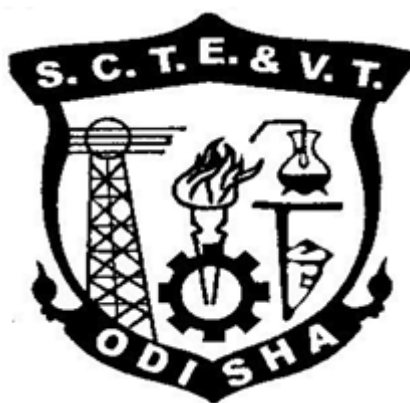


# **CURRICULLUM OF 5<sup>th</sup> SEMESTER**

**For**

**DIPLOMA IN Applied Electronics &  
Instrumentation ENGINEERING**

**(Effective FROM 2020-21 Sessions)**



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

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 5th Semester (Applied Electronics & Instrumentation)(wef 2020-21)									
Subj ect Num ber	Subj ect Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
<b>Theory</b>									
Th.1		Entrepreneurship and Management & Smart Technology	4		-	20	80	3	100
Th.2		PROCESS INSTRUMENTATION & CONTROL	4		-	20	80	3	100
Th.3		INDUSTRIAL MEASUREMENT & INSTRUMENTATION-2	4		-	20	80	3	100
Th.4		LINEAR INTEGRATED CIRCUIT AND ITS APPLICATION	5			20	80	3	100
Th.5		BIOMEDICAL & ENVIRONMENTAL INSTRUMENTATION	4			20	80	3	100
		<i>Total</i>	21			100	400	-	500
<b>Practical</b>									
Pr.1		LINEAR INTEGRATED CIRCUIT AND ITS APPLICATION LAB	-		3	25	25	3	50
Pr.2		PROCESS CONTROL LAB	-	-	3	25	25	3	50
Pr.3		INDUSTRIAL MEASUREMENT & INSTRUMENTATION-2 LAB	-	-	3	25	25	3	50
Pr.4		BIOMEDICAL & ENVIRONMENTAL INSTRUMENTATION-LAB	-	-	3	25	25	3	50
Pr.5		PROJECT Phase-I	-	-	4	50	-	-	50
		Student Centred Activities(SCA)	-		2	-	-	-	-
		<i>Total</i>	-	-	18	150	100	-	250
		<b>Grand Total</b>	<b>21</b>		<b>18</b>	<b>250</b>	<b>500</b>	<b>-</b>	<b>750</b>
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/SWAYAMetc., 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									

## 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 : PROCESS INSTRUMENTATION & CONTROL

Theory : 4 Periods per week  
Total Periods : 60 Periods  
Examination : 3 Hours

I.A. : 20 Marks  
Term End Exam: 80 Marks  
TOTAL MARKS : 100 Marks

### Chapter wise Distribution of periods with Total periods

Sl.No.	Topics	Periods
1.	Basic concept of control system	08
2.	Process control	12
3.	Various control Action	10
4.	Controllers	10
5.	Characteristics of process control	05
6.	Concept of Digital control system	05
7.	Advance control System	10
TOTAL		60

### Rationale:

This subject will give the detail knowledge to the student about different types of process control system and modern process instrumentation used in industries uses process Automation Technology .Student can know about various controller and control system to monitor various process parameter. Case study of PLC based instrumentation scheme in process industry.

### Objectives:

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

- i. Learn about various types of manual and automatic control system with examples.
- ii. Give an idea about analog and Digital control system.
- iii. Acquainted with various type of modern control system like PLC, DCS and SCADA System.
- iv. Familiar about various type of control action.

### Detailed Contents:

#### Chapter-1 Basic Concept of Control System :

- 1.1 Define of control system
- 1.2 Distinguish between open loop and closed loop system:
- 1.3 Explain stability of negative feedback in a close loop system.
- 1.4 Give some examples of an open loop and closed loop control system.
- 1.5 Distinguish between manual Automatic controls systems.
- 1.6 Explain the conversation from manual to Automatic operation.
- 1.7 Give introduction of cascaded feet forward and ratio type adaptive control system (only function no mathematically derivation).
- 1.8 Explain with examples for controlling temperature and pressure by close loop control system.

#### Chapter-2. Process Control:

- 2.1 Introduction.
- 2.2 Principle of Process control
- 2.3 Types of control system and its applications
- 2.4 Elements of process control system
- 2.5 Properties of controller
- 2.6 Classification of controller
- 2.7 Analog controller.
- 2.8 Pneumatic controller
- 2.9 Hydraulic controller.
- 2.10 Electrical and Electronic controller
- 2.11 Digital controller.

#### Chapter-3 Various Control Action:

- 3.1 Different type of control action.
- 3.2 Explain the principle of ON/OFF control action.
- 3.3 Explain the principle of proportional control action.
- 3.4 Explain the principle of integral control action.

- 3.5 Explain the principle of Derivative control action.
- 3.6 Explain the principle of composite control action [ P+I, P+D,P+I+D) .
- 3.7 Explain floating control.
- 3.8 Comparison of various control action.

**Chapter-4      Controllers:**

- 4.1 Definition of Controllers.
- 4.2 Classification of controller (Pneumatic, Hydraulic, Electrical and Electronic control system).
- 4.3 Flapper Nozzle system, Pneumatic Relay, Pneumatic ON/OFF.
- 4.4 Three mode (PID Pneumatic controller).
- 4.5 Hydraulic Control system with Examples.
- 4.6 Hydraulic proportional, integral and Derivative controller.
- 4.7 Advantages and Disadvantage of Pneumatic and Hydraulic control system.
- 4.8 Advantages and Disadvantages of Pneumatic and Hydraulic control system.
- 4.9 Electronic controller with example.
- 4.10 Realization of various control mode action using OP-AMP –ON/OFF ,Proportional ,integral, Two mode and three mode using OP-AMP.)
- 4.11 Gives some examples of Electronic controller.
- 4.12 Comparison of Pneumatic and Hydraulic and Electronic controller.

**Chapter-5      Characteristics of Process Control:**

- 5.1 Dynamic elements in control loop (negative feedback, Dead time capacitive characteristics of real process).
- 5.2 Analysis of self-operating proportional controller for Flow level.
- 5.3 Explain the idea about proportional Band Delay Dead in time).
- 5.4 Explain the idea about proportional band, Delay Dead in time process, Transfer function, Bandwidth and Gain, Offset error.
- 5.5 Explain the characteristics of pneumatic PID Controller the pressure control application.

