STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 3rd Semester Electrical Engg.(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		Engineering Mathematics-III	4		-	20	80	3	100
Th.2		Circuit and Network Theory	4	1	-	20	80	3	100
Th.3		Element of Mechanical Engineering	4		-	20	80	3	100
Th.4		Electrical Engineering Material	4			20	80	3	100
Th.5		Environmental studies	4			20	80	3	100
		Total	20	01		100	400	-	500
		Practical							
Pr.1		Mechanical Engineering Lab	-	-	3	25	50	3	75
Pr.2		Circuit and Simulation Lab	-	-	6	50	50	3	100
Pr.3		Mechanical Workshop	-	-	6	25	50	3	75
		Student Centred Activities(SCA)		-	3	-	-	-	-
		Total	-	-	*18*	*100*	*150*	-	*250*
		Grand Total	**20**	**01**	**18**	**200**	**550**	**-**	**750**
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 3RD SEMESTER

For

DIPLOMA IN ENGINEERING

(Effective FROM 2019-20 Sessions)

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

Th1. ENGINEERING MATHEMATICS – III

(COMMON TO ELECT,ETC, AE & I and other Allied branches of Electrical and ETC)

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

A. RATIONALE:

The subject engineering mathematics-III is a common paper for engineering branches. This subject includes complex numbers, Matrices, Laplace Transforms, Fourier series, Differential equations and Numerical Methods etc for solution of engineering problems.

B. OBJECTIVE:

On completion of study of Engineering Mathematics-III, the students will be able to:

1. Apply complex number concept in electricity , Quadratic equation , Imaginary numbers in signal processing, Radar & even biology (Brain Waves)
2. Apply Matrices in Engineering fields such as Electrical Circuits and Linear programming.
3. Transform Engineering problems to mathematical models with the help of differential equations and familiarize with the methods of solving by Analytical methods, Transform method and operator method and Numerical methods.
4. Solve algebraic equations by iterative Methods easily programmable in computers.
5. Analysis data and develop interpolating polynomials through method of differences

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Complex Numbers	06
2	Matrices	04
3	Differential Equations	10
4	Laplace transforms	12
5	Fourier Series	12
6	Numerical Methods	04
7	Finite difference & interpolation	12
	Total:	**60**

D. COURSE CONTENTS

1. Complex Numbers

1.1 Real and Imaginary numbers.
1.2 Complex numbers, conjugate complex numbers, Modulus and Amplitude of a complex number.
1.3 Geometrical Representation of Complex Numbers.
1.4 Properties of Complex Numbers.
1.5 Determination of three cube roots of unity and their properties.

1.6 De Moivre's theorem
1.7 Solve problems on 1·1 - 1·6

2. Matrices

2.1. Define rank of a matrix.
2.2. Perform elementary row transformations to determine the rank of a matrix.
2.3. State Rouche's theorem for consistency of a system of linear equations in n unknowns.
2.4. Solve equations in three unknowns testing consistency.
2.5. Solve problems on 2.1 – 2.4

3. Linear Differential Equations

3.1. Define Homogeneous and Non – Homogeneous Linear Differential Equations with constant coefficients with examples.
3.2. Find general solution of linear Differential Equations in terms of C.F. and P.I.
3.3. Derive rules for finding C.F. And P.I. in terms of operator D, excluding $\frac{1}{f(D)}x^n$.
3.4. Define partial differential equation (P.D.E) .
3.5. Form partial differential equations by eliminating arbitrary constants and arbitrary functions.
3.6. Solve partial differential equations of the form Pp + Qq = R
3.7. Solve problems on 3.1- 3.6

4. Laplace Transforms

4.1. Define Gamma function and $\Gamma(n+1) = n!$ and find $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.
4.2. Define Laplace Transform of a function $f(t)$ and Inverse Laplace Transform .
4.3. Derive L.T. of standard functions and explain existence conditions of L.T.
4.4. Explain linear, shifting property of L.T.
4.5. Formulate L.T. of derivatives, integrals, multiplication by t^n and division by t.
4.6. Derive formulae of inverse L.T. and explain method of partial fractions .
4.7. solve problem on 4.1- 4.6

5. Fourier Series

5.1. Define periodic functions.
5.2. State Dirichlet's condition for the Fourier expansion of a function and it's convergence
5.3. Express periodic function $f(x)$ satisfying Dirichlet's conditions as a Fourier series.
5.4. State Euler's formulae.
5.5. Define Even and Odd functions and find Fourier Series in ($0 \le x \le 2\pi$ *and* $-\pi \le x \le \pi$).
5.6. Obtain F.S of continuous functions and functions having points of discontinuity in ($0 \le x \le 2\pi$ *and* $-\pi \le x \le \pi$)
5.7. Solve problems on 5.1 – 5.6

6. Numerical Methods

6.1. Appraise limitation of analytical methods of solution of Algebraic Equations.
6.2. Derive Iterative formula for finding the solutions of Algebraic Equations by :

6.2.1. Bisection method
6.2.2. Newton- Raphson method

6.3. solve problems on 6.2

7. Finite difference and interpolation

7.1. Explain finite difference and form table of forward and backward difference.
7.2. Define shift Operator (E) and establish relation between E & difference operator(Δ).
7.3. Derive Newton's forward and backward interpolation formula for equal intervals.
7.4. State Lagrange's interpretation formula for unequal intervals.
7.5. Explain numerical integration and state:
7.5.1. Newton's Cote's formula.
7.5.2. Trapezoidal rule.
7.5.3. Simpson's 1/3rd rule
7.6. Solve problems on 7.1- 7.5

Syllabus to be covered up to I.A.
Chapter: 1,2,3 and 4

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of Publisher**
1.	Higher engineering mathematics	Dr B.S. Grewal	khanna publishers
2.	Elements of mathematics Vol-1	Odisha state bureau of text book preparation and production	
3.	Text Book of Engineering Mathematics-I	C.R Mallick	Kalayani publication
4.	Text Book of engineering mathematics-III	C.R Mallick	Kalayani publication

Th2. Circuit and Network Theory

(Common to Electrical /EEE/E&M/EIC)

Name of the Course: Diploma in Electrical Engineering			
Course code:			
Total Period:	75(60L+15T)	Semester	3rd
Theory periods:	4P/week	Examination :	3 hrs
Tutorial:	1P/week	Internal Assessment:	20
Maximum marks:	100	End Semester Examination ::	80

A. Rationale:

Study of Magnetic and Electric Circuits are essential in study of Electrical Engineering. Study of Circuits, Network and Filters constitutes the basic and fundamental aspect of deriving insight into the functioning and analysis of Electrical network, instruments and machineries.

B. Objectives:

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

1. To develop the concept on Electrical circuit parameters
2. To develop problem solving ability on magnetic Circuit.
3. To develop knowledge on network analysis
4. Use of theorems in problem solving.
5. To develop knowledge on R-L, R-C and R-L-C circuit analysis in A.C
6. To understand the behavior of circuit in transient condition.
7. To develop knowledge of filters and their circuit characteristics

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Name of the Topic	Period
1	Magnetic Circuits	07
2	Coupled Circuits	05
3	Circuit Elements And Analysis	06
4	Network Theorems	08
5	Ac Circuit And Resonance	08
6	Poly-phase Circuit	06
7	Transients	06
8	Two-Port Network	08
9	Filters	06
	TOTAL	**60**

D. COURSE CONTENT:

1. MAGNETIC CIRCUITS

1 . 1 Introduction
1 . 2 Magnetizing force, Intensity, MMF, flux and their relations
1 . 3 Permeability, reluctance and permeance
1 . 4 Analogy between electric and Magnetic Circuits
1 . 5 B-H Curve
1 . 6 Series & parallel magnetic circuit.
1 . 7 Hysteresis loop

2. COUPLED CIRCUITS:

2 . 1 Self Inductance and Mutual Inductance
2 . 2 Conductively coupled circuit and mutual impedance
2 . 3 Dot convention
2 . 4 Coefficient of coupling
2 . 5 Series and parallel connection of coupled inductors.
2 . 6 Solve numerical problems

3. CIRCUIT ELEMENTS AND ANALYSIS:

3 . 1 Active, Passive, Unilateral & bilateral, Linear & Non linear elements
3 . 2 Mesh Analysis, Mesh Equations by inspection
3 . 3 Super mesh Analysis
3 . 4 Nodal Analysis, Nodal Equations by inspection
3 . 5 Super node Analysis.
3 . 6 Source Transformation Technique
3 . 7 Solve numerical problems (With Independent Sources Only)

4. NETWORK THEOREMS:

4.1 Star to delta and delta to star transformation
4.2 Super position Theorem
4.3 Thevenin's Theorem
4.4 Norton's Theorem
4.5 Maximum power Transfer Theorem.
4.6 Solve numerical problems (With Independent Sources Only)

5. AC CIRCUIT AND RESONANCE:

5.1 A.C. through R-L, R-C & R-L-C Circuit
5.2 Solution of problems of A.C. through R-L, R-C & R-L-C series Circuit by complex algebra method.
5.3 Solution of problems of A.C. through R-L, R-C & R-L-C parallel & Composite Circuits

5.4 Power factor & power triangle.
5.5 Deduce expression for active, reactive, apparent power.
5.6 Derive the resonant frequency of series resonance and parallel resonance circuit
5.7 Define Bandwidth, Selectivity & Q-factor in series circuit.
5.8 Solve numerical problems

6. **POLYPHASE CIRCUIT**
6.1 Concept of poly-phase system and phase sequence
6.2 Relation between phase and line quantities in star & delta connection
6.3 Power equation in 3-phase balanced circuit.
6.4 Solve numerical problems
6.5 Measurement of 3-phase power by two wattmeter method.
6.6 Solve numerical problems.

7. **TRANSIENTS:**
7.1 Steady state & transient state response.
7.2 Response to R-L, R-C & RLC circuit under DC condition.
7.3 Solve numerical problems

8. **TWO-PORT NETWORK:**
8.1 Open circuit impedance (z) parameters
8.2 Short circuit admittance (y) parameters
8.3 Transmission (ABCD) parameters
8.4 Hybrid (h) parameters.
8.5 Inter relationships of different parameters.
8.6 T and π representation.
8.7 Solve numerical problems

9. **FILTERS:**
9.1 Define filter
9.2 Classification of pass Band, stop Band and cut-off frequency.
9.3 Classification of filters.
9.4 Constant – K low pass filter.
9.5 Constant – K high pass filter.
9.6 Constant – K Band pass filter.
9.7 Constant – K Band elimination filter.
9.8 Solve Numerical problems

Syllabus coverage up to Internal assessment
Chapters: 1, 2, 3, 4 and 5.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of the publisher**
1	Electrical Technology Volume – I [for module: 2 only]	B. L. Thereja	S. Chand
2	Introduction to CIRCUIT ANDNETWORK	Gargi Basu	Platinum

3	Network Analysis and Synthesis	B.R.Gupta	S.CHAND
4	Circuit and Networks	Sakhija & Nagsarkar	OXFORD
5	CIRCUIT & NETWORKS for modules:- 1,3,4,5,6,7,8,9	A. Sudhakar & Shyam Mohan S Palli	Tata McGraw Hill
6	Introduction to Circuit and Network	Gargi Basu	Platinum Publishers

Th3. Elements of Mechanical Engineering

(Common to Electrical and EEE)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
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.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of the publisher**
1	Thermal Engineering	R. S. Khurmi	S Chand
2	Hydraulics & Hydraulic M/Cs	A. R. Basu	Dhanpat Rai & Co.
3	Thermal Engineering	A. S. Sarad	Satyaprakashan
4	Hydraulics & Hydraulic M/Cs	R. K. Bansal	Laxmi Publishers

Th4. ELECTRICAL ENGINEERING MATERIAL

(Common to Electrical /E&M)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
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
1	Electrical Engineering Material & Electronic components	K.B.Raina, S.K. Bhattacharya, T. Joneja	S. K. Kataria & Sons
2	An Introduction to Electrical Engineering Materials	C.S.Indulkar, S.Thiruvengadam	S. Chand
3	Electrical Engineering Materials	R.K.Shukla, Archana Singh	Mc Graw Hill

Th5. ENVIRONMENTAL STUDIES

(Common to all Branches)

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

A. RATIONALE:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every student in order to take care of the environmental aspect in each and every activity in the best possible manner.

