

**STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA**  
**TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES**

<b>DISCIPLINE: ELECTRICAL ENGINEERING</b>						<b>SEMESTER: 4<sup>TH</sup></b>						
<b>SL NO</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>PERIODS</b>			<b>EVALUATION SCHEME</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>INTERNAL EXAM</b>			<b>END SEM EXAM</b>	<b>TERM WORK</b>	<b>PRACTICAL EXAM</b>	<b>TOTAL MARKS</b>
						<b>TA</b>	<b>CT</b>	<b>Total</b>				
<b>THEORY</b>												
1	EET 401	ENERGY CONVERSION - I	4	1	0	10	20	30	70			100
2	EET 402	ELECTRICAL MEASUREMENT & MEASURING INSTRUMENT	4	1	0	10	20	30	70			100
3	EET 403	GENERATION TRANSMISSION AND DISTRIBUTION	4	1	0	10	20	30	70			100
4	EET 404	INSTRUMENTATION AND CONTROL	4	0	0	10	20	30	70			100
5	ETT 421	DIGITAL ELECTRONICS	4	1	0	10	20	30	70			100
<b>PRACTICAL/TERM WORK</b>												
6	EEP 401	ELECTRICAL LAB. PRACTICE – I	0	0	6					50	100	150
7	ETP 421	DIGITAL ELECTRONICS LAB.	0	0	3					25	25	50
8	MEP 421	MECHANICAL WORKSHOP PRACTICE	0	0	6					25	25	50
<b>GRAND TOTAL</b>			<b>20</b>	<b>4</b>	<b>15</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>350</b>	<b>100</b>	<b>150</b>	<b>750</b>

Total Contact hours per week: 39

Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test

Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%

## ENERGY CONVERSION – I

Name of the Course: Diploma in Electrical Engineering			
Course code:	EET 401	Semester	4 <sup>th</sup>
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester examination:	70

### 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. So an early knowledge of the technicians about transformers is necessary for which it is dealt with broadly in the fourth semester syllabus.

### B. OBJECTIVES

1. To acquire knowledge of construction, characteristic and control of the DC machines.
2. To acquire knowledge on performance of DC machines and transformers of all types.
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	19
2.	DC MOTORS	19
3.	SINGLE PHASE TRANSFORMER	22
4.	AUTO TRANSFORMER	05
5.	THREE PHASE TRANSFORMER	05
	<b>Total</b>	<b>70</b>

### D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

#### 1. D.C Generator

- 1.1. Explain principle of operation
- 1.2. Explain Constructional feature
- 1.3. Armature winding, back pitch, Front pitch, Resultant pitch and commutator- pitch.
- 1.4. Simple Lap and wave winding (problems on winding diagram)
- 1.5. Explain Different types of D.C. machines Shunt, Series and Compound machine with problem solving methods.
- 1.6. Derive EMF equation of DC generators. (Solve problems)
- 1.7. Explain Armature reaction in D.C. machine & commutation.
- 1.8. Explain Methods of improving commutation (Resistance and emf commutation)
- 1.9. Explain role of inter poles and compensating winding. (solve problems)
- 1.10. Characteristics of D.C. Generators with problem solving methods