**Chapter-6      concept of Digital control system:**

- 6.1 Basic terminology of computer of computer based digital control system.
- 6.2 Overview classical approach to digital controller design vs Analog computer.
- 6.3 Basic Digital control scheme.
- 6.4 Models Digital control systems Z-domain description of sample continuous with dead time.
- 6.5 Implementation of digital control.
- 6.6 Examples of digital Temperature and position control system.

**Chapter-7      Advance control System:**

- 7.1 Computer control of process & its need
- 7.2 PLC Definition-Relay based and PLC based control panel.
- 7.3 Programmable logic Controller (PLC).
  - (i) Parts of PLC
  - (II) Basic block diagram
  - (iii) Principle of operation
  - (IV) PLC size, specification, work station and application
  - (v). Basics of PLC Programming & types of PLC programming
- 7.4 Instruction sets-Ladder diagram for AND, OR, NAND.NOR Relay schematics
- 7.5 Define supervisory control and data Acquisition system (SCADA).
- 7.6 Explain SCADA system with neat block diagram application.
- 7.7 Explain microcontroller or microcontroller application in control system.
- 7.8 Explain the concept of distributed control system and its advantage.
- 7.9 Define remote terminal unit (RTU) and Master terminal unit (MTU).

**Coverage of Syllabus upto Internal Exams (I.A.)**

**Chapter 1,2,3,4**

**Books Recommended**

- 1. Process control by Peter Horriot, TMH Publications..
- 2. Principles of process control by D. Patranabis, TMH Publications.
- 3. Process Control and Optimization by B.G. Liptak, CRC press
- 4. Process Control System, F.G. Shinskey, TMH Publications.
- 5. Process Control Instrumentation C.B. Johnson. PHI publications ,
- 6. Instrumentation hand book.
- 7. R.J. Willam, "Hand book of SCADA System for the Oil and Gas Industry", Mold Clwyd.
- 8. Krishnakanth, Computerised Based Industrial Controls
- 9. D R Coughanowr: Process Systems Analysis and Control, McGraw Hill.

## TH-3 : INDUSTRIAL MEASUREMENT & INSTRUMENTATION-2

Theory : 4 Periods per week  
Total Periods : 60 Periods  
Examination : 3 Hours

I.A. : 20 Marks  
Term End Exam: 80 Marks  
TOTAL MARKS : 100 Marks

### Chapter wise Distribution of periods with Total periods

Sl.No.	Topics	Periods
1.	Measurement of Stress and Strain	10
2.	Measurement of Distance and Velocity	07
3.	Measurement of Density and Viscosity	10
4.	Measurement of Humidity and Moisture	08
5.	PH value of different solution	07
6.	Measurement of speed and Acceleration	08
7.	Virtual instrumentation	07
8.	In-frad Gas Analyzer	03
TOTAL		60

### Rationale:

The study of industrial parameter measurement will be give an idea to the student about measurement Of ON LINE Process parameter such as stress and strain, Displacement ,velocity ,speed, Acceleration, Humidity PH value, pulse, Moisture and some idea about virtual instrumentation Engineering process and also infrared Gas Analyzer. Instrumentation is a collective term for measuring instruments that are used for indicating, measuring and recording physical quantities. The term has its origins in the art and science of scientific instrument-making. Process Instrumentation in Oil and Gas. Process instrumentation is an integral part of any process industry because it allows real time measurement and control of process variables such as levels, flow, pressure, temperature, pH and humidity.

### Objectives :-

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

1. know about skill complicated physical parameter measurement in-terms of electrical
2. Know about skill complicated Signal in-order to make the further processing by multi-media processor.
3. Identify the different type's sensors and transducer various physical parameter and medical parameter measurement.
4. Know about virtual instrumentation Techniques and in farad gas analyzer.

### Detailed Contents:

#### Chapter-1 Measurement of Stress and Strain

- 1.1 Define Stress and Strain.
- 1.2 Explain different types of sensor and Transducers to convert stress and strain converted electrical Voltage.
- 1.3 Define strain and classify strain gauge.
- 1.4 Explain theory of operation of Resistive strain Gauge.
- 1.5 Explain the concept multi-axial strain measurement by Rosette Gauge.
- 1.6 Selection criteria strain gauge material and bonding material Techniques.
- 1.7 Concept of semiconductor strain Gauge.
- 1.8 Strain Gauge auxiliary circuit (Wheatstone bridge method)
- 1.9 Effect of change of temperature of strain gauge operation.
- 1.10 Explain the operation instrument for static and dynamic strain gauge measurement.
- 1.11 Give some application of strain gauge.

#### Chapter-2. Measurement of Distance and Velocity

- 2.1 Define Velocity and Distance.
- 2.2 Potentiometric Displacement Transducer performance Characteristics.
- 2.3 Linear variable Differential Transducer (L.V.D.T ) Performance , Characteristics and application.
- 2.4 Capacitive type Transducer and its signal conditioning circuit.
- 2.5 Piezo electronic crystal circuit equivalent capacitor piezo electric type displacement transducer.



- 2.6 Measurement of velocity.
- 2.7 calibration Method of velocity (RMM measuring)

### **Chapter-3 Measurement of Density and Viscosity**

- 3.1 Define Viscosity and Density.
- 3.2 Explain different units viscosity and density.
- 3.3 Explain different types density sensor and viscosity sensor..
- 3.4 Explain the function of hygrometer and hydraulic head type densitometer and chain balance densitometer.
- 3.5 Explain the measurement of density of slurry type of fluid.
- 3.6 U Tube density gauge.
- 3.7 Radiation type densitometer.
- 3.8 Gas density detector
- 3.9 Electrometer magnetic suspension type gas densitometer.
- 3.10 Orifice gas density meter
- 3.11 Measurement of specific gravity of glass.
- 3.12 Explain various method viscosity measurements.
- 3.13 Explain the function of orest ward apparatus.
- 3.14 Define Co-efficient of viscosity and explain different types viscosity co-efficient and Stroke's Law.
- 3.15 Distinguish between Newtonian and Non-Newtonian method.
- 3.16. Explain function two flow viscosity, Torque viscosity and side volt viscosity.