B. OBJECTIVE:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	The Multidisciplinary nature of environmental studies	04
2	Natural Resources	10
3	Systems	08
4	Biodiversity and it's Conservation	08
5	Environmental Pollution	12
6	Social issues and the Environment	10
7	Human population and the environment	08
	Total:	**60**

D. COURSE CONTENTS

1. The Multidisciplinary nature of environmental studies:

1.1 Definition, scope and importance.

1.2 Need for public awareness.

2. Natural Resources:

Renewable and non renewable resources:

2.1 Natural resources and associated problems.

2.1.1. Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.

2.1.2. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

2.1.3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

2.1.4. Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .

2.1.5. Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

2.1.6. Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

2.2 Role of individual in conservation of natural resources.

2.3 Equitable use of resources for sustainable life styles.

3. **Systems:**

3.1. Concept of an eco system.

3.2. Structure and function of an eco system.

3.3. Producers, consumers, decomposers.

3.4. Energy flow in the eco systems.

3.5. Ecological succession.

3.6. Food chains, food webs and ecological pyramids.

3.7. Introduction, types, characteristic features, structure and function of the following eco system:

3.8. Forest ecosystem:

3.9. Aquatic eco systems (ponds, streams, lakes, rivers, oceans,

estuaries).

4. **Biodiversity and it's Conservation:**

4.1. Introduction-Definition: genetics, species and ecosystem diversity.
4.2. Biogeographically classification of India.
4.3. Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.
4.4. Biodiversity at global, national and local level.
4.5. Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

5. **Environmental Pollution:**

5.1. Definition Causes, effects and control measures of:

5.1.1 Air pollution.
5.1.2 Water pollution.
5.1.3 Soil pollution
5.1.4 Marine pollution
5.1.5 Noise pollution.
5.1.6 Thermal pollution
5.1.7 Nuclear hazards.

5.2. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
5.3. Role of an individual in prevention of pollution.
5.4. Disaster management: Floods, earth quake, cyclone and landslides.

6. **Social issues and the Environment:**

6.1. Form unsustainable to sustainable development.
6.2. Urban problems related to energy.
6.3. Water conservation, rain water harvesting, water shed management.
6.4. Resettlement and rehabilitation of people; its problems and concern.
6.5. Environmental ethics: issue and possible solutions.
6.6. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
6.7. Air (prevention and control of pollution) Act.
6.8. Water (prevention and control of pollution) Act.
6.9. Public awareness.

7. **Human population and the environment:**

7.1. Population growth and variation among nations.
7.2. Population explosion- family welfare program.
7.3. Environment and humanhealth.
7.4. Human rights.
7.5. Value education

7.6. Role of information technology in environment and human health.

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**
1.	Textbook of Environmental studies	Erach Bharucha	#UGC
2.	Fundamental concepts in Environmental Studies	D.D. Mishra	S.Chand & Co-Ltd
3.	Text book of Environmental Studies	K.Raghavan Nambiar	SCITECH Publication Pvt. Ltd.
4.	Environmental Engineering	V.M.Domkundwar	Dhanpat Rai & Co

Pr1. MECHANICAL ENGINEERING LABORATORY

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
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

Pr2. CIRCUIT AND SIMULATION LAB

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

A. Rationale:

The response of Electrical Circuit can be verified practically by applying different theorems and fundamental techniques. The students will become sure that the theoretical tricks which they have learned from books are true. The students will become competent in the field of circuit analysis

B. Objective:

On completion of the lab course the student will be able to:

1. Verify the theorems using different components.
2. Know the various types of filters.
3. Simulate different circuits using P-Spice/MATLAB software.

C. Course content in terms of specific objectives:

1. Measurement of equivalent resistance in series and parallel circuit
2. Measurement of power and power factor using series R-L-C Load.
3. Verification of KCL and KVL.
4. Verification of Super position theorem
5. Verification of Thevenin's Theorem
6. Verification of Norton's Theorem
7. Verification of Maximum power transfer Theorem
8. Determine resonant frequency of series R-L-C circuit.
9. Study of Low pass filter & determination of cut-off frequency
10. Study of High pass filter & determination of cut-off frequency
11. Analyze the charging and discharging of an R-C & R-L circuit with oscilloscope and Compute the time constant from the tabulated data and determine the rise time graphically.
12. Construct the following circuits using P-Spice/MATLAB software and compare the measurements and waveforms.
    i. Superposition theorem
    ii. Series Resonant Circuit
    iii. Transient Response in R-L-C series circuit

Note: P-Spice/MATLAB software might be loaded in 10 systems.

Pr3. MECHANICAL WORKSHOP PRACTICE

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	90	Examination:	3 hrs
Lab. periods:	6 P / week	Sessional:	25
Maximum marks:	75	End Semester Examination ::	50

1. Carpentry:

1 . 1 Name of carpentry tools and uses

1 . 2 Different operations

a. Sawing
b. Planning
c. Chiseling

1 . 3 Measuring & Marking

1 . 4 Different types of timbers used by carpenters, substitutions of timbers.

1 . 5 Jobs :

a. Slot. Notch
b. Mortise and tenon joint
c. Single dovetail joint

2. Turning

Study of S. C. Lathes and their accessories, practice in lathe work involving various operations such as plane turning, step turning, tapper turning, knuckling and external V. Threading. (One job only.)

List of Equipments for a batch size thirty (Electrical Laboratory)

Sl. No.	Equipment	Quantity
1	DC SHUNT MOTOR coupled with a DC SHUNT GENERATOR (MG SET)	
2	DC SERIES MOTOR	
3	DC SHUNT MOTOR	
4	DC COMPOUND MOTOR	
5	1- PHASE TRANSFORMER	
6	MULTIMETER	
7	MEGGER	
8	VOLTMETER [MI type 0-30, 0-300, 0-150-300-600 V], [MC type 0-50, 0-100, 0-150, 0-300, 0-600, 0-75-150 V]	
9	AMMETER [MI type 0-100mA, 0-2.5, 0-5, 0-5-10A] [MC type 0-100ma, 0-500 ma,0-1, 0-2.5, 0-3, 0-5A]	
10	WATTMETER [LPF-150W, 300W, 600W], [UPF 700W, 1400W]	
11	TACHOMETER [ANALOG & DIGITAL 0-10,000 rpm]	
12	P.F METER [5A,250V,0.5P.F]	
13	VARIABLE RESISTANCE (50Ω,5Amp)	
14	VARIABLE RESISTANCE (100Ω,5Amp)	
15	VARIABLE RESISTANCE (150Ω,5Amp)	
17	VARIABLE RESISTANCE (600Ω,1.2 Amp)	
18	VARIABLE RESISTANCE (20Ω,5Amp)	
19	RESISTIVE LOAD BOX (1.2KW)	
20	LAMP LOAD BOX (1.2 KW)	
21	STARTER (3 point)	
22	STARTER (4 point)	
23	BALL PIN HAMMER	
24	MALLET HAMMER	
25	COMBINATION PLIER	
26	NOSE PLIER	
27	WIRE GAUGE	
28	WIRE STRIPPER	
29	NEON TESTER(240V)	
30	MEASURINGTAPE(30M)	
31	SCREW DRIVER(10 INCH)	
32	SCREW DRIVER(5 INCH)	
33	ELECTRICIAN KNIFE	
34	WIRE CUTTER	
35	PVC TAPE	
36	Fuse(240v,5 amp)	
37	Fuse(240v,15 amp)	
38	One way switch(240v,5Amp)	
39	One way switch(240v,15Amp)	
40	Combination plier	
41	Nose plier	

42	Wire gauge	
43	Wire stripper	
44	Incandsecent lamp(180w,230v)	
45	Flourescent tube(40w,230v)	
46	Choke(230v)	
47	Starter	
48	Tubelight stand	
49	Lamp holder	
50	Sodium vapour lamp set	
51	Mercury vapour lamp	
52	Icdp switch(230v,5 amp)	
53	Ictp switch(400v,15 amp)	
54	Pcv board(2×2)	
55	Pcv board(2×4)	
56	Pcv board(4×6)	
57	Pcv board(6×6)	
58	Pcv board(4×10)	
59	Pcv board(6×8)	
60	Junction box	
61	PVC CONDUIT PIPE(20m)	
62	BATTENT(1.5 inch,10 m)	
63	CASING CAPPING(20m)	
64	5Pin Socket(230v,5Amp)	
65	5Pin Socket(230v,15Amp)	
66	Extention Chord(30m)	
67	FAN REGULATOR	
68	BEARING PULLER	
69	CAPACITOR(2.5µf,230V)	
70	CAPACITOR(3µf,230V)	
71	CEILING FAN	
72	PEDESTAL FAN	
73	BATTERY CHARGER [0-12-24 V]	
74	BANDPASS FILTER	
75	LOW PASS FILTER	
76	HIGH PASS FILTER	
77	BAND ELIMINATION FILTER	
78	CONSTANT K TYPE BANDPASS FILTER	
79	CRO	
80	FUNCTION GENERATOR	
81	NETWORK THEOREM KIT	
82	PARALLEL RESONANCE TRAINER KIT	
83	RC CIRCUIT AND TIME CONSTANT KIT	
84	SERIES RESONANCE TRAINER KIT	

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 4th Semester (Electrical)(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	1	-	20	80	3	100
Th.2		Analog Electronics & OP-Amp	4		-	20	80	3	100
Th.3		Electrical Measurement & Instrumentation	4	1	-	20	80	3	100
Th.4		Generation, Transmission and Distribution	4			20	80	3	100
		Total	*16*	*02*		*80*	*320*	-	*400*
		Practical							
Pr.1		Electrical Machine Lab-I	-	-	6	25	50	3	75
Pr.2		Analog Electronics Lab	-	-	3	25	50	3	75
Pr.3		Simulation Practice on MATLAB	-	-	3	25	50	3	75
Pr.4		Electrical Drawing			6	25	100	3	125
		Student Centered Activities(SCA)		-	3				
		Total	-	-	*21*	*100*	*250*	-	*350*
		Grand Total	**16**	**02**	**21**	**180**	**520**	**-**	**750**
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 ENGINEERING

(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			
Course code:		Semester	4th
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment :	20
Tutorial:	1 P / week		
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. Analog Electronics and OP-AMP

Name of the Course: Diploma in Electrical Engineering			
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 Engineers use electronic devices and circuits in various fields. The modern electrical plants need help of solid state electronic circuits for control, starting etc. So it was felt to provide a subject having electronic devices and circuits for the electrical students. Study of practical circuits and components have been dealt here with in the theoretical approach.

