STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

DISCIPLINE: ELECTRICAL ENGINEERING (PT)						**SEMESTER: 4TH**						
SL NO	**SUBJECT CODE**	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**						
			L	**T**	**P**	**SESSIONAL EXAM**			**END SEM EXAM**	**TERM WORK**	**PRACTICAL EXAM**	**TOTAL MARKS**
						TA	CT	Total				
THEORY												
1.	PET 401/ ETT 321	ANALOG ELECTRONICS AND OP-AMP	4	0	0	10	20	30	70			100
2.	PET 402 / EET 301	CIRCUIT & NETWORK THEORY	4	1	0	10	20	30	70			100
3.	PET 403 / MET 321	ELEMENTS OF MECHANICAL ENGINEERING	4	1	0	10	20	30	70			100
4.	PET 404/EET 402	ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS	4	1	0	10	20	30	70			100
PRACTICAL/TERM WORK												
5.	PEP 401 / MEP 321	MECHANICAL ENGINEERING LAB.	0		5	-	-		-	50	50	100
6.	PEP 402 / ETP321	ANALOG ELECTRONICS LAB.	0		4	-	-		-	50	50	100
GRAND TOTAL			16	3	9	40	80	120	280	100	100	600

Total Contact hours per week: 28
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%

Analog Electronics and OP-AMP

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	PET 401/ ETT 321	Semester	3rd
Total Period:	60L	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

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: **6 P**

- 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**:** **5 P**

2 . 1 Thermistors, Sensors & barretters

2 . 2 Zener Diode

2 . 3 Tunnel Diode

2 . 4 PIN Diode

3. **RECTIFIER CIRCUITS & FILTERS:** **7 P**

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:** **7 P**

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:** **7 P**

5.1 Transistor biasing

5.2 Stabilisation

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:** **13 P**

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:** **6 P**

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:** **9P**

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

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

Circuit and Network Theory

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	PET 402 / EET 301	Semester	4th
Total Period:	75(60L+15T)	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. Rationale:

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

B. Objectives:

1. To develop the concept on Electrical circuit parameters and laws
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 concept on network functions and parameters.
8. To develop knowledge of filters and their circuit characteristics

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Name of the Topic	Period
1	CIRCUIT ELEMENTS AND LAWS	04
2	MAGNETIC CIRCUITS	06
3	NETWORK ANALYSIS	04
4	NETWORK THEOREMS	08
5	AC CIRCUIT AND RESONANCE	10
6	COUPLED CIRCUITS	06
7	TRANSIENTS	08
8	TWO-PORT NETWORK	08
9	FILTERS	06
	TOTAL	**60**

D. <u>COURSE CONTENT:</u>

1. **CIRCUIT ELEMENTS AND LAWS:** 04
   - 1.1 Voltage, current, power and energy
   - 1.2 Resistance, Inductance & capacitance as parameters
   - 1.3 Active, Passive, Unilateral & bilateral, Linear & Non linear elements
   - 1.4 KVL and KCL, Voltage division & current division.
2. **MAGNETIC CIRCUITS** 06
   - 2 . 1 Introduction
   - 2 . 2 Magnetizing force, Intensity, MMF, flux and their relations
   - 2 . 3 Permeability, reluctance and permeance

2 . 4 Analogy between electric and Magnetic Circuits
2 . 5 B-H Curve
2 . 6 Series & parallel magnetic circuit
2 . 7 Hysteresis loop

3. **NETWORK ANALYSIS:** 04
3.1 Mesh Analysis
3.2 Mesh Equations by inspection
3.2.1 Super mesh Analysis
3.2.2 Nodal Analysis
3.2.3 Nodal Equations by inspection
3.2.4 Super node Analysis
3.3 Source Transformation Technique

4. **NETWORK THEOREMS:** 08
4.1 Star – delta transformation
4.2 Super position Theorem
4.3 Thevenin's Theorem
4.4 Norton's Theorem
4.5 Reciprocity Theorem
4.6 Compensation Theorem
4.7 Maximum power Transfer theorem
4.8 Milliman's Theorem

5. **AC CIRCUIT AND RESONANCE:** 10
5.1 Review of 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 Series resonance & band width in RLC Circuit
5.7 Resonant frequency for a tank circuit
5.8 Q factor & selectivity in series circuit.
5.9 Poly phase Circuit
5.10 Voltage, current & power in star & delta connection
5.11 Three phase balanced circuit

6. **COUPLED CIRCUITS:** 06
6.1 Self Inductance and Mutual Inductance
6.2 Conductively coupled circuit and mutual impedance
6.3 Dot convention
6.4 Coefficient of coupling
6.5 Series and parallel connection of coupled inductors

7. **TRANSIENTS:** 08
7.1 Steady state & transient state response.
7.2 Response to R-L, R-C & RLC circuit under DC condition.
7.3 Application of Laplace transform for solution of D.C transient circuits.