### **Chapter-4 Measurement of Humidity and Moisture**

- 4.1 Define Moisture and Humidity.
- 4.2 Define absolute relative specific humidity and Dew point..
- 4.3 Classified difference types humidity measuring instrument (Hydrometer, Phychrometer).
- 4.4 Explain the function Humidity measurement by using Hair, Electrical type hygrometer (Resistive, capacitive and crystal Hygrometer)
- 4.5 Explain the difference type Phychrometer.
- 4.6 Define Dew point and Explain Dew point measurement Techniques.
- 4.7 Distinguish between Humidity measurements.
- 4.8 Infrared Techniques Humidity measurement.
- 4.9 Explain conductive and dielectric type moisture meter.

### **Chapter-5 PH value of different solution**

- 5.1 Define PH value of solution and hydrogen Ion concentration.
- 5.2 Explain PH Scale.
- 5.3 Explain the different types of electrode (PH sensor Hydrogen electrode, Calomel electrode, Glass electrode for PH measurement).
- 5.4 Explain electrical Method PH measurement.
- 5.5 Explain PH measurement Techniques by using Glass electrode.

### **Chapter-6 Speed and Acceleration**

- 6.1 Different sped measurement process.
- 6.2 Explain the function various types Tachometer (Mechanical type, Electrical type).
- 6.3 Explain the non-contact method speed measurement by using optical method such as Stroboscope.
- 6.4 Electrical type Tachometer Eddy current, Electro-generator type .Digital Tachometer, contact type Tachometer.
- 6.5 Mechanical type Tachometer –Centrifugal force type Tachometer, Revolution type and Resonance type.
- 6.6 Define Tachometer and distinguish between AC and DC Tachometer.
- 6.7 General purpose acceleration (Piezo electric and Strain Gauge type.).

### **Chapter-7 Virtual Instrument**

- 7.1 Introduction of VI and architecture.
- 7.2 Block diagram and front panel of VI.
- 7.3 Explain Front panel different parameters of VI.
- 7.4 Explain array, structure and cluster.
- 7.5 Instrument drive.

### **Chapter-8 Gas Analyzer**

- 8.1 Explain the principal of Gas analyzer.
- 8.2 Describe the function of In-farad and oxygen gas.
- 8.3 Explain the measurement techniques gas constitutions by Thermal conductivity method.

## **Books Recommended**

1. Industrial Instrumentation –Author---S. K. Singh–Publisher- Mc Graw Hill Eaducation.
2. Electrical Instrumentation & process control – Author- Dr. J. P. Navari, E.R. Sonal Sapre- Publisher –S. Chand.
3. Mechanical Measurement & control - Author – R. K. Khedkar – Publisher –
4. Mechanical Measurement and measuring instrument –Author- R. K. Jain( Reference Books)
5. Electrical Electronics & Instrumentation Measurement- Author –A. K. Sahani-Publisher-Dhanpat Rai & Co

## Th.4. LINEAR INTEGRATED CIRCUIT AND ITS APPLICATION

Theory : 5 Periods per week  
Total Periods :75 Periods  
Examination : 3 Hours

I.A. :20 Marks  
Term End Exam : 80 Marks  
TOTAL MARKS :100 Marks

### Chapter wise Distribution of periods with Total periods

SL NO.	TOPIC	PERIODS
1.	DIODE, TRANSISTORS AND CIRCUITS	10
2.	AUDIO POWER AMPLIFIERS.	08
3.	FIELD EFFECT TRANSISTOR (FET).	10
4.	FEED BACK AMPLIFIER & OSCILLATOR	08
5.	TUNED AMPLIFIER & WAVE SHAPING CIRCUIT	12
6.	OPERATIONAL AMPLIFIER CIRCUITS & FEEDBACK CONFIGURATIONS	14
7.	APPLICATION OF OPERATIONAL AMPLIFIER, TIMER CIRCUITS & IC voltage regulator	13
		75

### Rationale:

Analog Electronics has played a developmental role in the field of Electronics. In each and every field, electronics systems are used. Analog electronics is one of the subjects which is the base of all advance electronics. It starts with PN junction which makes the student to follow the functioning of all semiconductor based electronics. This is a core group subject and it develops cognitive and psychomotor skills. This Subject deals the fundamental analysis & design of Electronics and systems. The concept of Semiconductor, different electronics circuits and their applications will required in the subject Analog Electronics. This subject also which deals with Analog Integrated Circuits and wave shaping Circuits for various applications in Electronics Engineering. The operational Amplifier will play vital role in day to day life of most of the Electronics equipment. The concept of operational Amplifier, IC voltage regulator has also been incorporated in this subject.

### Objective:

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

1. Know the concept of Diode & its applications
2. Know about transistor & its parameters
3. Know the different types of Audio & Power Amplifiers.
4. Know about the Field Effect Transistors & its classification.
5. Know about the concept of Feedback Amplifier.
6. Concept of Barkhausen Criterion of Oscillation & the different types of oscillators & its applications.
7. Know about the concept of Tuned Amplifier.
8. Know the concept of Clipping & Clamping circuits & wave shaping circuits
9. Concept of Operational Amplifier
10. Different Characteristics Op-Amp.
11. Concept of IC Voltage Regulator.

### Detailed Contents:

#### Unit-1: DIODE, TRANSISTORS AND CIRCUITS

- 1.1 Working principle, of Diode & its current equation, Specification and use of p-n junction diode.
- 1.2 Breakdown of diode (Avalanche & Zener Breakdown) and Construction, working, Characteristics
- 1.3 Classification of Rectifiers and working of different types of Rectifiers- Half-Wave Rectifier, Full-Wave Rectifier (CT & BRIDGE type)

- 1.4 Working principle of p-n-p and n-p-n transistor, different types of transistor connection (CB, CE and CC) & input and output characteristics of transistor in different connections.
- 1.5 Define ALPHA, BETA and GAMMA of transistors in various modes. Establish the Mathematical relationship between them.
- 1.6 Basic concept of Biasing, Types of Biasing, h-parameter model of BJT, load line (AC & DC) and determine the Q-point.
- 1.7 Types of Coupling, working principle and use of R-C Coupled Amplifier & Frequency Responses of R-C coupled Amplifier & draw the curve.