B. Objectives:

1. To develop knowledge on the characteristics of different types of diodes, transistors, UJT, FET and to draw a comparison in their characteristics and application.
2. To develop knowledge of their application.
3. To develop knowledge of different oscillator circuits and to identify the difference between them and their frequency relation.
4. To develop knowledge of operational amplifiers and their application in the field.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Name of the Topic	Periods
1	P-N JUNCTION DIODE	6
2	SPECIAL SEMICONDUCTOR DEVICES	5
3	RECTIFIER CIRCUITS & FILTERS	7
4	TRANSISTORS	7
5	TRANSISTOR CIRCUITS	7
6	TRANSISTOR AMPLIFIERS & OSCILLATORS	13
7	FIELD EFFECT TRANSISTOR	6
8	OPERATIONAL AMPLIFIERS	9
	Total	**60**

D. Course Content:

1. P-N JUNCTION DIODE:

- 1 . 1 P-N Junction Diode
- 1 . 2 Working of Diode
- 1 . 3 V-I characteristic of PN junction Diode.
- 1 . 4 DC load line
- 1 . 5 Important terms such as Ideal Diode, Knee voltage
- 1 . 6 Junctions break down.
  - 1.6.1 Zener breakdown
  - 1.6.2 Avalanche breakdown
- 1 . 7 P-N Diode clipping Circuit.
- 1 . 8 P-N Diode clamping Circuit

2. **SPECIAL SEMICONDUCTOR DEVICES:**

2 . 1 Thermistors, Sensors & barretters
2 . 2 Zener Diode
2 . 3 Tunnel Diode
2 . 4 PIN Diode

3. **RECTIFIER CIRCUITS & FILTERS:**

3.1 Classification of rectifiers
3.2 Analysis of half wave, full wave centre tapped and Bridge rectifiers and calculate:
- 3.2.1 DC output current and voltage
- 3.2.2 RMS output current and voltage
- 3.2.3 Rectifier efficiency
- 3.2.4 Ripple factor
- 3.2.5 Regulation
- 3.2.6 Transformer utilization factor
- 3.2.7 Peak inverse voltage

3.3 Filters:
- 3.3.1 Shunt capacitor filter
- 3.3.2 Choke input filter
- 3.3.3 π filter

4. **TRANSISTORS:**

4.1 Principle of Bipolar junction transistor
4.2 Different modes of operation of transistor
4.3 Current components in a transistor
4.4 Transistor as an amplifier
4.5 Transistor circuit configuration & its characteristics
- 4.5.1 CB Configuration
- 4.5.2 CE Configuration
- 4.5.3 CC Configuration

5. **TRANSISTOR CIRCUITS:**

5.1 Transistor biasing
5.2 Stabilization
5.3 Stability factor
5.4 Different method of Transistors Biasing
- 5.4.1 Base resistor method
- 5.4.2 Collector to base bias
- 5.4.3 Self bias or voltage divider method

6. **TRANSISTOR AMPLIFIERS & OSCILLATORS:**

6.1 Practical circuit of transistor amplifier
6.2 DC load line and DC equivalent circuit
6.3 AC load line and AC equivalent circuit
6.4 Calculation of gain
6.5 Phase reversal
6.6 H-parameters of transistors
6.7 Simplified H-parameters of transistors

6.8 Generalised approximate model
6.9 Analysis of CB, CE, CC amplifier using generalised approximate model
6.10 Multi stage transistor amplifier
6.10.1 R.C. coupled amplifier
6.10.2 Transformer coupled amplifier
6.11 Feed back in amplifier
6.11.1 General theory of feed back
6.11.2 Negative feedback circuit
6.11.3 Advantage of negative feed back
6.12 Power amplifier and its classification
6.12.1 Difference between voltage amplifier and power amplifier
6.12.2 Transformer coupled class A power amplifier
6.12.3 Class A push – pull amplifier
6.12.4 Class B push – pull amplifier
6.13 Oscillators
6.13.1 Types of oscillators
6.13.2 Essentials of transistor oscillator
6.13.3 Principle of operation of tuned collector, Hartley, colpitt, phase shift, wein-bridge oscillator (no mathematical derivations)

7. **FIELD EFFECT TRANSISTOR:**

7.1 Classification of FET
7.2 Advantages of FET over BJT
7.3 Principle of operation of BJT
7.4 FET parameters (no mathematical derivation)
7.4.1 DC drain resistance
7.4.2 AC drain resistance
7.4.3 Trans-conductance
7.5 Biasing of FET

8. **OPERATIONAL AMPLIFIERS:**

8.1 General circuit simple of OP-AMP and IC – CA – 741 OP AMP
8.2 Operational amplifier stages
8.3 Equivalent circuit of operational amplifier
8.4 Open loop OP-AMP configuration
8.5 OPAMP with fed back
8.6 Inverting OP-AMP
8.7 Non inverting OP-AMP
8.8 Voltage follower & buffer
8.9 Differential amplifier
8.9.1 Adder or summing amplifier
8.9.2 Sub tractor
8.9.3 Integrator
8.9.4 Differentiator
8.9.5 Comparator

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3, 4 and 5.

Learning Resources:			
Sl.No	**Name of Authors**	**Title of the Book**	**Name of the publisher**
1	Sanjeev Gupta	Electronic Devices and Circuits	Dhanpat Rai Publications
2	R.S SEDHA	Electronics circuit	S.CHAND

Th3. ELECTRICAL MEASUREMENT & INSTRUMENTATION

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	4th
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment :	20
Tutorial:	1 P / week		
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. ENERGYMETERS 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 Maxewell'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

Th4. GENERATION TRANSMISSION & DISTRIBUTION

Name of the Course: Diploma in Electrical Engineering			
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 :

Power system comprises generation, transmission and distribution. In this subject generation, transmission and distribution, types of generation schemes, transmission with transmission loss and efficiencies, different type of sub-stations, different type of distribution schemes, EHV AC and HV DC overhead transmission, underground cable transmission and economic aspects involved are dealt with. Further, types of tariff are briefly included to give brief and overall idea to the students.

B. OBJECTIVES :

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

1. Different schemes of power generation with their block diagram.
2. Mechanical and electrical design of transmission lines and numerical problems.
3. Types of cables and their methods of laying and testing.
4. Different schemes of distribution with problem solving
5. Different types of sub-stations.
6. Economic aspects of power supply system with problem and type of tariff of electricity.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1.	Generation of electricity	07
2.	Transmission of electric power	05
3.	Over head line	07
4.	Performance of short & medium lines	07
5.	EHV transmission	07
6.	Distribution System	07
7.	Underground cable	06
8.	Economic Aspects	06
9.	Types of tariff	03
10.	Substation	05
	TOTAL	**60**

D. COURSE CONTENTS IN TERMS OF SPECIFIC OBJECTIVES.

1. GENERATION OF ELECTRICITY

1.1 Elementary idea on generation of electricity from Thermal, Hydel, Nuclear, Power station.

1.2 Introduction to Solar Power Plant (Photovoltaic cells).

1.3 Layout diagram of generating stations.

2. TRANSMISSION OF ELECTRIC POWER

2.1 Layout of transmission and distribution scheme.
2.2 Voltage Regulation & efficiency of transmission.
2.3 State and explain Kelvin's law for economical size of conductor.
2.4 Corona and corona loss on transmission lines.

3. OVER HEAD LINES

3.1 Types of supports, size and spacing of conductor.
3.2 Types of conductor materials.
3.3 State types of insulator and cross arms.
3.4 Sag in overhead line with support at same level and different level. (approximate formula effect of wind, ice and temperature on sag)
3.5 Simple problem on sag.

4. PERFORMANCE OF SHORT & MEDIUM LINES

4.1. Calculation of regulation and efficiency.

5. EHV TRANSMISSION

5.1 EHV AC transmission.
5.1..1. Reasons for adoption of EHV AC transmission.
5.1..2. Problems involved in EHV transmission.
5.2 HV DC transmission.
5.2..1. Advantages and Limitations of HVDC transmission system.

6. DISTRIBUTION SYSTEMS

6.1 Introduction to Distribution System.
6.2 Connection Schemes of Distribution System: (Radial, Ring Main and Inter connected system)
6.3 DC distributions.
6.3.1 Distributor fed at one End.
6.3.2 Distributor fed at both the ends.
6.3.3 Ring distributors.
6.4 AC distribution system.
6.4.1. Method of solving AC distribution problem.
6.4.2. Three phase four wire star connected system arrangement.

7. UNDERGROUND CABLES

7.1 Cable insulation and classification of cables.
7.2 Types of L. T. & H.T. cables with constructional features.
7.3 Methods of cable lying.
7.4 Localization of cable faults: Murray and Varley loop test for short circuit fault / Earth fault.

8. ECONOMIC ASPECTS

8.1 Causes of low power factor and methods of improvement of power factor in

power system.

8.2 Factors affecting the economics of generation: (Define and explain)

8.2.1 Load curves.

8.2.2 Demand factor.

8.2.3 Maximum demand.

8.2.4 Load factor.

8.2.5 Diversity factor.

8.2.6 Plant capacity factor.

8.3 Peak load and Base load on power station.

9. TYPES OF TARIFF

9.1. Desirable characteristic of a tariff.

9.2. Explain flat rate, block rate, two part and maximum demand tariff. (Solve Problems)

10. SUBSTATION

10.1 Layout of LT, HT and EHT substation.

10.2 Earthing of Substation, transmission and distribution lines.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3, 4 and 5.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Author**	**Publisher**
1.	Principles of Power System	V. K. Mehta	S Chand
2	A text book of Power System Engineering	A Chakrabarti, M L Soni, P V Gupta, U S Bhatnagar	Dhanpat Rai & Co
3.	A course of electrical power system	S. L. Uppal	Khanna publisher
4.	Power System Engineering	D. P. Kothari, IJ Nagrath	TMH

Pr1. ELECTRICAL MACHINE LAB-I

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	4th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Sessional	25
Maximum marks:	75	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.

Learning Resources:

Sl. No.	Title of the Book	Name of Author	Publisher
1.	Laboratory courses in Electrical Engineering	S G Tarnekar; P K Kharbanda; S D Naik et.al	S.Chand

Pr2. ANALOG ELECTRONICS LAB

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

A. RATIONALE

In this practical work the students get knowledge about the Analog Systems components.They will become capable of developing and implementing Analog Circuit.

B. OBJECTIVE

On completion of the Lab. Course the student will be able to

1. Identify the active components
2. Understand the behavior character of basic semiconductor devices
3. Understand the concept of oscillator. Amplifier, Rectifier etc.

C. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

1. Determine the input and output Characteristics of CE & CB transistor configuration
2. Determine Drain & Transfer Characteristics of JFET
3. Construct Bridge Rectifier using different filter circuit and to determine Ripple factor & analyze wave form with filter & without filter.
4. Construct Bridge Rectifier using different filter and to determine Ripple factor.
5. Construct & test the regulator using Zener diode
6. Construct different types of biasing circuit and analyze the wave form

   (i) Fixed bias (ii) Emitter bias (iii) Voltage divider bias
7. Study the single stage CE amplifier & find Gain
8. Study multi stage R-C coupled amplifier & to determine frequency- response & gain.
9. Construct & Find the gain

   (I) Class A. Amplifier (ii) Class B. Amplifier (iii) Class C Tuned Amplifier
10. Construct & test push pull amplifier & observer the wave form
11. Construct & calculate the frequency of

    (i) Hartly Oscillator (ii) Collpit's Oscillator (iii) Wein Bridge Oscillator (iv) R-C phase

shift oscillator and draw wave form & calculate the frequency

12. Construct & Test Differentiator and Integrator using R-C Circuit

13. Study Multivibrator (Astable, Bistable, Monstable) Circuit & Draw its Wave forms

- **Mini Project:** To collect data like base configuration. Operational Characteristics, applications and critical factor etc. On all semiconductor devices studied in theory and compile a Project report throughout and submit at the end of the semester. To assemble and test simple circuit using above components with test Points.(e.g. Series Regulator / Oscillators etc)

Learning Resources:

Sl. No.	Title of the Book	Name of Author	Publisher
1.	Basic electronic Lab. Manual :	Paul B. Zbar	S.Chand

Pr3. SIMULATION PRACTICE ON MATLAB

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

A. RATIONALE:

Computer simulation is necessary for any hardware, before its fabrication. MATLAB software provides a unique platform for computer simulation. Practice on MATLAB has been opted for final semester students to be familiar with programming and simulation practice with SIMULINK to make them comfortable for designing various hardware projects and verify different experiments in absence of proto type experimental equipments.

B. OBJECTIVE:

1. To learn programming in MATLAB to perform mathematical manipulation.
2. To prepare virtual experiment setup for different electrical and power electronics experiments under MATLAB Simulink.