- 1.11. State application of different types of D.C. Generators.
- 1.12. Concept of critical resistance causes of failure of development of emf.
- 1.13. Explain losses and efficiency of D.C. machines, condition for maximum efficiency and numerical problems.
- 1.14. Explain parallel operation of D.C. Generators.
- 2. D. C. MOTORS**
  - 2.1 Explain basic working principle of DC motor
  - 2.2 State Significance of back emf in D.C. Motor.
  - 2.3 Derive voltage equation of Motor
  - 2.4 Derive torque (Equation of Armature Torque and shaft Torque) (solve problems)
  - 2.5 Explain performance characteristics of shunt, series and compound motors and their application. (Solve problems)
  - 2.6 Explain methods of starting shunt, series and compound motors, (solve problems)
  - 2.7 Explain speed control of D.C shunt motors by
    - 2.7.1 Flux control method
    - 2.7.2 Armature voltage (rheostatic) Control method.
    - 2.7.3 Solve problems
  - 2.8 Explain speed control of series motors by Flux control method and series parallel method.
  - 2.9 Explain determination of efficiency of D.C. Machine by break test method.
  - 2.10 Explain determination of efficiency of D.C. Machine by Swinburne's Test method.
  - 2.11 Explain Losses & efficiency and condition for maximum power and solve numerical problems.
- 3. SINGLE PHASE TRANSFORMER**
  - 3.1 Explain working principle of transformer.
  - 3.2 Explains Transformer Construction – Arrangement of core & winding in different types of transformer – Brief ideas about transformer accessories such as conservator, tank, breather explosion vent etc.
  - 3.3 Explain types of cooling methods
  - 3.4 State the procedures for Care and maintenance
  - 3.5 Derive EMF equation
  - 3.6 Ideal transformer voltage transformation ratio
  - 3.7 Explain Transformer on no load and on load phasor diagrams.
  - 3.8 Explain Equivalent Resistance. Reactance and Impedance.
  - 3.9 Explain phasor diagram of transformer with winding Resistance and Magnetic leakage. Phasor diagram on load using upf, leading pf and lagging pf.
  - 3.10 Explain Equivalent circuit and solve numerical problems.
  - 3.11 Calculate Approximate & exact voltage drop of a Transformer.
  - 3.12 Calculate Regulation of various loads and power factor.
  - 3.13 Explain Different types of losses in a Transformer. (solve problems)
  - 3.14 Explain Open circuit test.
  - 3.15 Explain Short circuit test.
  - 3.16 Explain Efficiency, efficiency at different loads and power factors, condition for maximum efficiency (solve problems)
  - 3.17 Explain All Day Efficiency (solve problems)
  - 3.18 Explain determination of load corresponding to Maximum efficiency.
  - 3.19 Explain parallel operation of single phase transformer.
- 4. AUTO TRANSFORMER**
  - 4.1 Explain constructional features.

- 4.2 Explain Working principle of single phase Auto Transformer.
- 4.3 State Comparison of Auto transformer with an two winding transformer (saving of Copper)
- 4.4 State Uses of Auto transformer.
- 4.5 Explain Tap changer with transformer (on load and off load condition)

**5. THREE PHASE TRANSFORMER**

- 5.1 State and show Type of connection – Star-Star, Star-Delta, Delta-Star and Delta – Delta.
- 5.2 Explain parallel operation and state conditions for Parallel operation.
- 5.3 Maintenance schedule of power transformer.

<b>Learning Resources:</b>			
<b>Text books:</b>			
<b>Sl.No</b>	<b>Name of Author</b>	<b>Title of the Book</b>	<b>Publisher</b>
1.	B. L. Thareja and A. K. Thareja	Electrical Technology – II	
2.	J. B. Gupta	Electrical Technology	
<b>Reference Books:</b>			
1.	Ashfaq Husain	Electric Machine	
2.	S. K. Bhattacharya	Electrical Machine	TMH
3.	Jaggi	Testing maintenance and repair of electrical machine and equipment	

**N. B. :** After completion of each topic the students are required to submit assignment on concepts and Applications. It is also required to solve mathematical problems as when applicable.

## ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

<b>Name of the Course: Diploma in Electrical Engineering</b>			
Course code:	EET 402	Semester	4 <sup>th</sup>
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### A. RATIONALE :

The subject "Electrical measurement and measuring instruments" is important in the field of electrical engineering. The subjects deal with the methods of measuring voltage, current, power, energy, frequency, power factor & parameters like resistance, inductance and capacitance and constructional detail 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. The detailed classification of all instruments used for the above measurement is dealt up carefully. Also accuracy, precision, resolution and errors and their correction are very important and have been fully discussed.

### 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.

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Measuring instruments	07
2.	Analog ammeters and voltmeters	10
3.	Wattmeter and measurement of power	07
4.	Energy meters and measurement of energy	06
5.	Measurement of speed, frequency and power factor	05
6.	Instrument transformer	08
7.	Measurement of resistance	06
8.	Measurement of inductance and capacitance	06
9.	Digital instruments	05
	<b>TOTAL</b>	<b>60</b>

### D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

- |           |   |           |
|-----------|---|-----------|
| <b>1.</b> | <b>MEASURING INSTRUMENTS</b>  | <b>07</b> |
| 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.   |           |