8. **TWO-PORT NETWORK:** 08
8.1 Open circuit impedance (z) parameters
8.2 Short circuit admittance (y) parameters
8.3 Transmission (ABCD) parameters

8.4 Hybrid (n) parameters
8.5 Inter relationships at different parameters
8.6 Inter connection of two port networks
8.7 T and π representation

9. **FILTERS:** 06

9.1 Classification of filters
9.2 Filter networks
9.3 Equations of filter networks
9.4 Classification of pass Band and stop Band
9.5 Characteristic impedance in the pass and stop bands
9.6 Constant – K low pass filter
9.7 Constant – K high pass filter
9.8 Constant – K Band pass filter
9.9 Constant – K Band elimination filler
9.10 m- derived T section filter

Learning Resources:

Text Books

Sl.No	**Name of Authors**	**Title of the Book**	**Name of the publisher**
1	A. Sudhakar & Shyam Mohan S Palli	CIRCUIT & NETWORKS for modules:- 1,3,4,5,6,7,8,9	Tata McGraw Hill
2	B. L. Thereja	Electrical Technology Volume – I [for module: 2 only]	S. Chand
3	Sakhija & Nagsarkar	Circuit and Networks [For modules:- 1,3,4,5,7,8 and 9.]	

Elements of Mechanical Engineering

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	PET 403 / MET 321	Semester	4th
Total Period:	75(60L+15T)	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:	1P/week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

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:

	Chapters	
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.	06
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	05
3.	BOILERS: 3.1 State types of Boilers	10

	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.	10
5.	STEAM TURBINES: 5.1 State Types 5.2 Differentiate between impulse and reaction Turbine	06
6.	CONDENSER: 6.1 Explain the function of condenser 6.2 State their types	04
7.	I.C. ENGINE: 7.1 Explain working of two stroke and 4 stroke petrol and Diesel engines. 7.2 Differentiate between them	04
8.	HYDROSTATICS: 8.1 Describe properties of fluid 8.2 Determine pressure at a point, pressure measuring Instruments	05
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	05
10.	HYDRAULIC DEVICES AND PNEUMATICS: 10.1 Intensifier 10.2 Hydraulic lift 10.3 Accumulator 10.4 Hydraulic ram	05

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	R. S. Khurmi	Thermal Engineering	
2	A. R. Basu	Hydraulics & Hydraulic M/Cs	

Reference Books:

1	A. S. Sarad	Thermal Engineering	
2	R. K. Bansal	Hydraulics & Hydraulic M/Cs	

ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	PET 404/EET 402	Semester	4th
Total Period:	75 (60L + 15T)	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P / week	Teacher's Assignment:	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.	WATTMETERS AND MEASUREMENT OF POWER	07
4.	ENERGYMETERS AND MEASUREMENT OF ENERGY	06
5.	MEASUREMENT OF SPEED, FREQUENCY AND POWER FACTOR INSTRUMENT TRANSFORMER	05
6.	MEASUREMENT OF RESISTANCE	08
7.	MEASUREMENT OF INDUCTANCE AND CAPACITANCE	06
8.	DIGITAL INSTRUMENTS	06
9.	TOTAL	05
		60

D. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES

1. MEASURING INSTRUMENTS **07**

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

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

3. WATTMETERS AND MEASUREMENT OF POWER

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.

4. ENERGYMETERS AND MEASUREMENT OF ENERGY

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

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.
5.4 Synchroscopes – objectives and working.
5.5 Phase Sequence Indicators and its working.

6. INSTRUMENT TRANSFORMER

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

7. MEASUREMENT OF RESISTANCE

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.

8. MEASUREMENT OF INDUCTANCE NAD CAPACITANCE

Explain measurement of inductance by
8.1 Maxewell'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

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

Learning Resources:			
TEXT BOOKS:			
Sl.No	**Name of Author**	**Title of the Book**	**Publisher**
1.	A.K. Sawhney	Electric Measurement and Measuring instruments	Dhanpat
Reference Books:			
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.

PR-I: MECHANICAL ENGG. LABORATORY

Name of the Course: Diploma in Electrical Engineering

Course code:	PEP 401 / MEP 321	Semester	3rd
Total Period:	75	Examination	4 hrs
Lab. periods:	5 P / week	Term Work	50
Maximum marks:	100	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: ANALOG ELECTRONICS LAB-I

Name of the Course: Diploma in Electrical Engineering (PT)			
Course code:	PEP 402 / ETP321	Semester	3rd
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P / week	Term Work	50
Maximum marks:	100	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)