C. Topic wise distribution of periods:		
Sl. No.	**Topics**	**No of Periods**
1.	Introduction to MATLAB programming	20
2.	Introduction to SIMULINK	25
	Total	**45**

D. 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

Pr4. ELECTRICAL DRAWING

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester:	4th
Total Period:	90	Examination:	3 hrs
Theory periods:	6 P/week	Term work:	25
Maximum marks:	125	End Semester Examination:	100

A. Rationale:

A technical person takes help of an engineering drawing to understand the constructional features of machines and accessories. Electrical drawing is introduced for the final year students to be familiar with Circuit diagrams of AC motors starters, Development of stator windings with conventional symbols.

Sketching as to BIS and REC specification and symbol of electrical earthing installations, SP and DP structures and substations of 132/33 kV and 33/11 kV type. This will enable them to follow engineering drawing in the working environment.

B. Objectives:

1. To draw wiring circuit diagram for different AC and DC motor starters.
2. To follow BIS and REC standard to draw earthing installation and SP and DP Structures and stay sets for line supports.
3. To use various symbols to draw the single line diagram of 33/11kV substations.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	**Topics**	**Periods**
1.	Wiring Diagram of Starters	18
2.	Development of DC armature winding	18
3.	1 φ and 3 φ transformer	12
4.	Sketches of Earthing and LT and HT line	18
5.	Single line diagram sub station	09
6.	Auto CAD practice	15
	Total	**90**

D. COURSE CONTENT:

1. **WIRING DIAGRAM AND CONTROL CIRCUIT**
   - 1.1 3 point D. C. motor starter.
   - 1.2 4 point D.C. motor starter.
   - 1.3 DOL starter
   - 1.4 Star delta starter.
   - 1.5 Auto Transformer Starter.
   - 1.6 Rotor resistance starter.
2. **DRAW D.C. M/C PARTS** (Dimensional Drawing)
   - 2.1. Pole with pole shoes.
   - 2.2. Commutator
   - 2.3. Armature
   - 2.4. DC. armature winding
     - (a) Simple lap winding
     - (b) Simple wave winding.

3. **DRAW 1-PHASE & 3-PHASE TRANSFORMER** (Assembly Drawing)
   - 3.1 Stepped core type.
   - 3.2 Plane shell type.

5. **DRAW SKETCHES OF THE FOLLOWING AS PER B.I.S AND REC SPECIFICATIONS**
   - 5.1 Earthing installation.
   - 5.2 Double pole structure for LT and HT distribution lines.

6. **DRAW SINGLE LINE DIAGRAM OF SUBSTATION**
   - 6.1 Single line diagram of 33/11kV distribution substation.
   - 6.2 Single line diagram of a 11/0.4 kV distribution substation.

8. **COMPUTER AIDED ELECTRICAL DRAWING USING SOFT WARE**
   - 8.1 Draw Electrical symbols (take Print out)
   - 8.2 Draw D.C. m/c parts (take print out)
   - 8.3 Draw A. C. m/c parts (take print out)
   - 8.4 Draw electrical layout of diagram of Electrical Installation of a building.

Learning Resources:

Sl.No	***Title of the Book***	***Name of Authors***	***Name of the publisher***
1	*Electrical Design and Drawing*	*Surjit Singh*	*Dhanpat Rai & Sons*
2	*Electrical Engineering Drawing*	*C.R. Dargan*	*Asian Publication*

Equipment List

ANALOG ELECTRONICS LAB

Sl. No.	Equipment
1	Breadboard
2	Regulated Power Supply
3	Digital Multimeter
4	JFET Characteristics Trainer kit
5	Rectifier Trainer with Filter
6	Voltage Regulator Trainer Kit using Zener Diode
7	BJT Biasing Trainer (fixed Bias, Emitter Bias, Voltage Divider Bias, Collector Feedback Bias)
8	CE amplifier Trainer
9	RC couple Amplifier Trainer
10	CRO with Probes
11	Step Down Transformer
12	Zener Diode
13	Function Generator
14	Class A,Class B,Class C Tuned Amplifier Trainer
15	Oscillator Trainer kit(Heartly osicalltor,collpits oscillator. Wein Bridge Oscillator, RC Phase Shift Oscillator)
16	Transistor Configuration Trainer Kit
17	Push Pull Amplifier Trainer
18	OPamp Trainer Kit for Differentiation and Integration
19	Multivibrator Trainer Kit(Astable,Bistable,Monostable)

ELECTRICAL MACHINE LAB-I

Sl. No.	Equipment
1	DC SHUNT MOTOR coupled with a DC SHUNT GENERATOR (MG SET)
2	DC SERIES MOTOR
3	DC SHUNT MOTOR
4	DC COMPOUND MOTOR
5	1- PHASE TRANSFORMER
6	MULTIMETER
7	MEGGER
8	VOLTMETER
9	AMMETER
10	WATTMETER
11	TACHOMETER
12	P.F METER
13	VARIABLE RESISTANCE
14	RESISTIVE LOAD BOX
15	LAMP LOAD BOX
16	3 POINT STARTER
17	4 POINT STARTER
18	1PH VARIAC
19	SPRING WEIGHT
20	STAR DELTA STARTER
21	3PHASE INDUCTION MOTOR -SHUNT GENERATOR SET
22	DRUM CONTROL
23	INDUCTIVE LOAD(VARIABLE)
24	CAPACITIVE LOAD
25	2 POINT STARTER
26	OHM METRE

MATLAB S/W- Multiuser

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 5th Semester (Electrical)(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 and Management & Smart Technology	4		-	20	80	3	100
Th.2		Energy Conversion-II	4		-	20	80	3	100
Th.3		Digital Electronics & Microprocessor	5		-	20	80	3	100
Th.4		Utilization of Electrical Energy & Traction	4			20	80	3	100
Th.5		Power Electronics & PLC*	4			20	80	3	100
		Total	21			100	400	-	500
		Practical							
Pr.1		Electrical Machine Lab-II	-	-	6	25	50	3	75
Pr.2		Power Electronics & PLC Lab	-	-	3	25	50	3	75
Pr.3		Digital Electronics & Microprocessor Lab	-	-	3	25	50	3	75
Pr.4		Project Phase– I			3	25	-	-	25
		Student Centered Activities(SCA)		-	3	-	-	-	-
		Total	-	-	*18*	*100*	*150*	-	*250*
		Grand Total	**21**	**-**	**18**	**200**	**550**	**-**	**750**
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 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

TH.2 ENERGY CONVERSION – II

Name of the Course: Diploma in Electrical Engineering			
Course code:	Th.2	Semester:	5th
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:

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.

B. 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.

C. 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.	Commutator motors	06
6.	Special Electric Machine	05
7.	Three phase transformers	05
	Total	**60**

D. 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 reluctant 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. Theraja and A. K. Theraja	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

TH.3 DIGITAL ELECTRONICS & MICROPROCESSOR

Name of the Course: Diploma in Electrical Engineering			
Course code:	Th.3	Semester	5th
Total Period:	75	Examination	3 Hrs.
Theory periods:	5P / week	Internal Assessment:	20
Tutorial:	---	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE

The tremendous power and usefulness of digital electronics can be seen from the wide variety of industrial and consumer products, such as automated industrial machinery, computers, microprocessors, pocket calculators, digital watches and clocks, TV games, etc., Which are based on the principles of digital electronics? The years of applications of digital electronics have been increasing every day. In fact, digital systems have invaded all walks of life. This subject will very much helpful for student to understand clearly about the developmental concept of digital devices.

B. OBJECTIVES

On comprehend of the subject, the student will able to

1. Comprehend the systems and codes.
2. Familiar with logic gates.
3. Realize logic expressions using gates.
4. Construct and verify the operation of arithmetic & logic circuits
5. Understand and appreciate the relevance of combinational circuits.
6. Know various logic families & flops.
7. Architecture & different instructions of 8085 microprocessor.
8. Assembly language programs and write programs & functions of the interfacing chips like 8255, 8259, 8259 etc.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1	Basics Of Digital Electronics	15
2	Combinational Logic Circuits	15
3	Sequential Logic Circuits	15
4	8085 Microprocessor	20
5	Interfacing And Support Chips	10
	Total	**75**

D : **COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES**

1. BASICS OF DIGITAL ELECTRONICS

1.1 Binary, Octal, Hexadecimal number systems and compare with Decimal system.

1.2 Binary addition, subtraction, Multiplication and Division.
1.3 1‘s complement and 2‘s complement numbers for a binary number
1.4 Subtraction of binary numbers in 2‘s complement method.
1.5 Use of weighted and Un-weighted codes & write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
1.6 Importance of parity Bit.
1.7 Logic Gates: AND, OR, NOT, NAND, NOR and EX-OR gates with truth table.
1.8 Realize AND, OR, NOT operations using NAND, NOR gates.
1.9 Different postulates and De-Morgan‘s theorems in Boolean algebra.
1.10 Use Of Boolean Algebra For Simplification Of Logic Expression
1.11 Karnaugh Map For 2,3,4 Variable, Simplification Of SOP And POS Logic Expression Using K-Map.

2. COMBINATIONAL LOGIC CIRCUITS

2.1 Give the concept of combinational logic circuits.
2.2 Half adder circuit and verify its functionality using truth table.
2.3 Realize a Half-adder using NAND gates only and NOR gates only.
2.4 Full adder circuit and explain its operation with truth table.
2.5 Realize full-adder using two Half-adders and an OR – gate and write truth table
2.6 Full subtractor circuit and explain its operation with truth table.
2.7 Operation of 4 X 1 Multiplexers and 1 X 4 demultiplexer
2.8 Working of Binary-Decimal Encoder & 3 X 8 Decoder.
2.9 Working of Two bit magnitude comparator.

3. SEQUENTIAL LOGIC CIRCUITS

3.1 Give the idea of Sequential logic circuits.
3.2 State the necessity of clock and give the concept of level clocking and edge triggering,
3.3 Clocked SR flip flop with preset and clear inputs.
3.5 Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
3.6 Concept of race around condition and study of master slave JK flip flop.
3.7 Give the truth tables of edge triggered D and T flip flops and draw their symbols.
3.8 Applications of flip flops.
3.9 Define modulus of a counter
3.10 4-bit asynchronous counter and its timing diagram.
3.11 Asynchronous decade counter.
3.12 4-bit synchronous counter.
3.13 Distinguish between synchronous and asynchronous counters.
3.14 State the need for a Register and list the four types of registers.
3.15 Working of SISO, SIPO, PISO, PIPO Register with truth table using flip flop.

4. 8085 MICROPROCESSOR

4.1 Introduction to Microprocessors, Microcomputers
4.2 Architecture of Intel 8085A Microprocessor and description of each block.
4.3 Pin diagram and description.
4.4 Stack, Stack pointer & stack top
4.5 Interrupts
4.6 Opcode & Operand,
4.7 Differentiate between one byte, two byte & three byte instruction with example.
4.8 Instruction set of 8085 example
4.9 Addressing mode
4 .10 Fetch Cycle, Machine Cycle, Instruction Cycle, T-State
4.11 Timing Diagram for memory read, memory write, I/O read, I/O write
4.12 Timing Diagram for 8085 instruction
4.13 Counter and time delay.
4. 14 Simple assembly language programming of 8085.