<b>2.</b>	<b>ANALOG AMMETERS AND VOLTMETERS</b>	<b>10</b>
	Describe Construction, principle of operation, errors, ranges merits and demerits of	
	2.1 Moving iron type instruments.	
	2.2 Permanent Magnet Moving coil type instruments.	
	2.3 Dynamometer type instruments	
	2.4 Rectifier type instruments	
	2.5 Induction type instruments	
	2.6 Extend the range of instruments by use of shunts and Multipliers.	
	2.7 Solve Numerical	
<b>3.</b>	<b>WATTMETERS AND MEASUREMENT OF POWER</b>	<b>07</b>
	3.1 Describe Construction, principle of working of Dynamometer type wattmeter and	
	3.2 What are the Errors in Dynamometer type wattmeter and methods of their correction	
	3.3 Discuss L P F Electro – Dynamometer type wattmeter	
	3.4 Discuss Induction type watt meters	
	3.5 Measurement of Power in Single Phase and Three Phase Circuit.	
<b>4.</b>	<b>ENERGYMETERS AND MEASUREMENT OF ENERGY</b>	<b>06</b>
	4.1 Introduction	
	4.2 Single Phase and poly phase Induction type Energy meters – construction, working principle and their compensation and adjustments.	
	4.3 Testing of Energy Meters	
<b>5.</b>	<b>MEASUREMENT OF SPEED, FREQUENCY AND POWER FACTOR</b>	<b>05</b>
	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.	
	5.4 Synchrosopes – objectives and working.	
	5.5 Phase Sequence Indicators and its working.	
<b>6.</b>	<b>INSTRUMENT TRANSFORMER</b>	<b>08</b>
	6.1 Explain Current Transformer and Potential Transformer.	
	6.2 Explain Ratio error, Phase Angle error and Burden	
	6.3 Clamp – On Ammeters	
	6.4 State Use of CT and PT	
<b>7.</b>	<b>MEASUREMENT OF RESISTANCE</b>	<b>06</b>
	7.1 Classification of resistance	
	7.2 Explain Measurement of low resistance by voltage drop and potentiometer method & its use to Measure resistance.	
	7.3 Explain Measurement of medium resistance by wheat Stone bridge method and substitution Method.	
	7.4 Explain Measurement of high resistance by loss of charge method.	
	7.5 Explain construction & principle of operations ( meggers) insulation resistance & Earth resistance megger.	
	7.6 Explain construction and principles of Multimeter.	
<b>8.</b>	<b>MEASUREMENT OF INDUCTANCE NAD CAPACITANCE</b>	<b>06</b>
	Explain measurement of inductance by	

- 8.1 Maxwell's Bridge method.
- 8.2 Owen Bridge method
- Explain measurement of capacitance by
- 8.3 De Sauty Bridge method
- 8.4 Schering Bridge method
- 8.5 LCR Bridge method

**9. DIGITAL INSTRUMENTS**

**05**

- 9.1 Digital Voltmeters (DVM)
- 9.2 Characteristic of Digital Meters
- 9.3 Digital Multimeters

<b>Learning Resources:</b>			
<b>Text books:</b>			
<b>Sl.No</b>	<b>Name of Author</b>	<b>Title of the Book</b>	<b>Publisher</b>
1.	A.K. Sawhney	Electric Measurement and Measuring instruments	Dhanpat
<b>Reference Books:</b>			
1.	J. B. Gupta	Electrical and Electronics Measuring instruments and Measurement	
2.	E.W. Golding & H Widdis	Electrical Measurement and Measuring instruments	

**N. B. :** After completion of each topic the students are required to submit assignment on concepts and Applications. It is also required to solve mathematical problems as when applicable.

## GENERATION TRANSMISSION & DISTRIBUTION

Name of the Course: Diploma in Electrical Engineering			
Course code:	EET 403	Semester	4 <sup>th</sup>
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### 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 technicians.

### B. OBJECTIVES :

To acquire knowledge of:

1. Different schemes of 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
	<b>Total</b>	<b>60</b>

### D. COURSE CONTENTS IN TERMS OF SPECIFIC OBJECTIVES.

#### 1. GENERATION OF ELECTRICITY

- 1.1 Give Elementary idea on generation of electricity from Thermal / Hydel / Nuclear Power station.
- 1.2 Draw layout of generating stations.



## **2. TRANSMISSION OF ELECTRIC POWER**

- 2.1 Draw layout of transmission and distribution scheme.
- 2.2 Explain voltage Regulation & efficiency of transmission.
- 2.3 State and explain Kelvin's law for economical size of conductor.
- 2.4 Explain corona and corona loss on transmission lines.