#### **Unit-2: AUDIO POWER AMPLIFIERS**

- 1.1 Classify Power Amplifier & Differentiate between Voltage and Power Amplifier.
- 1.2 Working principle of different types of Power Amplifier (Class-A, Class-AB, Class-B and Class-C & Class D amplifier).
- 1.3 Construction and working principle and advantages of Push Pull (Class-B) Amplifiers

#### **Unit-3: FIELD EFFECT TRANSISTOR (FET)**

- 3.1 FET & its classifications & Differentiate between JFET & BJT.
- 3.2 Construction, working principle & characteristics of JFET & Explain JFET as an amplifier, parameters of JFET & Establish relation among JFET parameters.
- 3.3 Construction & working principle MOSFET & its classification & characteristics (Drain & Transfer)
- 3.4 Explain the operation of CMOS, VMOS & LDMOS.

#### **Unit-4: FEED BACK AMPLIFIER & OSCILLATOR**

- 4.1 Define & classify Feedback Amplifier, principle of negative feedback with the help of block diagram, Types of feedback – negative & positive feedback.
- 4.2 Types of negative feedback – voltage shunt, voltage series, current shunt & current series and characteristics voltage gain, bandwidth, input Impedance output impedance, stability, noise, distortion in amplifiers.
- 4.3 Oscillator -block diagram of sine wave oscillator, Types Requirement of oscillation- Barkhausen criterion
- 4.4 RC oscillators – RC phase shift, Crystal, LC oscillators – Colpitts, Hartley & Wien Bridge Oscillators: Circuit operation, circuit diagram, equation for frequency of oscillation & frequency stability

#### **Unit-5: TUNED AMPLIFIER & WAVE SHAPING CIRCUIT**

- 5.1 Defined and classify Tuned amplifier, Explain parallel Resonant circuit, Resonance Curve & sharpness of Resonance.
- 5.2 working principle of Single tuned Voltage & Double tuned Amplifier & its limitation
- 5.3 Different type of Non-linear circuits - Clipper, diode series & shunt, positive & negative biased & unbiased and combinational clipper clippers circuit & its application.
- 5.4 Different type of Clamper circuit (positive & negative clampers) & its application.
- 5.5 Working of Astable, Monostable & Bistable Multivibrator with circuit diagram.
- 5.6 Working & use of Integrator and Differentiator circuit using R- C circuit (Linear), input / output waveforms & frequency response.

#### **Unit-6: OPERATIONAL AMPLIFIER CIRCUITS & FEEDBACK CONFIGURATIONS**

- 6.1 Differential amplifier & explain its configuration & significance.
- 6.2 Block diagram representation of a typical Op- Amp, its equivalent circuits and draw the schematic symbol
- 6.3 Discuss the types of integrated circuits manufacturer's designations of ICs, Package types, pin identification and temperature and ordering information.
- 6.4 Define the following electrical characteristics input offset voltage, input offset current, CMMR, Large signal voltage gain, Slew rate.
- 6.5 Draw and explain the Open Loop configuration (inverting, non-inverting Amplifier)

- 6.6 Draw the circuit diagram of the voltage series feedback amplifier and derive the close loop Voltage gain, gain of feedback circuits input resistance, and output resistance, bandwidth and total output offset voltage with feedback.
- 6.7 Draw the circuit diagram of the voltage shunt feedback amplifier and derive the close loop, Voltage gain, gain of feedback circuits and input resistance, and output resistance, bandwidth and total output offset voltage with feedback.

#### **Unit-7. APPLICATION OF OPERATIONAL AMPLIFIER, TIMER CIRCUITS& IC voltage regulator**

- 7.1 Discuss the summing scaling and averaging of inverting and non-inverting amplifiers
- 7.2 DC & AC Amplifies using OP-AMP.
- 7.3 Integrator and differentiator using op-amp.
- 7.4 Active filter and describe the filter design of fast order low Pass Butterworth
- 7.5 Concept of Zero-Crossing Detector using Op-Amp
- 7.6 Block diagram and operation of IC 555 timer & IC 565 PLL& its applications.
- 7.7 Working of Current to voltage Convertor using Operational Amplifier
- 7.8 Working of the Voltage to Frequency Convertor using Operational Amplifier.
- 7.9 Working of the Frequency to Voltage Conversion using Operational Amplifier.
- 7.10 Operation of power supply using 78XX and 79XX, LM 317 Series with their PIN configuration
- 7.11 Functional block diagram & Working of IC regulator LM 723 & LM 317.

#### **Coverage of Syllabus upto Internal Exams (I.A.) Chapter 1,2,3,4**

#### **Books Recommended**

1. *A Textbook of Electronic Circuit by Dr. R.S. Sedha, -S.Chand Publication*
2. *Micro Electronic Circuits By Adel S. Sedra, Kenneth C. Smith, -Oxford publication,*
3. *Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky, -Pearson Education*
4. *Operational Amplifier & Linear Integrated Circuit by R.K. Geakward, PHI*
5. *Millman's Electronic Devices and Circuits, Millman, Halkias, SatyabrataJit, -McGraw-Hill*
6. *Basic Electronics & linear Circuits by N.N. Bhargaya, D.C. Kulshreshtha & S C Gupta- McGraw Hill*
7. *Electronics principle by Sahdev-Dhanpat Rai & Co. Pub*  
*Micro Electronics Circuits by Adel S. Sedra, Kenneth, C. Smith, Oxford Publication*

## TH-5 : BIOMEDICAL & ENVIRONMENTAL INSTRUMENTATION

Theory : 4 Periods per week  
Total Periods : 60 Periods  
Examination : 3 Hours

I.A. : 20 Marks  
Term End Exam: 80 Marks  
TOTAL MARKS : 100 Marks

### Chapter wise Distribution of periods with Total periods

Sl. No.	Topics	Periods
1.	Introduction to biomedical instrumentation	12
2.	Measurement of electrical biological parameter	10
3.	Measurement of non-electrical biological parameter	08
4.	Modern medical imaging system	10
5.	Biological laboratory instrument	08
6.	Measurement of biological chemical parameter	06
7.	Patient safety & electrical safety of medical equipment	06
TOTAL		60

### Rationale:

The subject biomedical instrumentation is a very vital subject for the students at the present age, to know about biomedical electronic instrument used for getting the biological information of the human being correctly for investigation. The students will have an exposure to biomedical instrumentation use for medical instruments in actual fields. The course contains two pre wired panels with a variety of cables and accessories.it provides training in basic monitoring circuitry, such as ECG, EEG, EMG, PULSE RATE GSR and temperature monitors. Biomedical Instrumentation is an application of biomedical engineering, which focuses on the devices and mechanics used to measure, evaluate, and treat biological systems. It focuses on the use of multiple sensors to monitor physiological characteristics of a human or animal. Bioinstrumentation or Biomedical Instrumentation is an application of biomedical engineering, which focuses on the devices and mechanics used

to measure, evaluate, and treat biological systems. It focuses on the use of multiple sensors to monitor physiological characteristics of a human.

