STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 4th Semester (Electrical-PT)(wef 2019-20)									
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Energy Conversion-I	4	-	-	20	80	3	100
Th.2		Element of Mechanical Engineering	4	-	-	20	80	3	100
Th.3		Electrical Egineering Material	4	-	-	20	80	3	100
		Total	12	-		60	240		300
		Practical							
Pr.1		Electrical Machine Lab-I			6	50	50	3	100
Pr.2		Mechanical Engineering Lab			6	25	50	3	75
Pr.3		Technical Seminar			2	25	-	3	25
		Student Centered Activities(SCA)		-	3				
		Total	-	-	*17*	*100*	*100*	-	*200*
		Grand Total	**12**	**-**	**17**	**160**	**340**	**-**	**500**
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 4TH SEMESTER

For

DIPLOMA IN ELECTRICAL ENGINEERING(PT)

(Effective FROM 2019-20 Sessions)

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

Th1. ENERGY CONVERSION – I

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

A. RATIONALE

Energy Conversion-I deals with DC machines and transformers. The application of DC generators and motors in modern industries are still in practice. The electrical technicians have to look after the installation, operation, maintenance and control of such machine. So the knowledge of these machines is felt essential. Transformers of various voltage ratios and KVA ratings are in wide use in industries as well as in distribution and transmission.

B. OBJECTIVES

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

1. To acquire knowledge of construction, characteristic and control of the DC machines.
2. To acquire knowledge on performance of DC machines and transformers.
3. To acquire knowledge of testing and maintenance of transformers and DC machines.

C. TOPIC WISE DISTRIBUTION OF PERIODS		
Sl. No.	**Topic**	**Periods**
1.	DC GENERATORS	17
2.	DC MOTORS	15
3.	SINGLE PHASE TRANSFORMER	20
4.	AUTO TRANSFORMER	03
5.	INSTRUMENT TRANSFORMERS	05
TOTAL		60

D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

1. D.C GENERATOR

1.1. Operating principle of generator
1.2. Constructional features of DC machine.
  1.2.1. Yoke, Pole & field winding, Armature, Commutator.
  1.2.2. Armature winding, back pitch, Front pitch, Resultant pitch and commutator- pitch.
  1.2.3. Simple Lap and wave winding, Dummy coils.
1.3. Different types of D.C. machines (Shunt, Series and Compound)
1.4. Derivation of EMF equation of DC generators. (Solve problems)
1.5. Losses and efficiency of DC generator. Condition for maximum efficiency and numerical problems.
1.6. Armature reaction in D.C. machine
1.7. Commutation and methods of improving commutation.
  1.7.1. Role of inter poles and compensating winding in commutation.
1.8. Characteristics of D.C. Generators

1.9. Application of different types of D.C. Generators.
1.10. Concept of critical resistance and critical speed of DC shunt generator
1.11. Conditions of Build-up of emf of DC generator.
1.12. Parallel operation of D.C. Generators.
1.13. Uses of D.C generators.

2. D. C. MOTORS

2.1. Basic working principle of DC motor
2.2. Significance of back emf in D.C. Motor.
2.3. Voltage equation of D.C. Motor and condition for maximum power output(simple problems)
2.4. Derive torque equation (solve problems)
2.5. Characteristics of shunt, series and compound motors and their application.
2.6. Starting method of shunt, series and compound motors.
2.7. Speed control of D.C shunt motors by Flux control method. Armature voltage Control method. Solve problems
2.8. Speed control of D.C. series motors by Field Flux control method, Tapped field method and series-parallel method
2.9. Determination of efficiency of D.C. Machine by Brake test method(solve numerical problems)
2.10. Determination of efficiency of D.C. Machine by Swinburne's Test method(solve numerical problems)
2.11. Losses, efficiency and power stages of D.C. motor(solve numerical problems)
2.12. Uses of D.C. motors