## **3. OVER HEAD LINES**

- 3.1 State 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 Derive for sag in overhead line with support at same level and different level (approximate formula effect of wind, ice and temperature on sag simple problem)

## **4. PERFORMANCE OF SHORT & MEDIUM LINES**

- 4.1 Calculation of regulation and efficiency.

## **5. EHV TRANSMISSION**

- 5.1 Explain EHV AC transmission.
- 5.2 Explain Reasons for adoption of EHV AC transmission.
- 5.3 Problems involved in EHV transmission.
- 5.4 Explain HV DC transmission.
- 5.5 State Advantages and Limitations of HVDC transmission system.

## **6. DISTRIBUTION SYSTEMS**

- 6.1 Introduction to Distribution System. Explain Connection Schemes of Distribution System – (Radial, Ring Main and Inter connected system)
- 6.2 Explain DC distributions (a) Distributor fed at one End (b) Distributor fed at both the ends (c) Ring distributors.
- 6.3 Explain AC distribution system. Explain Method of solving AC distribution problem.
- 6.4 Explain three phase four wire star connected system arrangement.

## **7. UNDERGROUND CABLES**

- 7.1 Explain cable insulation and classification of cables.
- 7.2 State Types of L. T. & H.T. cables with constructional features.
- 7.3 State and Explain Methods of cable lying.
- 7.4 State methods of Localisation of cable faults – Murray and Varley loop test for short circuit fault/Earth fault.

## **8. ECONOMIC ASPECTS**

- 8.1 State and explain causes of low power factor.
- 8.2 Explain methods of improvement of power factor.
- 8.3 Define & explain Load curves.
- 8.4 Define & explain Demand factor.
- 8.5 Define & explain Maximum demand.
- 8.6 Define & explain Load factor.
- 8.7 Define & explain Diversity factor.

**8.8** Define & explain Plant capacity factor.

**8.9** Define & explain peak load and Base load on power station

**9. TYPES OF TARIFF**

9.1 Explain flat rate and two part tariff and block rate tariff with problems

**10. SUBSTATION**

10.1 Draw and explain layout of LT. HT and EHT substation.

10.2 Draw and Explain Earthing of Substation, transmission and distribution lines.

<b>Learning Resources:</b>			
<b>TEXT BOOKS:</b>			
<b>Sl.No</b>	<b>Name of Author</b>	<b>Title of the Book</b>	<b>Publisher</b>
1.	V. K. Mehta	Electrical power	
2.	D. P. Kothari	Power System Engineering	
<b>REFERENCE BOOKS:</b>			
1	S. L. Uppal	A course of electrical power system	
2	Sony Gupta, Bhat Nagar	A course of electrical Power	

## INSTRUMENTATION & CONTROL

<b>Name of the Course: Diploma in Electrical Engineering</b>			
Course code:	EET 404	Semester	4 <sup>th</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	0	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### A. RATIONALE

Due to automation in industry the study of instrumentation and control is essential. Since the whole system is a combination of analog and digital system, 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 knowledge of the construction, characteristics and methods of usage of sensors and transducers.
2. To acquire knowledge of remote control using servo – mechanism.
3. To derive transfer functions for simple circuit for making circuit calculation e.g with use of diagram Algebra.
4. To acquire knowledge of stable Behavior of circuits and to determine their stability.

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Sensor and Transducer	10
2.	Oscilloscope	06
3.	Measurement of Non-electric quantities	10
4.	Control system	5
5.	Servo Mechanism	5
6.	Mathematical model of Physical System	7
7.	Servo motor	6
8.	Block diagram of Control System	5
9.	Stability of Control System	6
	<b>Total</b>	<b>60</b>

### D. COUSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

#### 1. SENSORS AND TRANSDUCER

- 1.1 Define Transducer, sensing element or detector element and transduction elements.