### Objectives:

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

1. Know about different physiological variables of interest in medical-Electronics.
2. Know different bio-electric potentials such as ECG, EEG, EMG, ERG, EOG and EGG.
3. Get acquainted with different biomedical instruments such as pacemaker, Defibrillator, Ultrasonography.
4. Get an exposure to bio-telemetry systems.
5. Help students know general concepts of imaging system.
6. Help students understand the electrical safety measures and standards.

### Detailed Contents:

#### Chapter-1- Introduction to biomedical instrumentation

- 1.1 Defined human parameter measurement system & explain its contents.
- 1.2 Fundamentals & specification of biomedical instrumentation system, physiological system of body.
  - a. Cardiovascular system.
  - b. Respiratory system.
  - c. Nervous system.
- 1.3 Different types of sensors & transducer for biological application.
  - a. Types
  - b. Properties.
  - c. Characteristics.
- 1.4 Explain sources of bio-electric potential.
  - a. Action potential & its propagation.
  - b. Resting potential & its propagation.
  - c. Bioelectric potential.

#### Chapter-2. Measurement of electrical biological parameter

- 2.1. Lead & electrodes.
- 2.2. Electrocardiography.
- 2.3. Electrical activity of the heart.
- 2.4. Equivalent cardiac generator.
- 2.5. Electro cardiogram (ECG).

- 2.6. Standardization of recording & display of electrocardiogram (ECG).
- 2.7 EEG (Electro encephalo gram)
- 2.8 EMG (Electro myo gram)
- 2.9 EOG (Electro oculo gram)
- 2.10 ERG (Electro retino gram)
- 2.11 EGG. (Electrogastrogram)

**Chapter-3 Measurement of non-electrical biological parameter**

- 3.1 Blood flow measurement.
- 3.2 Study of drop recorded.
- 3.3 Electromagnetic flow meter.
- 3.4 Measurement of systolic & diastolic pressure.
- 3.5 Heart sound.
- 3.6 Electrical stethoscope.
- 3.7 Pulmonary function analyzer.

**Chapterr-4 Modern medical imaging system**

- 4.1 Medical display system.
- 4.2 Medical thermography X-ray.
- 4.3 Basic of X-ray & radioisotope instrumentation.
- 4.4 Instrumentation for diagnostic x-ray & handling of x-ray machine.
- 4.5 Basic concept & operation of digital x-ray machine.
- 4.6 Real time ultrasonic imaging system.
- 4.7 Eco-cardiograph.

**Chapter-5 Biological laboratory instrument**

- 5.1 Define blood cell.
- 5.2 Explain chemical test on blood.
- 5.3 Explain the working of blood cell counter by conductivity method.
- 5.4 Explain spectrophotometer type instrument.
- 5.5 Function of clinical flame photometer.
- 5.6 Explain & function of compound Microscope.

**Chapter-6 Measurement of biological chemical parameter**

- 6.1 Measurement of CO (Carbon monoxide).
- 6.2 Oconcentration in exhaled air.
- 6.3 Blood & lungs.
- 6.4 PH. value of blood.
- 6.5 Impedance plenty sonography blood gas analyzer.

**Chapter-7 Patient safety & electrical safety of Medical equipment**

- 7.1 Application of biomedical engineering & computer application in medical field.
- 7.2 Tele medicine.
- 7.3 Physiological effect of electrical current.
- 7.4 Shock hazard of electrical biomedical equipment.
- 7.5 Hospital instrumentation & management.

**Coverage of Syllabus upto Internal Exams (I.A.)**

**Chapter 1,2,3,4,5**

**Books Recommended**

1. Hand book of biomedical instrumentation – Author- R. S. KHANDPUR- Publisher- T.M.H. PUBLICATION
2. Biomedical instrumentation & measurement - Author –LESILE CROMEWELL, FRED J. WEIBELL, ERICH A. PFEIFFER -- Publisher-.P.H.I.
3. Biomedical instrumentation & measurement – Author- CARR & BROWN –Publisher- PEARSON PUBLICATION.
4. Mechanical instrumentation, Application & Design –Author- John . G. Webstr, Publisher- John wiley & sons. (Reference Books)
5. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson.

# Pr.1 LINEAR INTEGRATED CIRCUIT AND ITS APPLICATION LAB

Practical : 3 Periods per week  
Total Periods : 45 Periods  
Examination : 3 Hours

Sessional : 25 Marks  
Term End Exam : 25 Marks  
TOTAL MARKS : 50 Marks

## Rationale:

Analog Electronics lab is an introductory experimental laboratory that explores the design, construction, and debugging of analog electronic circuits. This laboratory projects investigate the performance characteristics of diodes, transistors, JFETs etc including the construction of a small audio amplifier and preamplifier. The course provides opportunity to simulate real-world problems and solutions that involve tradeoffs and the use of engineering judgment. Design of amplifiers and other electronic systems have to satisfy specifications. Bipolar and field-effect transistors, diodes integrated circuits and passive components are part of the hardware needed. Gain, bandwidth, feedback, stability are some of the design concepts needed. This Lab. Based on the application of Operational Amplifier, IC Voltage Regulated & PCB Design. The students will use software & Circuit maker software at the end of the section is an introductory experimental laboratory that explores the design, construction, and debugging of analog electronic circuits. This subject covers diodes, transistors, JFETs, op-amps, and basic analog circuit design as applied to audio and radio frequency circuits. Students spend for some period's term designing their own projects. Projects vary in scope and breadth, depending on students' level of prior background and interest. Students will learn to understand and use a wide variety of analog circuits.