5. INTERFACING AND SUPPORT CHIPS

5.1 Basic Interfacing Concepts, Memory mapping & I/O mapping
5.2 Functional block diagram and description of each block of Programmable peripheral interface Intel 8255 ,
5.3 Application using 8255: Seven segment LED display, Square wave generator, Traffic light Controller

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**
1	Fundamental of Digital Electronics	Ananda Kumar	PHI
2	Digital Electronics – Principal & Application	S. K. Mondal	TMH
3	Digital Electronics	B. R. Gupta & V. Singhal	S. K. Kateria
4	Digital Electronics	P. Raja	SciTech
5	Microprocessor Architecture programming & Application with 8085	R.S Gaonkar	Peneram
6	Fundamentals of Microprocessor & Micro Computers	B.Ram	Dhanpat rai
7	Microprocessor and Inter facing	Sunetra Choudhury & S. P. Chowdhury	Scitech

TH.4 UTILIZATION OF ELECTRICAL ENERGY & TRACTION

Name of the Course: Diploma in Electrical Engineering			
Course code:	Th.4	Semester:	5th
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 factures 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.	*Utilization of Electrical Energy by Traction*	*G. C. Garg*	*Khanna Publisher*
2.	*Utilization of Electrical Energy*	*E. I. Taylor*	*TMH*
3.	*A Text book on Power system Engineering*	*Soni, Gupta and Bhatnagar*	*Dhanpat Rai & Sons*

TH.5 POWER ELECTRONICS AND PLC

Name of the Course: Diploma in Electrical Engineering			
Course code:	Th.5	Semester:	5th
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:

The development of high power semiconductor devices has facilitated electronic control techniques for electrical power control in a simple, economic and efficient manner. Thus a new area of power electronics has now emerged which replaced the old and bulky method of power control through the use of small electronic devices. Power electronics application has occupied an indispensible position in industrial applications like heating, welding, uninterrupted power supply, battery charging etc. Industrial drives, lighting control are most efficiently controlled by power electronics devices to achieve optimum performance. The objective of this paper is to familiar students with the principles and operations of Power electronics devices in Industrial applications with drives control.

B. Objectives:

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

1. Understand construction, working principle & application of various power electronics devices.
2. Know different gate triggering circuits and commutation methods.
3. Understand working principle of phase controlled rectifier.
4. Know the types and working principle of inverter.
5. Understand working principle and voltage control of chopper.
6. Understand frequency variation using Cyclo-converter.
7. Understand control principle of AC & DC industrial drive.
8. Know different application of SCR / Thyristor.
9. Concept in PLC & its Programming

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1.	Understand The Construction And Working Of Power Electronic Devices	18
2.	Understand The Working Of Converters, Ac Regulators And Choppers.	12
3.	Understand The Inverters And Cyclo-Converters	08
4.	Understand Applications Of Power Electronic Circuits	10
5.	PLC And Its Applications	12
	Total	**60**

D. COURSE CONTENT:

1. UNDERSTAND THE CONSTRUCTION AND WORKING OF POWER ELECTRONIC DEVICES

1.1 Construction, Operation, V-I characteristics & application of power diode, SCR, DIAC,TRIAC, Power MOSFET,GTO &IGBT
1.2 Two transistor analogy of SCR.
1.3 Gate characteristics of SCR.
1.4 Switching characteristic of SCR during turn on and turn off.
1.5 Turn on methods of SCR.
1.6 Turn off methods of SCR (Line commutation and Forced commutation)
  1.6.1 Load Commutation
  1.6.2 Resonant pulse commutation
1.7 Voltage and Current ratings of SCR.
1.8 Protection of SCR
  1.8.1 Over voltage protection
  1.8.2 Over current protection
  1.8.3 Gate protection
1.9 Firing Circuits
  1.9.1 General layout diagram of firing circuit
  1.9.2 R firing circuits
  1.9.3 R-C firing circuit
  1.9.4 UJT pulse trigger circuit
  1.9.5 Synchronous triggering (Ramp Triggering)
1.10 Design of Snubber Circuits

2. UNDERSTAND THE WORKING OF CONVERTERS, AC REGULATORS AND CHOPPERS.

2.1 Controlled rectifiers Techniques(Phase Angle, Extinction Angle control), Single quadrant semi converter, two quadrant full converter and dual Converter
2.2 Working of single-phase half wave controlled converter with Resistive and R-L loads.
2.3 Understand need of freewheeling diode.
2.4 Working of single phase fully controlled converter with resistive and R- L loads.
2.5 Working of three-phase half wave controlled converter with Resistive load
2.6 Working of three phase fully controlled converter with resistive load.
2.7 Working of single phase AC regulator.
2.8 Working principle of step up & step down chopper.
2.9 Control modes of chopper
2.10 Operation of chopper in all four quadrants.

3. UNDERSTAND THE INVERTERS AND CYCLO-CONVERTERS

3.1 Classify inverters.
3.2 Explain the working of series inverter.
3.3 Explain the working of parallel inverter
3.4 Explain the working of single-phase bridge inverter.

3.5 Explain the basic principle of Cyclo-converter.
3.6 Explain the working of single-phase step up & step down Cyclo-converter.
3.7 Applications of Cyclo-converter.

4. UNDERSTAND APPLICATIONS OF POWER ELECTRONIC CIRCUITS

4.1 List applications of power electronic circuits.
4.2 List the factors affecting the speed of DC Motors.
4.3 Speed control for DC Shunt motor using converter.
4.4 Speed control for DC Shunt motor using chopper.
4.5 List the factors affecting speed of the AC Motors.
4.6 Speed control of Induction Motor by using AC voltage regulator.
4.7 Speed control of induction motor by using converters and inverters (V/F control).
4.8 Working of UPS with block diagram.
4.9 Battery charger circuit using SCR with the help of a diagram.
4.10 Basic Switched mode power supply (SMPS) - explain its working & applications

5. PLC AND ITS APPLICATIONS

5.1 Introduction of Programmable Logic Controller(PLC)
5.2 Advantages of PLC
5.3 Different parts of PLC by drawing the Block diagram and purpose of each part of PLC.
5.4 Applications of PLC
5.5 Ladder diagram
5.6 Description of contacts and coils in the following states
i)Normally open ii) Normally closed iii) Energized output iv)latched Output v) branching
5.7 Ladder diagrams for i) AND gate ii) OR gate and iii) NOT gate.
5.8 Ladder diagrams for combination circuits using NAND,NOR, AND, OR and NOT
5.9 Timers-i)T ON ii) T OFF and iii)Retentive timer
5.10 Counters-CTU, CTD
5.11 Ladder diagrams using Timers and counters
5.12 PLC Instruction set
5.13 Ladder diagrams for following
(i) DOL starter and STAR-DELTA starter (ii) Stair case lighting (iii) Traffic light Control (iv) Temperature Controller
5.14 Special control systems- Basics DCS & SCADA systems
5.15 Computer Control–Data Acquisition, Direct Digital Control System (Basics only)

Syllabus coverage up to Internal assessment

Chapters: 1 and 2.

Learning Resources:			
Sl.No	***Title of the Book***	***Name of Authors***	***Name of the Publisher***
1.	*Power Electronics*	*Dr. P. S. Bhimbhra*	*Khanna Publisher*
2.	*Modern Power Electronics*	*B.K.Bose*	*PHI Publisher*

	and AC Drives		
3.	*Power Electronics*	*M. D. Singh and K.B Khanchandani*	*TMH*
4.	*Power Electronics*	*M H Rashid*	PHI Publisher
5.	*Power Electronics*	*P C Sen*	*TMH*
6.	*Power Electronics*	*N Mohan*	*Willey (India)*
7.	*Programmable logic Controllers*	*Frank D. Petruzela*	TMH
8.	*Programme logic controller*	*Dr.M.Mitra&Dr.S.Sengupta*	*Penram*

Pr.1 ELECTRICAL MACHINE LAB-II

Name of the Course: Diploma in Electrical Engineering			
Course code:	Pr.1	Semester	5th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Term Work	25
Maximum marks:	75	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 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 POWER ELECTRONICS & PLC LAB

Name of the Course: Diploma in Electrical Engineering			
Course code:	Pr.2	Semester	5th
Total Period:	45	Examination	3 hrs
Lab. periods:	3 P / week	Term Work	25
Maximum marks:	75	End Semester Examination:	50

A. RATIONALE: The sole objective of the subject is to be familiar with solid state devices used in power system. To perform experiments for determining the characteristics of components and become fit to meet the challenges in practical implementation.

B. OBJECTIVE:

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

1. Determine characteristic of semiconductor devices.
2. Develop ability to design drive circuit for above.
3. Design low voltage power circuit to be used in electronics circuit.

C. LIST OF EXPERIMENTS

(I) Power Electronics

1. Study of switching characteristics of a power transistor.
2. Study of V-I characteristics of SCR.
3. Study of V-I characteristics of TRIAC.
4. Study of V-I characteristics of DIAC.
5. Study of drive circuit for SCR & TRIAC using DIAC.
6. Study of drive circuit for SCR & TRIAC using UJT.
7. To study phase controlled bridge rectifier using resistive load.
8. To study series Inverter.
9. Study of voltage source Inverter.
10. To perform the speed control of DC motor using Chopper.
11. To study single-phase Cyclo-converter

(II) PLC Programming

1. Introduction/Familiarization PLC Trainer & its Installation with PC
   (a) Learn the basics and hardware components of PLC
   (b) Understand configuration of PLC system
   (c) Study various building blocks of PLC
   (d) Determine the No. of digital I/O & Analog I/O
2. Execute the different Ladder Diagrams
   (a) Demonstrate PLC and Ladder diagram-Preparation downloading and running
   (b) Execute Ladder diagrams for different Logical Gates
   (c) Execute Ladder diagrams using timers & counters
3. Execute the Ladder Diagrams with model applications
   (i) DOL starter (ii)Star- Delta starter
4. Execute Ladder diagrams with model applications (i) Stair case lighting (ii) Traffic light controller

Pr.3 DIGITAL ELECTRONICS & MICROPROCESSOR LAB

Name of the Course: Diploma in Electrical Engineering			
Course code:	Pr.3	Semester	5th
Total Period:	45	Examination	3 hrs
Lab. periods:	3 P / week	Term Work	25
Maximum marks:	75	End Semester Examination:	50

A.RATIONALE

In this practical work students knowledge about the Digital systems will be reinforced. They will become capable of developing and implementing Digital Circuits. They will also be able to acquire skills of operating A/D and D/A converters, counters and display system.

B. OBJECTIVE

On completion of the Lab course the student will able to

1. Understand and comprehended the simple the Digital design Circuits.
2. Assembly Language Program using 8085 instruction
3. Application of 8085 using interfacing

C.COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

(I) Digital Electronics

1. Verify truth tables of AND, OR, NOT, NOR, NAND, XOR, XNOR gates.
2. Implement various gates by using universal properties of NAND & NOR gates and verify truth table.
3. Implement half adder and Full adder using logic gates.
4. Implement half subtractor and Full subtractor using logic gates.
5. Implement a 4-bit Binary to Gray code converter.
6. Implement a Single bit digital comparator.
7. Study Multiplexer and demultiplexer.
8. Study of flip-flops.
   i) S-R flip flop ii) J-K flip flop iii) flip flop iv) T flip flop
9. Realize a 4-bit asynchronous UP/Down counter with a control for up/down counting.
10. Realize a 4-bit synchronous UP/Down counter with a control for up/down counting.
11. Implement Mode-10 asynchronous counters.
12. Study shift registers.

(II) Microprocessor

(A) General Programming using 8085A development board

1. a. 1'S Complement. b. 2'S Complement.
2. a. Addition of 8-bit number. b. Subtraction of 8-bit number resulting 8/16 bit number.
3. a. Decimal Addition 8-bit number. b. Decimal Subtraction 8-bit number
3. a. Compare between two numbers. b. Find the largest in an Array
5. Block Transfer.

(B) Interfacing using 8085

1. Traffic light control using 8255.
2. Generation of square wave using 8255

Learning Resources:

Electronics Lab premier by Sacikala - (S. Chand)

Pr.4 PROJECT WORK (Phase-I)

Name of the Course: Diploma in Electrical Engineering			
Course code:	Pr.4	Semester	5th
Total Period:	45	Examination	----
Lab. periods:	3 P / week	Term Work	25
Maximum marks:	25	End Semester Examination:	---

A. RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the individual strengths of students. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of software engineering/ Hardware design and practices in real life situations, so as to participate and manage a large software engineering projects and /or appropriate Hardware with embedded software in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

B. OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Field computing and to achieve real life experience in software/hardware design.

C. GENERAL GUIDELINES

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester).

Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. Preferably there should not be more than 5 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Speed control techniques using thyristor.
- ✓ Battery design & its maintenance.
- ✓ Energy management Techniques.
- ✓ Dynamic models of Electrical machine.
- ✓ Solar based cooker, lamp, water heater etc. & Solar operated vehicles.
- ✓ Remote control operated Electrical devices.
- ✓ Advanced energy meter.
- ✓ Design of Illumination techniques using advanced luminaries etc.
- ✓ Dynamic models of Electrical Machine.
- ✓ PLC & Microprocessor based project.
- ✓ Any other related area found worth.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	**Performance Criteria**
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self-expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9.	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.
It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations to such an exhibition.

D. PROJECT PHASE-I AND PHASE-II

The Project work duration shall cover two semesters (5^{th} and 6^{th} sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5^{th} sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Requirements specification, Circuit Diagram with brief description and Design of the system have to be complete in Phase-I. Preliminary analysis/modelling/simulation/experiment/feasibility can also begin in this phase. Project Milestones are to be set so that progress can be tracked. In Phase-II Design, Testing, Documentation have to be complete. Project Report have to be complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the schedule.
At the end of Project Phase-I in 5^{th} semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

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. 3-phase wattmeter
7. 1-phase wattmeter
8. 3-Phase Variac
9. DOL starter
10. Star-Delta Starter
11. Rotor Resistance starter
12. Auto Transformer Starter
13. 3-Point Starter
14. Field Regulator
15. DC Voltmeter
16. DC Ammeter
17. AC Voltmeter
18. AC Ammeter
19. 3-Phase Resistive Load Box
20. 3-Phase Energy meter
21. Demonstrational model of Oil Circuit Breaker
22. Reverse Current Relay kit
23. Demonstrational model of Buchholz's Relay Trainer Kit
24. Earth fault relay test kit
25. Power Electronics trainer kit to perform (a) switching characteristics of a power transistor (b) V-I characteristics of SCR, TRIAC, DIAC (c) Drive circuit for SCR & TRIAC using DIAC & UJT (d) phase controlled bridge rectifier using resistive load (e) series Inverter (f) voltage source Inverter (g) speed control of DC motor using Chopper (h) single-phase Cyclo-converter
26. 8085 microprocessor trainer kit
27. Traffic Light controller interfacing module
28. Digital electronics trainer kit
29. PLC trainer kit

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 6th Semester (Electrical)(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		Electrical Installation And Estimating	4	1	-	20	80	3	100
Th.2		Switch Gear And Protective Devices	4	1	-	20	80	3	100
Th.3		Control System Engineering	4	1	-	20	80	3	100
Th.4		Elective (Any one to be opted) (a) Testing And Maintenance of Electrical Machine (b) Renewable Energy (c) Electric vehicle	4	1		20	80	3	100
		Total	*16*	*04*		*80*	*320*	-	*400*
		Practical							
Pr.1		Electrical Workshop	-	-	6	50	100	3	150
Pr.2		Project Phase- II			8	50	100	3	150
Pr.3		Life Skill	-	-	2	50	-	3	50
		Student Centred Activities(SCA)		-	3	-	-	-	-
		Total	-	-	*19*	*150*	*200*	-	*350*
		Grand Total	**16**	**04**	**19**	**205**	**545**	**-**	**750**
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/Idea Tinkering and Innovation Lab Practice 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 6TH SEMESTER

For

DIPLOMA IN ELECTRICAL ENGINEERING

(Effective from 2020-21 Sessions)

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

Th1. ELECTRICAL INSTALLATION AND ESTIMATING

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

Prior to implementation of a project in the power transmission and distribution sectors, a material estimate is required in various stages: like i) transmission line construction ii) distribution line construction iii) erection of domestic installation iv) service connection to industrial installation etc. In estimating, calculation of quantity of material is estimated by the estimator. This subject 'Electrical Installation and Estimating' is meant for learning the estimation process by the final semester students

B. OBJECTIVE:

After completion of this subject the student will be able:

1. To write down detailed specification and numbers required of different materials.
2. To determine the size and material of conductor and cable from electrical and mechanical consideration. As such to prepare a detailed list of materials with complete specifications.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Indian electricity rules	06
2.	Electrical installations	12
3.	Internal wiring	12
4.	Over head installation	12
5.	Over head service lines	12
6.	Estimating for distribution substations	06
	Total	**60**

D. COURSE CONTENTS

1. INDIAN ELECTRICITY RULES

1.1 Definitions, Ampere, Apparatus, Accessible, Bare, cable, circuit, circuit breaker, conductor voltage (low, medium, high, EH), live, dead, cut-out, conduit, system, danger, Installation, earthing system, span, volt, switch gear, etc.

1.2 General safety precautions, rule 29, 30, 31, 32, 33, 34, 35, 36, 40, 41, 43, 44, 45, 46.

1.3 General conditions relating to supply and use of energy : rule 47, 48, 49, 50, 51, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 70.

1.4 OH lines : Rule 74, 75, 76, 77, 78, 79, 80, 86, 87, 88, 89, 90, 91

2. ELECTRICAL INSTALLATIONS

2. 1 Electrical installations, domestics, industrial, Wiring System, Internal distribution of Electrical Energy. Methods of wiring, systems of wiring, wire and cable, conductor materials used in cables, insulating materials mechanical protection. Types of cables used in internal wiring, multi-stranded cables, voltage grinding of cables, general specifications of cables.

2. 2 ACCESSORIES: Main switch and distribution boards, conduits, conduit accessories and fittings, lighting accessories and fittings, fuses, important definitions, determination of size of fuse – wire, fuse units. Earthing conductor, earthing, IS specifications regarding earthing of electrical installations, points to be earthed. Determination of size of earth wire and earth plate for domestic and industrial installations. Material required for GI pipe earthing.

2. 3 LIGHTING SCHEME: Aspects of good lighting services. Types of lighting schemes, design of lighting schemes, factory lighting, public lighting installations, street lighting, general rules for wiring, determination of number of points (light, fan, socket, outlets), determination of total load, determination of Number of sub-circuits.

3. INTERNAL WIRING

3 . 1 Type of internal wiring, cleat wiring, CTS wiring, wooden casing capping, metal sheathed wiring, conduit wiring, their advantage and disadvantages comparison and applications.

3 . 2 Prepare one estimate of materials required for CTS wiring for small domestic installation of one room and one verandah within 25 m^2 with given light, fan & plug points.

3 . 3 Prepare one estimate of materials required for conduit wiring for small domestic installation of one room and one verandha within 25 m^2 with given light, fan & plug points.

3 . 4 Prepare one estimate of materials required for concealed wiring for domestic installation of two rooms and one latrine, bath, kitchen & verandah within 80m^2 with given light, fan & plug points.

3 . 5 Prepare one estimate of materials required for erection of conduct wiring to a small workshop installation about 30m^2 and load within 10 KW.

4. OVER HEAD INSTALLATION

4.1. Main components of overhead lines, line supports, factors Governing Height of pole, conductor materials, determination of size of conductor for overhead transmission line, cross arms, pole brackets and clamps, guys and stays, conductors configurations, spacing and clearances, span lengths, overhead line insulators, types of insulators, lighting arresters, danger plates, anti-climbing devices, bird guards, beads of jumpers, jumpers, tee-offs, guarding of overhead lines.

4.2. Prepare an estimate of materials required for LT distribution line within load of 100 KW maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation

consideration using ACSR.

4.3. Prepare an estimate of materials required for LT distribution line within load of 100 KW maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.

4.4. Prepare an estimate of materials required for HT distribution line (11 KV) within 2 km and load of 2000 KVA maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consider action using ACSR.

5. OVER HEAD SERVICE LINES

5. 1 Components of service lines, service line (cables and conductors), bearer wire, lacing rod. Ariel fuse, service support, energy box and meters etc.

5. 2 Prepare and estimate for providing single phase supply of load of 5 KW (light, fan, socket) to a single stored residential building.

5. 3 Prepare and estimate for providing single phase supply load of 3KW to each floor of a double stored building having separate energy meter.

5. 4 Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using insulated wire.

5. 5 Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using bare conductor and insulated wire combined.

6. ESTIMATING FOR DISTRIBUTION SUBSTATIONS

6. 1 Prepare one materials estimate for following types of transformer substations.

6.1.1 Pole mounted substation.

6.1.2 Plinth Mounted substation.

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:			
Sl.No	**Name of Authors**	**Title of the Book**	**Name of Publisher**
1	Surjit Singh	Electrical Installation and Estimating	Dhanpatrai and sons
2	J B Gupta	A course in Electrical Installation, Estimating and costing	S K Kataria and Sons
3	N. Alagappan S.Ekambaram	Electrical Estimating and Costing	TATA McGRAW HILL

Th2. SWITCH GEAR AND PROTECTIVE DEVICES

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

Switch gear and protection plays an important role in the protection of electrical power system. Since the demand of electrical power is increasing the job of generation, transmission & distribution of electrical energy is becoming very completed. To maintain the energy supply to the consumer switching producer with protection is to be maintained moreover new models of switch gear and protection circuits are also being developed. The use of interconnection bus with National power grid type of switch gear and protecting devices need to be trained in proper manners. In the subject information on above context has been included so that the updated knowledge can be given to the students.

B. OBJECTIVE:

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

1) The basic principles of protection of alternator, transformer and feeders.
2) Fuse and Circuit breaker.
3) Protective Relay.
4) Lighting Arrestor.
5) Calculation of symmetrical fault current.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction to switchgear	6
2	Fault calculation	10
3	Fuses	6
4	Circuit breakers	10
5	Protective relays	8
6	Protection of electrical power equipment and lines	6
7	Protection against over voltage and lighting	8
8	Static relay	6
	Total:	**75**

D. COURSE CONTENTS:

1. INTRODUCTION TO SWITCHGEAR

1.1 Essential Features of switchgear.
1.2 Switchgear Equipment.
1.3 Bus-Bar Arrangement.
1.4 Switchgear Accommodation.
1.5 Short Circuit.
1.6 Short circuit.
1.7 Faults in a power system.

2. FAULT CALCULATION

2.1 Symmetrical faults on 3-phase system.
2.2 Limitation of fault current.

2.3 Percentage Reactance.
2.4 Percentage Reactance and Base KVA.
2.5 Short – circuit KVA.
2.6 Reactor control of short circuit currents.
2.7 Location of reactors.
2.8 Steps for symmetrical Fault calculations.
2.9 Solve numerical problems on symmetrical fault.

3. FUSES

3.1 Desirable characteristics of fuse element.
3.2 Fuse Element materials.
3.3 Types of Fuses and important terms used for fuses.
3.4 Low and High voltage fuses.
3.5 Current carrying capacity of fuse element.
3.6 Difference Between a Fuse and Circuit Breaker.

4. CIRCUIT BREAKERS

4.1 Definition and principle of Circuit Breaker.
4.2 Arc phenomenon and principle of Arc Extinction.
4.3 Methods of Arc Extinction.
4.4 Definitions of Arc voltage, Re-striking voltage and Recovery voltage.
4.5 Classification of circuit Breakers.
4.6 Oil circuit Breaker and its classification.
4.7 Plain brake oil circuit breaker.
4.8 Arc control oil circuit breaker.
4.9 Low oil circuit breaker.
4.10 Maintenance of oil circuit breaker.
4.11 Air-Blast circuit breaker and its classification.
4.12 Sulphur Hexa-fluoride (SF6) circuit breaker.
4.13 Vacuum circuit breakers.
4.14 Switchgear component.
4.15 Problems of circuit interruption.
4.16 Resistance switching.
4.17 Circuit Breaker Rating.

5. PROTECTIVE RELAYS

5.1 Definition of Protective Relay.
5.2 Fundamental requirement of protective relay.
5.3 Basic Relay operation
  5.3.1. Electromagnetic Attraction type
  5.3.2. Induction type
5.4 Definition of following important terms
5.5 Definition of following important terms.
  5.5.1. Pick-up current.
  5.5.2. Current setting.
  5.5.3. Plug setting Multiplier.
  5.5.4. Time setting Multiplier.
5.6 Classification of functional relays
5.7 Induction type over current relay (Non-directional)
5.8 Induction type directional power relay.
5.9 Induction type directional over current relay.