- 1.2 Classify transducer. Give examples of various class of transducer.
- 1.3 Resistive transducer
  - i) Potentiometer
  - ii) Strain gauges- a) Derive gauge factor, b) Explain constructional features of Bonded and unbonded strain gauge.
  - iii) Platinum Resistance thermo meter.
  - iv) Constructional feature and resistance temperature characteristic of thermistors.
- 1.4 Inductance Transducer
  - i) Explain principle of linear variable differential Transformer (LVDT)
  - ii) State uses LVDT.
- 1.5 Capacitive Transducer.
  - i) Explain general principle of capacitive transducer.
  - ii) Explain variable area capacitive transducer.
  - iii) Explain change in distance between plate capacitive transducer.
  - iv) Advantage and disadvantages of capacitive transducer.
- 1.6 Piezo electric Transducer and its applied.
- 1.7** Principle of opto-electronic Transducer and its application.
- 2. OSCILLOSCOPE**
  - 2.1 Principle of operation of Cathode Ray Tube.
  - 2.2 Principle of operation of Oscilloscope (with help of block diagram).
  - 2.3 Measurement of DC Voltage & current.
  - 2.4 Measurement of AC Voltage, current, phase & frequency.
- 3. MEASUREMENT OF NON ELECTRIC QUALITIES**
  - 3.1 Principle of measurement of stress and strain by help of deflection type wheatstone bridge.
  - 3.2 Principle of measurement of pressure
    - i) Measurement of low pressure by – Pirani gauge.
    - ii) Measurement of normal pressure by inductive and capacitive transducer.
  - 3.3 Principle of measurement of temperature
    - i) Measurement of temperature by platinum resistance thermometer.
    - ii) Measurement of temperature by thermo couple.
    - iii) Measurement of High temperature high optical pyrometer.
  - 3.4 Measurement of flow by turbine meter.
  - 3.5 Measurement of liquid level by resistive transducer.
- 4. CONTROL SYSTEM**
  - 4.1 Introduction
  - 4.2 Classification of control system.
  - 4.3 Open loop control system.
  - 4.4 Closed loop control system.
  - 4.5 Comparison of open loop vs. closed loop control system.
  - 4.6 What is feedback and what are its effects.
- 5. SERVOMECHANISM**
  - 5.1 Introduction.
  - 5.2 Automatic Tank level control system.
  - 5.3 Position control system.
  - 5.4 D. C. closed loop servo control system.

- 5.5 A.C closed loop servo control system
- 6. Mathematical modeling of physical system.
  - 6.1 Mathematical modeling of translational mechanical system.
  - 6.2 Mathematical modeling of rotational mechanical system.
  - 6.3 Mathematical modeling of electrical system.
  - 6.4 Analogous between mechanical and electrical system.
  - 6.5 Transfer function.
  - 6.6 Transfer function of single input-single output (SISO) system.
  - 6.7 Characteristic Equation.
  - 6.8 Procedure for deriving transfer function.
- 7. SERVOMOTORS
  - 7.1 D. C servomotors.
  - 7.2 A. C. servomotors.
  - 7.3 Synchro transmitter and receiver.
  - 7.4 Synchro as an error detector.
- 8. BLOCK DIAGRAM OF CONTROL SYSTEM
  - 8.1 Block diagram of a closed loop system.
  - 8.2 Derive transfer function.
  - 8.3 Procedure for drawing block diagram.
  - 8.4 Block diagram reduction and manipulation.
- 9. STABILITY OF CONTROL SYSTEM
  - 9.1 Definition of stability of control system.
  - 9.2 Necessary conditions for stability.
  - 9.3 Routh stability criterion.
  - 9.4 Application of Routh stability criterion to liner feedback system.

<b>Learning Resources:</b>			
<b>TEXT BOOKS:</b>			
Sl.No	Name of Author	Title of the Book	Publisher
1.	A. Ananda Kuamr	Control System	PHI
2.	A.K. Sawhney	Electric Measurement and Measuring instruments	DPT

## DIGITAL ELECTRONICS

Name of the Course: Diploma in Electrical Engineering			
Course code:	ETT 421	Semester	4 <sup>th</sup>
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### 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. Know the concept of D/A & A/D.

### C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1	Number Systems and Codes	6
2	Logic Gates	6
3	Boolean Algebra	6
4	Combinational Circuits	8
5	Sequential Circuits	6
6	Logic Families	2
7	Counters	6
8	Registers	6
9	Digital to analog converters	5
10	Analog to Digital Converters	5
11	Display Devices	4
	<b>Total</b>	<b>60</b>

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

### **1 NUMBER SYSTEMS AND CODES**

- 1.1 List different number system & their relevance : binary, octal, decimal, Hexadecimal
- 1.2 Study the Conversion from one number system to another.
- 1.3 Perform Arithmetic operations of binary number systems.
- 1.4 Represent the Concept of complemently numbers : 1's & 2's complement of Binary numbers.
- 1.5 Perform Subtraction of binary numbers using complementary numbers.
- 1.6 Perform multiplication and division of binary numbers.
- 1.7 Define concept of Digital Code & its application.
- 1.8 Distinguish between weighted & non-weight Code.
- 1.9 Study Codes : definition, relevance, types (BCD, Gray, Excess-3 and ASCII code and applications.
- 1.10 Generation of Error Detection & Correction Code using parity bit.