## Objective:

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

1. Perform various experiments Analog Electronic
2. Understand the behavior of different semiconductor devices
3. Understand the concept of Rectifiers, Amplifiers, Oscillators, feedback amplifiers
4. Know the specifications of Electronics components
5. The Characteristics of operational Amplifier.
6. Construction of Timer Circuit.
7. Construction of Power Supply IC based

**List of Practicals : ( Perform Any 08 Experiments + Any 04 (using Software) have to be Completed) + Minor Project compulsory = ( Total=13 Expt.)**

1. Determine the Forward & reverse characteristics of any two types Diode.
2. Construct Bridge Rectifier using different filter circuit and to determine Ripple factor & Analyse wave form with filter & without filter of above circuit.
3. Observe the input and output characteristics of CE & CB transistor configurations.
4. Construct & test the Transistor regulator using Zener diode.
5. Study the two stage CE amplifier, find Gain & draw the frequency response curve
6. Construct & Find the gain simple (i) Class A Amplifier. (ii) Class B Amplifier (iii) Class C Tuned Amplifier
7. Construct & test Class B -Push Pull amplifier & observe the wave form



8. Study & observe the Drain & Transfer characteristics of JFET & MOSFET
9. Study & Calculate the frequency & Draw the wave form of the followings
  - (i) Hartly Oscillator
  - (ii) Collpit's Oscillator
  - (iii) Wein Bridge Oscillator
  - (iv) R-C phase shift Oscillator
10. Study & test Astable, Monostable & Bistable Multivibrator using OPAMP or IC 555.
11. Construct & test timer circuit using IC 555 timer
12. Observe the waveform of Clipper, Clamper circuits
13. Construct and test voltage power supply using 78xx, 79xx, LM 317 ICs (+5V, -5V, +9V, -9V) using bread board / Software
14. Construct and test voltage power supply using LM723.
15. Study of Operational Amplifier 741 & draw its output waveform
16. Study inverting and non-inverting amplifier using OPAMP.
17. Construct and study the Integrator and differentiator using op-amp.
18. Study Active filter and describe the filter design of fast order low Pass Butterworth
19. (Any Four from above ) using p-spice / or **-Wiring X/MULTISIM** SOFTWARE, With this software you can create simple wiring layouts with the most common discreet electronic components or **TINA Design Suite**- A very nice and friendly circuit design and simulation program with 10,000+ built in components. Available in many languages)
20. Mini project: Place the component and test the Electronics Circuit and prepare a report at the end of session. At the end of Semester the Drafting, Simulation & design of PCB can be carried out using the following suitable software under Innovation minor Projects.

### **Books Recommended**

1. Handbook of Experiments in Electronics & Communication Engg by S P Rao & B. Sasikala- VIKAS
2. Advanced practical Electronics by KAR -Books & Allied Pvt

## PR2. Process control Lab

Practical	: 3 Periods per week	Sessional	: 25 Marks
Total Periods	: 45 Periods	Term End Exam	: 25 Marks
Examination	: 3 Hours	TOTAL MARKS	: 50 Marks

### Rationale:

The student will be have exposure to controller used on –line system .in addition to that they will be able to apply the knowledge of industrial Electronics in actual fields. Process Control Lab . Focus. Design and implementation of controllers for different processes. Infrastructure. Temperature process trainer; Pressure process trainer; Flow process trainer; Level process trainer; Multi process trainer: System to study Feed-forward, cascade and ratio control schemes; Heat exchanger set up; Pilot model

### Objective:

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

1. Learn basic difference between manual & automatic control systems with examples.
2. Understand easily the difference between modes of control.
3. Acquainted with pneumatic, Hydraulic & Electronic Control systems.
4. Learn most advanced control system like PLC, DCS & SCADA system.

### List of Practicals:

1. Performance study of Differential Pressure transmitter.
2. Performance study of ON/OFF, P, PI, PID controller on flow process.
3. Performance study of ON/OFF, P, PI, PID Controller on pressure process.
4. Performance study of ON/OFF, P, PI, PID Controller on Level process.
5. Performance study of ON- line Temperature process Analyzer.
6. Performance study of ON- line Pressure process Analyzer.
7. Performance study of ON- line Level process Analyzer.
8. Performance study of ON- line FLOW process Analyzer
9. Performance study of DC position control using P-I-D control action.
10. Performance study of I TO P Converter & P TO I Converter
11. Construction of proportional, proportional + integral controller using OP-AMP.
12. To study visit of nearest sub-station for SCADA/DCS Control system.

## PR3. Industrial measurement and instrumentation- Lab-2

Practical : 3 Periods per week  
Total Periods : 45 Periods  
Examination : 3 Hours

Sessional : 25 Marks  
Term End Exam : 25 Marks  
TOTAL MARKS : 50 Marks

### Rationale:

The students will be able to measure different types of industrial parameters using instruments like thermistor, RTD transducer, LVDT, Load cell, Hygrometer, Strain gauge, PH meter etc. with their application, practical working principle & operation. The Instrumentation and Measurement laboratory has the objective to familiarize the student with the operation of basic laboratory instrumentation such as Energy meter, multimeter, frequency counter, voltmeter, Ammeter and also with personal computers and circuit simulators such as p-spice and Workbench etc.

### Objective:

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

1. Know the measurements of strain Gauge, L.V.D.T.
3. Know capacitive type Transducer and using circuit and the characteristics displacement Versus voltage.
4. Study of piezo electric Transducer.
5. Study about stroboscope.
6. Study of Hygrometer and Humidity measurement.
7. Know measurement PH value of different solution.
8. View software to design-
  - (a) Temperature measurement using Thermometer.
  - (b) Water Level measurement.
  - © Mathematically expression.
  - (d) Digital circuit (using Logical expression)
9. Know ON Line Temperature measurement method.
10. Know ON line pressure measurement method.
11. Know Speed measurement of using of moving Tachometer.

### List of Practicals:

1. Measurement of using strain Gauge.
2. Measurement of using L.V.D.T and Draw the characteristics graph of Displacement versus voltage.
3. Measurement of using capacitive type Transducer and using circuit and the characteristics displacement Versus voltage.
4. To study of piezo electric Transducer.
5. To study about stroboscope.
6. To study of Hygrometer and Humidity measurement.
7. Using measurement PH value of different solution.
8. Using Lab view software to design-
  - (a) Temperature measurement using Thermometer.
  - (b) Water Level measurement.
  - © Mathematically expression.
  - (d) Digital circuit (using Logical expression)
9. ON Line Temperature measurement method.
10. ON line pressure measurement method.
11. Speed measurement of using of moving Tachometer.