3. SINGLE PHASE TRANSFORMER

3.1 Working principle of transformer.
3.2 Constructional feature of Transformer.
3.2.1 Arrangement of core & winding in different types of transformer.
3.2.2 Brief ideas about transformer accessories such as conservator, tank, breather, and explosion vent etc.
3.2.3 Explain types of cooling methods
3.3 State the procedures for Care and maintenance.
3.4 EMF equation of transformer.
3.5 Ideal transformer voltage transformation ratio
3.6 Operation of Transformer at no load, on load with phasor diagrams.
3.7 Equivalent Resistance, Leakage Reactance and Impedance of transformer.
3.8 To draw phasor diagram of transformer on load, with winding Resistance and Magnetic leakage with using upf, leading pf and lagging pf load.
3.9 To explain Equivalent circuit and solve numerical problems.
3.10 Approximate & exact voltage drop calculation of a Transformer.
3.11 Regulation of transformer.
3.12 Different types of losses in a Transformer. Explain Open circuit and Short Circuit test.(Solve numerical problems)
3.13 Explain Efficiency, efficiency at different loads and power factors, condition for maximum efficiency (solve problems)
3.14 Explain All Day Efficiency (solve problems)
3.15 Determination of load corresponding to Maximum efficiency.
3.16 Parallel operation of single phase transformer.

4. AUTO TRANSFORMER

4.1. Constructional features of Auto transformer.
4.2. Working principle of single phase Auto Transformer.
4.3. Comparison of Auto transformer with an two winding transformer (saving of

Copper).

4.4. Uses of Auto transformer.

4.5. Explain Tap changer with transformer (on load and off load condition)

5. INSTRUMENT TRANSFORMERS

1.1 Explain Current Transformer and Potential Transformer

1.2 Define Ratio error, Phase angle error, Burden.

1.3 Uses of C.T. and P.T.

Syllabus coverage up to Internal assessment

Chapters: 1 and 2.

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. Bhattarcharya*	*TMH*
6.	*Electrical Machines*	*D P Kothari, I J Nagrath*	*Mc Graw Hill*
7	*Electrical Machines*	*Prithwiraj purakait and Indrayudh Bandyopadhyay*	*OXFORD*

Th2. Elements of Mechanical Engineering

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

A. Rationale:

This subject has been introduced with a view to provide adequate understanding of properties of steam, thermodynamic laws, Boilers, Turbines, Condensers to the students of electrical engineering since these form the basic and fundamental aspect for drive mechanisms used in generation of electricity

B. Objectives:

On completion of the course content the students will be able to:

1. Explain the principle of working of Boilers, Turbines and condensers.
2. State the different types of boilers and Turbines and their uses.
3. Explain the properties of steam.
4. State and explain thermodynamic laws.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1.	THERMODYNAICS	06
2.	PROPERTIES OF STEAM	05
3.	BOILERS	10
4.	STEAM ENGINES	10
5.	STEAM TURBINES	06
6.	CONDENSER	04
7.	I.C. ENGINE	04
8.	HYDROSTATICS	05
9.	HYDROKINETICS	05
10.	HYDRAULIC DEVICES AND PNEUMATICS	05
	TOTAL	**60**

D. **Course Content :**

1. THERMODYNAICS:
   - 1 . 1 State Unit of Heat and work, 1st law of thermodynamics.
   - 1 . 2 State Laws of perfect gases
   - 1 . 3 Determine relationship of specific heat of gases at constant volume and constant pressure.
2. PROPERTIES OF STEAM:
   - 2 . 1 Use steam table for solution of simple problem
   - 2 . 2 Explain total heat of wet, dry and super heated steam
3. BOILERS:
   - 3 . 1 State types of Boilers
   - 3 . 2 Describe Cochran, Babcock Wilcox boiler
   - 3 . 3 Describe Mountings and accessories
4. STEAM ENGINES:
   - 4.1 Explain the principle of Simple steam engine

4.2 Draw Indicator diagram
4.3 Calculate Mean effective pressure, IHP and BHP and mechanical efficiency.
4.4 Solve Simple problem.

5. STEAM TURBINES:
5.1 State Types
5.2 Differentiate between impulse and reaction Turbine

6. CONDENSER:
6.1 Explain the function of condenser
6.2 State their types

7. I.C. ENGINE:
7.1 Explain working of two stroke and 4 stroke petrol and Diesel engines.
7.2 Differentiate between them

8. HYDROSTATICS:
8.1 Describe properties of fluid
8.2 Determine pressure at a point, pressure measuring Instruments

9. HYDROKINETICS:
9.1 Deduce equation of continuity of flow
9.2 Explain energy of flowing liquid
9.3 State and explain Bernoulli's theorem