### **2. LOGIC GATES**

- 2.1 Illustrate the Different between analog signals & systems and digital signals & Systems.
- 2.2 Discuss the Basic Logic & representation using electric signals.
- 2.3 Learn the Basic Logic gates (NOT, OR, AND, NOR, NAND, EX-OR & EX-NOR) – Symbol, function, expression, truth table & example IC nos.
- 2.4 Define Universal Gates with examples & realization of other gates

### **3. BOOLEAN ALGEBRA**

- 3.1 Understand Boolean : constants, variables & functions.
- 3.2 Comprehend the Laws of Boolean algebra.
- 3.3 State and prove Demorgan's Theorems.
- 3.4 Represent Logic Expression : SOP & POS forms & conversion.
- 3.5 Simplify the Logic Expression/Functions (Maximum of 4 variables) : using Boolean algebra and Karnaugh's map methods.
- 3.6 What is don't care conditions ?
- 3.7 Realisation of simplified logic expression using gates.
- 3.8 Illustrate with examples the above.

### **4. COMBINATIONAL CIRCUITS**

- 4.1 Define a Combinational Circuit and explain with examples.
- 4.2 Arithmetic Circuits (Binary)
  - a) Realise function, functional expression, logic circuit, gate level circuit, truth table & applications of Half-adders, Full-adder & full-Subtractor.
  - b) Explain Serial & Parallel address : concept comparison & application.
  - c) Working of 2 bit Magnitude Comparator : logic expression, truth table, gate level circuit & examples IC
- 4.3 Discuss Decoders : definition, relevance, gate level of circuit of simple decoders, Logic circuit of high order encoders, truth table & example IC nos.
- 4.4 Explain the working of Binary-Decimal Encoder & Decoder.
- 4.5 Discuss Multiplexers : definition, relevance, gate level circuit of simple. Demultiplexers (1:4) logic circuit with truth Table & example IC nos.

## 5. SEQUENTIAL CIRCUITS

- 5.1 Define Sequential Circuit : Explain with examples.
- 5.2 Know the Clock-definition characteristics, types of triggering & waveform.
- 5.3 Define Flip-Flop
- 5.4 Study RS, Clocked RS, D, T, JK, MS-JK flip-flop with logic Circuit and truth tables.
- 5.5 Concept of Racing and how it can be avoided.
- 5.6 Applications of flip-flops & its conversion.

## 6. LOGIC FAMILIES

- 6.1 List of various logic families & standard notations.
- 6.2 Explain propagation Delay, fan-out, fan-in, Power Dissipation & Speed with Reference to logic families.

## 7. COUNTERS

- 7.1 List the different types of counters-Synchronous and Asynchronous.
- 7.2 Explain the modulus of a counter.
- 7.3 Compare Synchronous and Asynchronous counters and know their ICs nos.
- 7.4 Explain the working of 4 bit ripple counter with truth table and timing diagram.
- 7.5 Explain the Synchronous decade counter & binary counter.

## 8. REGISTERS

- 8.1 Explain the working of buffer register.
- 8.2 Explain the working of various types of shift registers – ISO, SIPO, PISO, PIPO with truth table using flip flop.

## 9. DIGITAL TO ANALOG CONVERTERS

- 9.1 Explain the performance parameters of ADC-Resolution, Accuracy and Conversion time.
- 9.2 Explain Binary Weighted resistor DAC.
- 9.3 Explain the Successive – Approximation type DAC
- 9.4 Explain R-2R Ladder type DAC.

## 10. ANALOG TO DIGITAL CONVERTERS

- 10.1 Explain the performance parameters of ADC-Resolution, Quantization Error and conversion time.
- 10.2 Explain the Ramp type and Dual Slope ADC's
- 10.3 Explain the Successive – Approximation type ADC

## 11. DISPLAY DEVICES

- 11.1 Explain the operation of LED and concept of seven segment display.
- 11.2 Explain the LCD and its types.
- 11.3 Compare between LED's and LCD's.
- 11.4 Explain LED driver using IC 7447 decoder.
- 11.5 Explain 7 segment decoder/driver for LCD display.