## PR4. BIO-Medical instrumentation Lab.

Practical	: 3 Periods per week	Sessional	: 25 Marks
Total Periods	: 45 Periods	Term End Exam	: 25 Marks
Examination	: 3 Hours	TOTAL MARKS	: 50 Marks

### Rationale:

The student will have an exposure to Bio-Medical instrumentation. In addition to that they will be able to apply the knowledge of Medical Instruments in actual fields. The course contains pre-wired panels with variety of cable and accessories. It provides training in basic monitoring circuit, such as ECG, EEG, EMG, PULSE Rate and GSR and Temperature monitors. Biomedical Instrumentation Lab-I. Biomedical Instrumentation Lab-II. Students will become familiar with several labs outfitted with all facilities over the course of their studies. List of Equipment. Sphygmomanometer; Pace Maker; Short Wave Diathermy Unit

### Objective:

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

1. Used in Transducer in Bio-Medical Application.
2. Study of Differential Amplifier used in Bio-Medical Instrumentation.
3. Study of Differential Amplifier used in Bio-Medical Instrumentation.
4. Study of Electro-cardio-graph. .
5. Study of Electro-cardio-graph Recorder
6. Study of Pulse Rate counter with display.
7. Study of Respiratory Recording
8. Study of EEG amplifier & operation and Maintenance of ECG Instrument.
10. Study of Stethoscope, Blood Pressure Measurement instrument both Analog and Digital type, Pace Maker.

### List of Practicals:

1. Study of sensor and Transducer used in Bio-Medical Application.
2. Performance study of Differential Amplifier used in Bio-Medical Instrumentation.
3. Performance study of Bio-Medical Amplifier System.
4. Performance Study of Electro-cardio-graph. .
5. Performance Study of Electro-cardio-graph Recorder
6. Performance Study of Pulse Rate counter with display.
7. Performance Study of Respiratory Recording
8. Performance Study of EEG amplifier.
9. To study of operation and Maintenance of ECG Instrument.
10. Performance Study of Stethoscope.
11. Performance Study of Blood Pressure Measurement instrument both Analog and Digital type.
12. Case study of operation and Maintenance of Pace Maker.

## Pr 5. PROJECT WORK (Phase-I)

Name of the Course: Diploma in AEIE			
Course code:		Semester	5 <sup>th</sup>
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	50
		TOTAL Marks	50

### 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 Applied Electronics and Instrumentation. and practices in real life situations, so as to participate and manage a large Applied Electronics engineering projects in future.

Entire Project shall spread over 5<sup>th</sup> and 6<sup>th</sup> Semester. Part of the Project covered in 5<sup>th</sup> Semester shall be named as *Project Phase-I* and balance portion to be covered in 6<sup>th</sup> 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 Electronics 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 software/hardware design.
- To develop the skill of writing Project Report

### General Guidelines

The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the 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 5<sup>th</sup> 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

- ✓ Industrial Instrumentation Related
- ✓ Software Engineering and Software Development.
- ✓ Computer Graphics and Animation.
- ✓ Improving existing systems / equipment.
- ✓ Home Automation using IoT.
- ✓ Robotic Arm.
- ✓ Sensor Guided Robotics.
- ✓ Smart Energy Meter
- ✓ Home Automation System.
- ✓ Weather Monitoring System using IoT

- ✓ Solar and Smart Energy System
- ✓ IoT using Raspberry Pi for Weather Monitoring
- ✓ Wearable Health Monitoring Glove
- ✓ Embedded System Projects using 8051
- ✓ Load Control System Using DTMF
- ✓ Automatic Solar Radiation Tracker for Maximum Solar Energy
- ✓ Automatic Room Light Controller using IR Sensors
- ✓ Access control using RFID
- ✓ Biometric Authentication System
- ✓ 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 organisations to such an exhibition.

### **Project Phase-I and Phase-II**

The Project work duration shall cover 2 semesters(5<sup>th</sup> and 6<sup>th</sup> sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5<sup>th</sup> sem under Project Phase-I. The students may be allowed to study literature, and then define the Problem/objective of the Project. Requirements specification, material selection and Design of the system have to be complete in Phase-I. Fabrication may also begin in this phase. Project Milestones are to be set so that progress can be tracked . In Phase-II Coding, Fabrication, Simulation, Testing, Documentation 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-I in 5<sup>th</sup> 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.

## List of Equipment & Tools Required for Lab ( for group of 30)

### Linear Integrated Circuit Lab

Sl No	Equipment & Tools, Raw materials Required for Electronics Workshop	Laboratory Size-30 Nos Table- 8 nos
	<b>Equipment /Raw materials Required</b>	Quantity Required
1.	Forward & reverse characteristics of Diode trainer.	02
2.	Bridge Rectifier Trainer kit	02
3.	CE & CB transistor Trainer Kit	02
4.	Transistor regulator using Zener diode Trainer Kit.	02
5.	Two stage CE amplifier Trainer Kit	02
6.	(i) Class A Amplifier. (ii) Class B Amplifier (iii) Class C Tuned Amplifier Trainer Kit	01
7.	Class B -Push Pull amplifier Trainer Kit	02
8.	JFET Trainer Kit MOSFET Trainer Kit	02
9.	(i) Hartly Oscillator (ii) Collpit's Oscillator (iii) Wein Bridge Oscillator (iv) R-C phase shift Oscillator Trainer Kits	02
10.	Astable, Monostable & Bistable Multivibrator using OPAMP Trainer Kit	01
11.	IC 555 timer IC	30
12.	Clipper, Clamper Trainer Kit	02
13.	7805,7809,7905, 7909,LM 317 ICs	30
14.	Voltage power supply using LM723 Trainer Kit	02
15.	Operational Amplifier 741 Trainer Kit	02
16.	Inverting and non-inverting amplifier using OPAMP Trainer Kit	02
17.	Integrator and differentiator using op-amp Trainer Kit	02
18.	Active filter and describe the filter design of fast order low Pass Butterworth Trainer Kit	02
19.	Regulated Power supply 0-30v DC,2Amp or higher	04
20.	Dual trace CRO 30/50 M hz or higher	04
21.	Signal generator Square wave, sine wave, triangle wave, TTL pulse, positive and negative ramp, pulse and skewed sine wave, AM, and sweep functions, 0.1 Hz to 11 MHz, up/down range switchable in eight decade steps or higher	04
22.	Function Generator 0.1 Hz to 20Mhz with Digital display	04
23	Digital Multi Meter 4 & ½ of diff range	08
24.	Bread Boards/ Components Placing Board	30
25.	Required Software: 1. B2-Spice + Eagle : Simulation & PCB design software. 2. Supper CAD. 3. Electronics work bench: Simulation. 4. CADSTAR/TINA : PCB Design. 5. P Spice/TINA /MULTISIM : Simulation 6. Edwin : Simulation + PCB design. 7. ORCAD 8. Circuit Maker 9. Wiring X or TINA SOFTWARE,	As per requirement decided by the department along with Computer Systems & UPS

