational model of Buchholz's Relay Trainer Kit
25. Earth fault relay test kit