5.10 Differential relay
5.10.1. Current differential relay
5.10.2. Voltage balance differential relay.
5.11 Types of protection

6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES

6.1 Protection of alternator.
6.2 Differential protection of alternators.
6.3 Balanced earth fault protection.
6.4 Protection systems for transformer.
6.5 Buchholz relay.
6.6 Protection of Bus bar.
6.7 Protection of Transmission line.
6.8 Different pilot wire protection (Merz-price voltage Balance system)
6.9 Explain protection of feeder by over current and earth fault relay.

7. PROTECTION AGAINST OVER VOLTAGE AND LIGHTING

7.1. Voltage surge and causes of over voltage.
7.2. Internal cause of over voltage.
7.3. External cause of over voltage (lighting)
7.4. Mechanism of lightning discharge.
7.5. Types of lightning strokes.
7.6. Harmful effect of lightning.
7.7. Lightning arresters and Type of lightning Arresters.
7.7.1. Rod-gap lightning arrester.
7.7.2. Horn-gap arrester.
7.7.3. Valve type arrester.
7.8. Surge Absorber

8. STATIC RELAY:

8. 1 Advantage of static relay.
8. 2 Instantaneous over current relay.
8. 3 Principle of IDMT relay.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

Sl.No	Title of the Book	Name of Authors	Publisher
1	Principle of power system	V. K. Mehta	S Chand
2.	Protection and Swwitchgear	Bhavesh Bhalja R.P Maheshwari Nilesh G. Chothani	OXFORD
2	Electrical power	Soni, Gupta and Bhatnagar	Dhanpat Rai & Sons
3	Power system protection & switch gear	Bhuvanesh Oza	TMH
4	Electrical Power	S. L. Uppal	Khanna Publisher
5	Protection and Switchgear	Raghuraman	SCITECH

Th3.CONTROL SYSTEM ENGINEERING

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

Automatic control has played a vital role in modern Engineering and Science. It has become an indispensable part of modern manufacturing and industrial process. So knowledge of automatic control system is dreadfully essential on the part of an Engineer. Basic approach to the automatic control system has been given in the subjects, so that students can enhance their knowledge in their future professional carrier.

B. OBJECTIVE:

Study of 'Control System' enhances the ability of the student on:

1. Acquire knowledge about Mathematical modeling, Block diagram algebra, signal flow graphs and control system components.
2. Ability to deal with time response analysis of various systems.
3. Finding out steady state error and error constants.
4. Acquire knowledge about the analysis of stability in Root locus technique.
5. Learning about frequency response analysis of control system.
6. To use Bode plot and Nyquist plot for judgments about stability of a system.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Fundamental of control system	04
2.	Mathematical model of a system	04
3.	Control system components	04
4.	Block diagram algebra & signal flow graphs	08
5.	Time response analysis	10
6.	Analysis of stability by root locus technique	10
7.	Frequency response of system	10
8.	Nyquist plot	10
	Total	**60**

D. COURSE CONTENTS

1. FUNDAMENTAL OF CONTROL SYSTEM

1.1. Classification of Control system
1.2. Open loop system & Closed loop system and its comparison
1.3. Effects of Feed back
1.4. Standard test Signals(Step, Ramp, Parabolic, Impulse Functions)
1.5. Servomechanism

2. MATHEMATICAL MODEL OF A SYSTEM

2.1. Transfer Function & Impulse response,
2.2. Properties, Advantages & Disadvantages of Transfer Function
2.3. Poles & Zeroes of transfer Function
2.4. Simple problems of transfer function of network.
2.5. Mathematical modeling of Electrical Systems(R, L, C, Analogous systems)

3. CONTROL SYSTEM COMPONENTS

3.1. Components of Control System
3.2. Gyroscope, Synchros, Tachometer, DC servomotors, Ac Servomotors.

4. BLOCK DIAGRAM ALGEBRA & SIGNAL FLOW GRAPHS

4.1. Definition: Basic Elements of Block Diagram
4.2. Canonical Form of Closed loop Systems
4.3. Rules for Block diagram reduction
4.4. Procedure for of Reduction of Block Diagram
4.5. Simple Problem for equivalent transfer function
4.6. Basic Definition in Signal Flow Graph & properties
4.7. Construction of Signal Flow graph from Block diagram
4.8. Mason's Gain formula
4.9. Simple problems in Signal flow graph for network

5. TIME RESPONSE ANALYSIS.

5 . 1 Time response of control system.
5 . 2 Standard Test signal.
- 5.2.1. Step signal,
- 5.2.2. Ramp Signal
- 5.2.3. Parabolic Signal
- 5.2.4. Impulse Signal

5 . 3 Time Response of first order system with:
- 5.3.1. Unit step response
- 5.3.2. Unit impulse response.

5 . 4 Time response of second order system to the unit step input.
- 5.4.1. Time response specification.
- 5.4.2. Derivation of expression for rise time, peak time, peak overshoot, settling time and steady state error.

5.4.3. Steady state error and error constants.

5 . 5 Types of control system.[Steady state errors in Type-0, Type-1, Type-2 system]

5 . 6 Effect of adding poles and zero to transfer function.

5 . 7 Response with P, PI, PD and PID controller.

6. ANALYSIS OF STABILITY BY ROOT LOCUS TECHNIQUE.

6 . 1 Root locus concept.

6 . 2 Construction of root loci.

6 . 3 Rules for construction of the root locus.

6 . 4 Effect of adding poles and zeros to G(s) and H(s).

7. FREQUENCY RESPONSE ANALYSIS.

7 . 1 Correlation between time response and frequency response.

7 . 2 Polar plots.

7 . 3 Bode plots.

7 . 4 All pass and minimum phase system.

7 . 5 Computation of Gain margin and phase margin.

7 . 6 Log magnitude versus phase plot.

7 . 7 Closed loop frequency response.

8. NYQUIST PLOT

8.1 Principle of argument.

8.2 Nyquist stability criterion.

8.3 Niquist stability criterion applied to inverse polar plot.

8.4 Effect of addition of poles and zeros to G(S) H(S) on the shape of Niquist plot.

8.5 Assessment of relative stability.

8.6 Constant M and N circle

8.7 Nicholas chart.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3, 4 and 5.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of Publisher**
1.	Control System	A. Ananda Kumar	PHI
3.	Control System	K. Padmanavan	IK
2.	Control system Engineering	I. J. Nagarath, M. Gopal	WEN
4.	Control system Engineering	A Natrajan,Ramesh Babu	Scientific
5.	Control Systems	D N Manik	Cengage
6.	Control Systems	S P Eugene Xavier, J Joseph Cyril Babu	S Chand

Th4.TESTING AND MAINTENANCE OF ELECTRICAL MACHINE

(Elective- A)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

This subject intends to be acquainted with application level technology, normally adopted in Industries, commercial, public utility departments such as Electrical transmission and distribution, Irrigation, Water supply etc. The knowledge in this subject will make the readers able for inspection, testing, installation and commissioning of electrical machines as per IS standards. This will help him to initiate total productive maintenance.

B. OBJECTIVE:

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

1. To acquire knowledge on safety measures and precautions.
2. Testing of DC and AC rotating machines and transformers.
3. Identify common troubles in Electrical machines and switch gear.
4. Plan and carryout routine and preventive maintenance.
5. Install LV switch gear and maintain it.
6. Ascertain the condition of insulation and varnishing. (if necessary)
7. Initiate total productive maintenance.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Installation, Commissioning and Testing of Machine	15
2.	Installation, Commissioning and Testing of Transformer	15
3.	Installation, Commissioning & Testing of Sub-station.	15
4.	Maintenance	15
	Total	**60**

D. COURSE CONTENTS

1. Installation, Commissioning and Testing of Machine:

1.1. Inspection of arrival of machine and inspection procedure before its installation.
1.2. Generalized procedure of installation of Electrical machines.
1.3. Electric wiring for motors and switch gears.
1.4. General requirement for Electric Installation according to Indian Electricity rules.
1.5. Necessity of starters and relays for both DC and AC machines.
1.6. Testing before giving supply and testing report.

2. Installation, Commissioning and Testing of Transformer:

2. 1 Basic idea on dispatch, inspection, storage and handling of transformer.
2. 2 Civil construction feature regarding connection like ventilation, noise level, space for free movement.
2. 3 Foundation and drainage of oil.
2. 4 Cabling and cable box for transformer.
2. 5 Provision for fire protection.
2. 6 Provision for bushing support location of switch gear.
2. 7 Steps for commissioning fitting of all accessories.
2. 8 Filling of oil, drying out.
2. 9 Charging the breather with fresh silica gel.
2. 10 Cleaning of bushing, fixing of conductor & cables, earthing of tank and cover, neutral earthing.
2. 11 Fixing of protection circuits and setting of relays.

3. Installation, Commissioning & Testing of Sub-station.

3 . 1 Design and planning of indoor substation.
3 . 2 General requirement of layout of indoor substation with key diagram.
3 . 3 Consideration of safe operation of substation
3 . 4 Installation of outdoor substation:
3.4.1 Selection of site, transport & receipt of transformer, checking of insulation resistance of the winding, testing of transformer oil, protection fittings, construction of mounting, earthing arrangement and final commissioning.
3 . 5 Testing and commissioning of substation.
3.5.1. Installation of control and relay panels.
3.5.2. Preliminary preparation.
3.5.3. Sequence card for erection of switch gear equipments.
3.5.4. Location of place
3.5.5. Unpacking
3.5.6. Foundation
3.5.7. Erection
3.5.8. Relays
3 . 6 Bus-bar earthing connection, Earthing.
3.6.1. Connection to main cable.
3.6.2. Safety precaution
3 . 7 Installation of outdoor circuit breaker:
3.7.1. Receipt and storage.

3.7.2. Civil works.
3.7.3. Various steps for installation.
3 . 8 Pre-commissioning tests.

4. Maintenance:

4.1 Fundamental of maintenance.
4.2 Preventive maintenance and planning.
[Daily, Weekly, Monthly, Half-yearly and Yearly maintenance.]
4.3 Advantages of Preventive maintenance:
4.4 Breakdown maintenance: List of tools / instruments and materials used for maintenance.
4.5 Making or Preparing Maintenance schedule of DC machines, Induction machines, Synchronous machines, Transformer, Transmission line, Distribution lines, Underground cables, Circuit breakers, Switch gear and protective relays and substations, SF-6 circuit breakers, Batteries in substation.

Syllabus coverage up to Internal assessment

Chapters: 1, and 2.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of Publisher**
1	Installation Commissioning & Maintenance of Electrical Equipments	Tarlok Singh	S. K. Kataria & Sons
2.	Installation Servicing and Maintenance	S N Bhattacharya	S Chand
3.	Testing Commissioning Operation and Maintenance of Electrical Equipments	S Rao	Khanna Publisher
4.	Hand book of Inspection, for all type of Electrical Instruments	Er. R. N. Sahoo	Orissa Power Generation consultants and services
5.	Installation, Maintenance and Repair of Electrical Machines and Equipments	Madhvi Gupta	Katson Books

Th4. RENEWABLE ENERGY SYSTEMS
(Elective – B)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

It is well known that a plenty of energy is needed to sustain industrial growth and agricultural production. The existing sources energy such as coal, oil, uranium etc may not be sufficient to meet the ever increasing energy demands. These conventional sources of energy are also depleting and may be exhausted at the end of the century or the beginning of the next century.

Consequently sincere efforts shall have to be made by the scientists and engineers in exploring the possibilities of harnessing energy from several energy sources.