	<b>Any other Equipment / Raw materials required for above expt</b>	
--	--	--

### Process Control Lab

Sl No	Equipment & Tools Required for Electronics Workshop	Laboratory Size-30 Nos Table- 8 nos
<b>Equipment Required</b>		Quantity Required
1.	Differential Pressure transmitter.	01
2.	P, PI, PID controller on flow process Controller	01
3.	Pressure Process Controller	01
4.	Level Process Controller	01
5.	Temperature process analyzer configure as ON-OFF Controller, P, P+I, P+I+D Controller.	01
6.	Flow Process Controller	01
7.	Pressure to current converter trainer	01
8.	Current to Pressure Converter Trainer	01
9.	DC motor position control system (note: P & I controllers are available in this module)	01
10.	Process Control Simulator	01
11.	Simple thermal system	01
12.	On-Off temperature controller	01
13.	DMM	06 nos
14.	RTD as a temperature sensor	
15.	Regulated Power supply 0-30v or higher	06 nos
16.	Dual trace CRO 30/50 M hz or higher	02 nos
17.	Signal generator Square wave, sine wave, triangle wave, TTL pulse, positive and negative ramp, pulse and skewed sine wave, AM, and sweep functions, 0.1 Hz to 11 MHz, up/down range switchable in eight decade steps or higher	02 nos
18.	Any other Equipment required for above expt	

### Industrial Measurement & Instrumentation Lab 2

Sl No	Equipment & Tools Required for Electronics Workshop	Laboratory Size-30 Nos Table- 8 nos
<b>Equipment Required</b>		Quantity Required
1.	<p><b>Instrumentation Trainer</b> - provides the means to teach the students various Instrumentation techniques. It is provided with various transducers and associated Jigs, Rigs and Fixtures such as Linear Transducer Test Rig, Optical Rig and Thermal Rig etc. The instrument is beautifully made with all the transducers and associated Jigs visible from the front itself for a clear understanding.</p> <p>It enables the following types of measurements</p> <ul style="list-style-type: none"> <li>• Displacement using LVDT.</li> <li>• Angular Displacement using variable capacitance.</li> <li>• Core Displacement using inductive method.</li> <li>• Strain: using Strain guage.</li> <li>• Speed: Uses photopick up &amp; magnetic pick up.</li> <li>• Intensity: Uses LDR.</li> </ul>	01



	<ul style="list-style-type: none"> <li>Temperature: Uses TC,RTD &amp; Thermistor.</li> <li>Force: Uses piezoelectric pick up.</li> </ul>	
2.	Capacitive type Transducer and using circuit and with the characteristics displacement	01
3.	Piezo electric Transducer	01
4.	Speed measurement using stroboscope(Strobo meter)	01
5.	Humidity and Temperature measurement trainer module	01
6.	pH Measurement trainer	01
7.	<b>Lab view software</b> to design- (a) Temperature measurement using Thermometer. (b) Water Level measurement. © Mathematically expression. (d) Digital circuit (using Logical expression)	10
8.	ON Line Temperature measurement method.	01
9.	ON line pressure measurement method.	01
10.	Speed measurement of using of moving Tachometer	01
	<b>Any other Equipment required for above expt</b>	

### Biomedical Instrumentation Lab

Sl No	Equipment ,Raw materials & Tools Required for Electronics Workshop	Laboratory Size-30 Nos Table- 8 nos
		Quantity Required
1.	1. SIP 385-2 Kit/ Sensor and Transducer used in Bio-Medical Application Trainer Kit 2. Temperature diode sensor 3. Temperature sheaths. 4. Digital storage oscilloscope 5. DMM 6. Jumper leads.	01
2.	Differential Amplifier used in Bio-Medical Instrumentation Trainer Kit ECG Amplifier 12 Lead Trainer Kit Display: PC Interfacing Power Supply: 230V / 50Hz	01
3.	Bio-Medical Amplifier System Trainer Kit	01
4.	Electro myography Emg / Bio-Medical Amplifier System Trainer kit	01
5.	1.SIP 385-1 Kit/ Electro-cardio-graph Recorder Trainer Kit 2. Digital storage Oscilloscope 3. Function Generator 4. DMM. 5. Jumper leads	01
6.	1. SIP 385-2 Kit/ Pulse Rate counter with display 2. Digital storage Oscilloscope 3. Function Generator 4. DMM. 5. Diode Probe and sheath.	01
7.	Study of Respiratory Recording Trainer Kit	01
8	1. SIP 385-1 Kit/ Bio-Medical Instrumentation Trainer - Features: - Battery operated body signal measurements for safety - PC based graph drawing facility and display to capture body signals 2. ECG simulator	01

	<ul style="list-style-type: none"> <li>3. ECG lead selector</li> <li>4. ECG paste</li> <li>5. ECG leads cable</li> <li>6. ECG electrodes</li> <li>7. Alcohol</li> <li>8. Digital storage Oscilloscope</li> <li>9. DMM</li> </ul>	
9.	<ul style="list-style-type: none"> <li>1. Insertion Panel.</li> <li>2. Patient Lead Cables.</li> <li>3. ECG Electrode (4).</li> <li>4. PKg.of alcohol-treated Gauze Pads.</li> <li>5. Lead Selector Box.</li> <li>6. ECG Simulator.</li> <li>7. Scope and DMM.</li> </ul>	01
10	Stethoscope	05
11	Blood Pressure Trainer Kit, Skrip-bpm-4p	01
12	Pace Maker Trainer Kit	01
	<ul style="list-style-type: none"> <li><b>1. Rest required as per requirement</b></li> <li><b>2. Individual Expt Serial no 2 to ----- against experiment as per requirement for all Labs to be decided</b></li> </ul>	