10. HYDRAULIC DEVICES AND PNEUMATICS:
10.1 Intensifier
10.2 Hydraulic lift
10.3 Accumulator
10.4 Hydraulic ram

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3, and 4.

earning Resources:			
l.No	**tle of the Book**	**ame of Authors**	**ame of the publisher**
	hermal Engineering	. S. Khurmi	S Chand
	Hydraulics & Hydraulic M/Cs	. R. Basu	Dhanpat Rai & Co.
	hermal Engineering	. S. Sarad	Satyaprakashan
	Hydraulics & Hydraulic M/Cs	. K. Bansal	Laxmi Publishers

Th3. ELECTRICAL ENGINEERING MATERIAL

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

A. Rationale:

Electrical Engg. Materials hold prime importance for Electrical Engineers in design, installation & maintenance of electrical equipments. With the advent of latest metallurgical processes the materials used in the design processes brings safer and hazard free electrical installations. Hence basic knowledge on electrical Engineering materials is essential.

B. Objectives:

1. To clarify the students on insulating, conducting & magnetic materials.
2. To impart knowledge on the Physical, Electrical & Mechanical properties
3. To impart knowledge on practical uses of various materials in different areas.

C.TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1.	Conducting materials	16
2.	Semiconducting materials	10
3.	Insulating materials	09
4.	Dielectric materials	08
5.	Magnetic materials	08
6.	Material for special purposes	09
	Total:	**60**

D. COURSE CONTENT:

1. **Conducting Materials:**
   - 1 . 1 Introduction
   - 1 . 2 Resistivity, factors affecting resistivity
   - 1 . 3 Classification of conducting materials into low-resistivity and high resistivity materials
   - 1 . 4 Low Resistivity Materials and their Applications. (Copper, Silver, Gold, Aluminum, Steel)
   - 1 . 5 Stranded conductors
   - 1 . 6 Bundled conductors
   - 1 . 7 Low resistivity copper alloys
   - 1 . 8 High Resistivity Materials and their Applications(Tungsten, Carbon, Platinum, Mercury)

1.9 Superconductivity
1.10 Superconducting materials
1.11 Application of superconductor materials

2. **Semiconducting Materials:**

2.1 Introduction
2.2 Semiconductors
2.3 Electron Energy and Energy Band Theory
2.4 Excitation of Atoms
2.5 Insulators, Semiconductors and Conductors
2.6 Semiconductor Materials
2.7 Covalent Bonds
2.8 Intrinsic Semiconductors
2.9 Extrinsic Semiconductors
2.10 N-Type Materials
2.11 P-Type Materials
2.12 Minority and Majority Carriers
2.13 Semi-Conductor Materials
2.14 Applications of Semiconductor materials
- 2.14.1 Rectifiers
- 2.14.2 Temperature-sensitive resisters or thermistors
- 2.14.3 Photoconductive cells
- 2.14.4 Photovoltaic cells
- 2.14.5 Varisters
- 2.14.6 Transistors
- 2.14.7 Hall effect generators
- 2.14.8 Solar power

3. **Insulating Materials:**

3.1 Introduction
3.2 General properties of Insulating Materials
- 3.2.1 Electrical properties
- 3.2.2 Visual properties
- 3.2.3 Mechanical properties
- 3.2.4 Thermal properties
- 3.2.5 Chemical properties
- 3.2.6 Ageing

3.3 Insulating Materials – Classification, properties, applications
- 3.3.1 Introduction
- 3.3.2 Classification of insulating materials on the basis physical and chemical structure

3.4 Insulating Gases
- 3.4.1 Introduction.

3.4.2 Commonly used insulating gases

4. **Dielectric Materials:**

4.1 Introduction
4.2 Dielectric Constant of Permittivity
4.3 Polarization
4.4 Dielectric Loss
4.5 Electric Conductivity of Dielectrics and their Break Down
4.6 Properties of Dielectrics.
4.7 Applications of Dielectrics.