B. OBJECTIVE:

After completion of this subject the student will be able:

1. Power production from pollution free forces and environment friendly resources.
2. Production of power form nature at free of cost.
3. Solar energy conversion is noiseless and cheap.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Introduction to Renewable energy	5
2.	Solar Energy	15
3.	Wind Energy	12
4.	Biomass Power	12
5.	Other Energy Sources	16
	Total	**60**

D. COURSE CONTENTS

1. Introduction to Renewable energy:

1.1. Environmental consequences of fossil fuel use.
1.2. Importance of renewable sources of energy.
1.3. Sustainable Design and development.
1.4. Types of RE sources.
1.5. Limitations of RE sources.
1.6. Present Indian and international energy scenario of conventional and RE sources

2. Solar Energy:

2.1. Solar photovoltaic system-Operating principle.

2.2. Photovoltaic cell concepts
2.2.1. Cell, module, array, Series and parallel connections. Maximum power point tracking (MPPT).
2.3. Classification of energy Sources.
2.4. Extra-terrestrial and terrestrial Radiation.
2.5. Azimuth angle, Zenith angle, Hour angle, Irradiance, Solar constant.
2.6. Solar collectors, Types and performance characteristics,
2.7. Applications: Photovoltaic - battery charger, domestic lighting, street lighting, water pumping, solar cooker, Solar Pond.

3. Wind Energy:

3.1. Introduction to Wind energy.
3.2. Wind energy conversion.
3.3. Types of wind turbines
3.4. Aerodynamics of wind rotors.
3.5. Wind turbine control systems; conversion to electrical power:
3.6. Induction and synchronous generators.
3.7. Grid connected and self excited induction generator operation.
3.8. Constant voltage and constant frequency generation with power electronic control.
3.9. Single and double output systems.
3.10. Characteristics of wind power plant.

4. Biomass Power:

4.1. Energy from Biomass.
4.2. Biomass as Renewable Energy Source
4.3. Types of Biomass Fuels - Solid, Liquid and Gas.
4.4. Combustion and fermentation.
4.5. Anaerobic digestion.
4.6. Types of biogas digester.
4.7. Wood gassifier.
4.8. Pyrolysis,.
4.9. Applications: Bio gas, Bio diesel

5. Other Energy Sources

5.1. Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems.
5.2. Ocean Thermal Energy Conversion (OTEC).
5.3. Geothermal Energy – Classification.
5.4. Hybrid Energy Systems.
5.5. Need for Hybrid Systems.
5.6. Diesel-PV, Wind-PV, Microhydel-PV.
5.7. Electric and hybrid electric vehicles.

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**
1.	*Renewable Energy Sources and Emerging Technologies*	*D.P.Kothari, K.C Singal, Rakesh Ranjan*	*PHI Learning Pvt.Ltd, New Delhi*
2.	*Non-Conventional Energy Resources*	*B.H.Khan*	*Tata McGrawHill*
3	*Non-Conventional Energy Resources*	*J.P Navani & Sonal Sapra*	*S chand*
4.	*Non Conventional Energy sources and Utilisation*	*R K Rajput*	*S Chand*
5	*Wind Electrical Systems*	*S. N. Bhadra, D. Kastha, S. Banerjee*	*Oxford Univ. Press, New Delhi*
6.	*Non Conventional Energy Resources*	*N K Bansal*	*S Chand*

Th4. ELECTRIC VEHICLES

(Elective- C)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester:	6th
Total Period:	75	Examination:	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

The sole objective of this subject to be familiar with advanced Electric drive vehicle technology, its economic analysis, comparative study and environmental aspects.

B. OBJECTIVE:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the salient features of Hybrid electric vehicles.
b) Interpret the Dynamics of hybrid and Electric vehicles
c) Maintain the DC-DC converters in EV applications.
d) Maintain the DC-AC converters in EV applications
e) Select the batteries for EV applications, its charging.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Introduction to Hybrid Electric Vehicles	10
2.	Dynamics of hybrid and Electric vehicles	10
3.	DC-DC Converters for EV and HEV Applications	15
4.	DC-AC Inverter & Motors for EV and HEVs	15
5.	Batteries	10
	Total	**60**

D. COURSE CONTENTS

Unit – I Introduction to Hybrid Electric Vehicles

Evolution of Electric vehicles, Advanced Electric drive vehicle technology Vehicles-Electric vehicles (EV), Hybrid Electric drive (HEV), Plug in Electric vehicle (PIEV), Components used Hybrid Electric Vehicle ,Economic and environmental impacts of Electric hybrid vehicle Parameters affecting Environmental and economic analysis. Comparative study of vehicles for economic, environmental aspects.

Unit – II Dynamics of hybrid and Electric vehicles

General description of vehicle movement, Factors affecting vehicle motion- Vehicle resistance, tyre ground adhesion, rolling resistance, aerodynamic drag, equation of grading resistance, dynamic equation. Drive train configuration, Automobile power train, classification of vehicle power plant. Performance characteristics of IC engine, electric motor, need of gear box. Classification of motors used in Electric vehicles. Basic architecture of hybrid drive trains, types of HEVs Energy saving potential of hybrid drive trains ,HEV Configurations-Series, parallel, Series-parallel, complex.

Unit– III DC-DC Converters for EV and HEV Applications

EV and HEV configuration based on power converters, Classification of converters – unidirectional and bidirectional, Principle of step down operation, Boost and Buck- Boost converters, Principle of Step-Up operation, Two quadrant converters; multi quadrant converters, Electrical Engineering Curriculum Structure 210.

Unit– IV DC-AC Inverter & Motors for EV and HEVs

DC-AC Converters, Principle of operation of half bridge DC-AC inverter (R load, R-L load), Single phase Bridge DC-AC inverter with R load, R-L load, Electric Machines used in EVs and HEVs, principle of operation, working & control , Permanent magnet motors, their drives, switched reluctance motor, Characteristics and applications of above motors.

Unit– V Batteries

Overview of batteries, Battery Parameters, types of batteries, Battery Charging, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, flywheels , Control system for EVs and HEVs, overview, Electronic control unit ECU, Schematics of hybrid drive train, control architecture Regenerative braking in EVs.

Syllabus coverage up to Internal assessment

Unit: 1,2

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of Publisher**
1	Electric & Hybrid Vehicles	A.K. Babu	Khanna Publishing House
2.	A. E. Hybrid Vehicles and the Future of Personal Transportation	Fuhs	CRC Press
3.	I. *Electric and Hybrid Electric Vehicles*	Husain	CRC Press
4.	*Modern Electric Vehicle Technology*	Chan C. C. and K. T. Chau	Oxford Science Publication,
5.	M. H. *Power Electronics: Circuits, Devices and Applications*,	Rashid	3rd edition, Pearson,

Pr1.ELECTRICAL WORKSHOP PRACTICE

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Sessional:	50
Maximum marks:	150	End Semester Examination:	100

A. **RATIONALE:** The sole objective of the subject is skill development among the students after performing practice of the experiments and become fit to meet the challenges in practical installation.
In the beginning all the tools and instruments required/ used in conducting this subject are to be illustrated. The students are required to make a thorough hand on approach in practicing the experiments.

B. **OBJECTIVE:**
After completion of this workshop the student will be able to:
1. To be familiar with different cable and overhead line joints.
2. To be familiar with Electrical installation of residential building and to identify and maintenances of different electrical gadgets.
3. Fault finding, repairing of DC and AC machines with their accessories.

C. **LIST OF EXPERIMENT:**
1. Identification of single core (SC), twin core (TC), three cores (3c), four cores (4c); copper and aluminum PVC, VIR & Weather proof (WP) wire and prepare Britannia T-joint and Married joint.
2. Cutting copper and aluminum cable and crimping lug to them from 2.5mm^2 to 6 mm^2 cross section.
3. Connection and testing of fluorescent tube light, high pressure M.V. lamp, sodium vapor lamp, M.H lamp, CFL and latest model lamps – measure inductance, Lux/ lumens (intensity of illumination) in each case-prepare lux table .
4. Study battery charger and make charging of lead acid battery (record charging voltage, current and specific gravity).
5. Erection of residential building wiring by CTS and conduit wiring system using main two points and test installation by test lamp method and a meggar.
6. Fault finding & repairing of Ceiling Fan – prepare an inventory list of parts.
7. Find out fault of D.C. generator, repair and test it to run.
8. Find out fault of D.C. motor starters and A.C motor starter – prepare an inventory list of parts used in different starters.
9. Dismantle, over haul and assemble a single phase induction motor. Test and run it. – prepare an inventory list.
10. Dismantle over haul and assemble a three phase squirrel cage and phase wound motor. Test and run them.
11. Overhaul a single phase and 3-phase variac.

Pr2. PROJECT Phase - II

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	6th
Total Period:	120	Examination	3 hrs
Lab. periods:	8 P / week	Sessional	50
Maximum marks:	150	End Sem Examination	100

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Electrical engineering and practices in real life situations, so as to participate and manage a large Electrical engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable

alteration in the components of Task and schedule.
At the end of Project Phase-II in 6th semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	**Performance Criteria**
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.
It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:
   It should contain the following (in order)
   (i) Title of the Project
   (ii) "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
   (iii) By Name of the Student(s)
   (iv) Logo of the Institution
   (v) Branch Name/Depart Name and Institution Name with Address
   (vi) Academic Year
2. 1st Inner page
   Certificate:

It should contain he following

"This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

Seal and signature of the Supervisor/Guide with date

3. 2nd Inner Page
   Acknowledgement by the Student(s)
4. Contents.
5. Chapter wise arrangement of Reports
6. Last Chapter: Conclusion
   It should contain
   (i) Conclusion
   (ii) Limitations
   (iii) Scope for further Improvement
7. References

Pr-3 LIFE SKILL

(Common to All Branches)

Practical	**2 Periods/ week**	**Sessional**	**50 Marks**
Total Periods	**30 Periods**	**Total Marks**	**50 Marks**

Objective: After completion of this course the student will be able to**:**

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:

1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy
Swot Analysis – Concept, How to make use of SWOT
Inter personal Relation**:** Sources of conflict, Resolution of conflict ,
Ways to enhance interpersonal relation

2. PROBLEM SOLVING

Steps of Problem solving**:**

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience
Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,
Voice and language – Volume, Pitch, Inflection, Speed, Pause
Pronunciation, Articulation, Language, Practice of speech.
Use of AV aids such as Laptop with LCD projector, white board etc.

4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES

Group Discussion:
Introduction to group discussion, Ways to carry out group discussion,

Parameters— Contact, body language, analytical and logical thinking,
decision making
Interview Technique :
Dress, Posture, Gestures, facial expression, Approach
Tips for handling common questions.

5. WORKING IN TEAM

Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them
to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.

6. TASK MANAGEMENT

Introduction, Task identification, Task planning ,
organizing and execution, Closing the task

PRACTICAL

List of Assignment: *(Any Five to be performed including Mock Interview)*

1. SWOT analysis:-

Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.

a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

2. Solve the True life problem assigned by the Teacher.

3. Working in a Team

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.(One activity per group where Team work shall be exhibited)

4. Mock Interview

5. Discuss a topic in a group and prepare minutes of discussion.

6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.

7. Task Management

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.
Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics

at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

METHODOLOGY:

The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

Sl.No	Name of Authors	Title of the Book	Name of the Publisher
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.

EQUIPMENT LIST OF ELECTRICAL WORKS PRACTICE

Sl NO	EQUIPMENT LIST
1.	Single Core,Twin Core,Three Core,Four Core Copper and Aluminium PVC,VIR,and Weatherproof Wire
2.	Copper and Aluminium Cable ,Crimping Lug
3.	Flourescent Tube Light
4.	High Pressure M.V Lamp
5.	Sodium Vapour Lamp
6.	M.H Lamp
7.	CFL
8.	Battery Charger and Lead Acid Battery
9.	Single Phase Motor(Fan)
10.	DC Generator
11.	DC Motor with Starter
12.	AC Motor with Starter
13.	L.T And H.T Aluminium Cable
14.	Crimping Tools and Lug
15.	Single Phase Induction Motor
16.	Three Phase Squirrel Cage Induction Motor
17.	Phase Wound Motor
18.	Single Phase/ Three phase Variac
19.	Megger