### Learning Resources:

<b>TEXT BOOKS:</b>			
<b>Sl.No</b>	<b>Name of Author</b>	<b>Title of the Book</b>	<b>Publisher</b>
1.	Ananda Kumar	Fundamental of Digital Electronics	PHI
2.	S. K. Mondal	Digital Electronics – Principal & Application	TMH
<b>REFERENCE BOOKS:</b>			
1	B. R. Gupta & V. Singhal	Digital Electronics	S. K. Katteria
2	P. Raja	Digital Electronics	Sci Tech



### ELECTRICAL LAB PRACTICE-I

Name of the Course: Diploma in Electrical Engineering			
Course code:	EEP 401	Semester	4 <sup>th</sup>
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P / week	Term Work	50
Maximum marks:	150	End Semester Examination:	100

1. Identification of different terminals of a DC machine by Lamp method and multi-meter & measure insulation resistance.
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. Perform parallel operation of DC generator.
5. Study of Two point starter, connect and run a DC series motor
6. Study of Three point starter, connect and run a DC shunt motor & measure the no load current.
7. Study of Four point starter, connect and run a DC compound motor with differential, cumulative, short shunt and long shunt field connection.
8. Control the speed of a DC shunt motor by field control method.
9. Control the speed of a DC shunt motor by armature voltage control method.
10. Determine the speed- torque characteristic of a DC compound motor with various connections.
11. Determine the load current - torque characteristic of a DC compound motor with various connections.
12. Determine the efficiency of a DC machine by brake test method.
13. Identification of terminals, determination of voltage regulation of a single phase transformer and connect them in parallel.
14. Perform OC and SC test of a three phase transformer to determine the losses, efficiency and transformer parameters to draw equivalent circuit.
15. Determine the vector group of a three phase transformer and test for magnetic balance..
16. Determination of protection and metering core of a 33 kV, 7.5 VA, 50/ 1 Amp Oil CT, from the knee point of OCC and polarity test.
17. Determination of ratio error and phase angle error of a 33KV, 7.5VA, 50/1 OCT.
18. Murray loop test for detection of short circuit fault / earth fault of 11kV cable.

## DIGITAL ELECTRONICS LAB

Name of the Course: Diploma in Electrical Engineering			
Course code:	ETP 421	Semester	3 <sup>rd</sup>
Total Period:	45	Examination	4 hrs
Lab. periods:	3 P / week	Term Work	25
Maximum marks:	50	End Semester Examination:	25

### 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. Familiarized with use of Digital ICs.
2. Understand and comprehended the simple the Digital design Circuits.
3. Know A/D & D/A conversions.

### C. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

1. Familiarization of Digital Trainer, Kit, logic Pulse, Logic Probe & Digital ICs i.e., 7400, 7402, 7404, 7408, 7432 & 7486.
2. Verify truth tables of AND, OR, NOT, NOR, NAND, XOR, XNOR gates.
3. Implement various gates by using universal properties of NAND & NOR gates and verify truth table.
4. Implement half adder and Full adder using logic gates.
5. Implement half subtractor and Full subtractor using logic gates.
6. Implement a 4-bit Binary to Gray code converter.
7. Implement a Single bit digital comparator.
8. Study Multiplexer and demultiplexer.
9. Study of flip-flops.
  - i) S-R flip flop ii) J-K flip flop iii) flip flop iv) T flip flop
10. Realize a 4-bit asynchronous UP/Down counter with a control for up/down counting.
11. Realize a 4-bit synchronous UP/Down counter with a control for up/down counting.
12. Implement Mode-10 asynchronous counters.
13. Study shift registers.
14. Study 8-bit D/A and A/D conversion.
15. Study display devices, LED, LCD, 7-segment displays.

<b>Mini Project:</b> To collect data like pin configurations of digital IC and display devices.
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Assemble and tests circuits such as frequency counter and running LED lights.

**(Perform experiment on any 12 of the above experiments.)**

**Learning Resources:**

1. Electronics Lab premier by Sacikala - (S. Chand)

## MECHANICAL WORKSHOP PRACTICE

Name of the Course: Diploma in Electrical Engineering			
Course code:	MEP 421	Semester	3 <sup>rd</sup>
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P / week	Term Work	25
Maximum marks:	50	End Semester Examination:	25

### 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, taper turning, knuckling and external V. Threading. (One job only.)

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