5. **Magnetic Materials:**

5.1 Introduction
5.2 Classification
5.2.1 Diamagnetism
5.2.2 Para magnetism
5.2.3 Ferromagnetism
5.3 Magnetization Curve
5.4 Hysteresis
5.5 Eddy Currents
5.6 Curie Point
5.7 Magneto-striction
5.8 Soft and Hard magnetic Materials
5.8.1 Soft magnetic materials
5.8.2 Hard magnetic materials

6. **Materials for Special Purposes**

6.1 Introduction
6.2 Structural Materials
6.3 Protective Materials
6.3.1 Lead
6.3.2 Steel tapes, wires and strips
6.4 Other Materials
6.4.1 Thermocouple materials
6.4.2 Bimetals
6.4.3 Soldering Materials
6.4.4 Fuse and Fuse materials.
6.4.5 Dehydrating material.

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of Publisher
	ectrical Engineering Material & Electronic components	.B.Raina, S.K. Bhattacharya, T. Joneja	S. K. Kataria & Sons
	An Introduction to Electrical Engineering Materials	.S.Indulkar, S.Thiruvengadam	S. Chand
	Electrical Engineering Materials	.K.Shukla, Archana Singh	Mc Graw Hill

Pr1.ELECTRICAL MACHINE LAB-I

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:		Semester	4th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Sessional	50
Maximum marks:	100	End Semester Examination:	50

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, terminal testing, insulation testing of DC machines, and Transformers.
2. Know methods of Starting and Speed control of DC machines.
3. To determine efficiency, regulations of different machines.
4. To draw and study performance characteristics.
5. Load sharing of transformers.

C. LIST OF EXPERIMENTS:

1. Identification of different terminals of a DC machine by test lamp method and multi-meter method & to measure insulation resistance by megger.
2. Dimensional and material study of various parts of a DC machine.
3. Plot OCC of a DC shunt generator at constant speed and determine critical resistance from the graph.
4. Plot External Characteristics of a DC shunt generator at constant speed.
5. Study of Three point starter, connect and run a DC shunt motor & measure the no load current.
6. Study of Four point starter, connect and run a DC compound motor & measure no load current.
7. Control the speed of a DC shunt motor by field flux control method & armature voltage control method.
8. Determine the armature current vs. speed characteristic of a DC motor
9. Determine the efficiency of a DC machine by brake test method.
10. Identification of terminals, determination of voltage transformation ratio of a single phase transformer.
11. Perform OC Test and SC test of a single phase transformer.
12. Determine the voltage regulation of a single phase transformer at different loads.
13. Polarity test of single phase transformer and parallel operation of two single phase transformers.

Pr2. MECHANICAL ENGINEERING LAB

Name of the Course: Diploma in Electrical Engineering(PT)			
Course code:		Semester	4th
Total Period:	45	Examination :	3 hrs
Lab. periods:	3 P / week	Sessional:	25
Maximum marks:	75	End Semester Examination ::	50

1. APPLIED MECHANICS & MATERIAL TESTING

1.1 Determination of M.A.,V.R. and efficiency of Screw Jack

1.2 Determination of friction co-efficient of bearing

1.3 Determination of Young's modulus by Searle's Apparatus

1.4 Determination of M.A.,V.R. and efficiency of wheel train

1.5 Determination of Bending stress in beam using strain gauge

1.6 Study of Universal Testing Machine and determination of tensile stress and Young's module of M.S specification.

2. HYDRAULICS & HYDRAULIC MACHINE LAB

2.1 Study of pressure measuring devices such as (a) Piezo-meter (b) Simple manometer

2.2 Study of venturi-meter

2.3 Verification of Bernouli's Theorem

2.4 Model study of Centrifugal pumps, Francis, Turbine, Kaplan turbine and Pelton wheel.

3. HEAT ENGINE LAB

3.1 Study of Cochran Boiler

3.2 Study and demonstration of Stream Engine

3.3 Study and demonstration of Diesel Engine

3.4 Study and demonstration of Petrol Engine

Pr3. TECHNICAL SEMINAR

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:		Semester	4th
Total Period:	30	Examination	-
Lab. periods:	2 P / week	Sessional	25
Maximum marks:	25	End Semester Examination:	-

A. **RATIONALE:** The sole objective of the subject is to develop ability of improved communication skill. Ability to review, prepare and present technological developments. Ability to face the placement interviews.

B. **OBJECTIVE:**

The exclusive objective of this subject is,

1. To encourage the students to study advanced engineering developments.
2. To prepare and present technical reports.
3. To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models**.**

C. **PROCEDURE:**

During the seminar session each student is expected to prepare and present a topic onEngineering / technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 10 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are to be given based on the report.

A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.