CURRICULUM
FOR

FOURTH SEMESTER

DIPLOMA IN

ELECTRONICS AND COMMUNICATION ENGINEERING

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN ELECTRONICS & COMM.ENGG.

FOURTH SEMESTER

Code	Subjects	Study Scheme Hours			Total Hours L+T+P	Credits			Total credit
		L	T	P		L	T	P	
PC401	Electrical Machines	3	0	0	3	3	0	0	3
PC402	Electrical Machines Lab	0	0	2	2	0	0	1	1
PC403	Digital and Data Communication	3	0	0	3	3	0	0	3
PC404	Digital and Data Communication Lab	0	0	2	2	0	0	1	1
PC405	Microcontrollers and Embedded Systems	3	0	0	3	3	0	0	3
PC406	Microcontrollers and Embedded Systems Lab	0	0	2	2	0	0	1	1
PC407	Power Electronics	3	0	0	3	3	0	0	3
PC408	Power Electronics Lab	0	0	2	2	0	0	1	1
PE409	PE-1(Branch Specific Elective)	3	0	0	3	3	0	0	3
PE410	PE-1(Branch Specific Elective)Lab	0	0	2	2	0	0	1	1
SI/PR411	Fundamentals of Electronic Equipment Maintenance Lab	0	0	4	4	0	0	2	2
Total		**15**	**0**	**14**	**29**	**15**	**0**	**07**	**22**

PE- I (Branch specific elective):- Principles of Instrumentation/Linear Integrated Circuits

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC401**	**Course Title**: **ELECTRICAL MACHINES**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

This subject shall enable student to study the fundamental concepts of electrical machines, their operating principle and working. Such machines form a basis for understanding machines based on similar concepts as employed in industries, power stations, domestic and commercial appliances,etc.

DETAILED CONTENTS

1. Single phase and Three Phase Supply: (04 hrs)

1.1 Advantage of three-phase system over single-phase system.

1.2 Star Delta connections.

1.3 Relation between phase and line voltage and current in a three-phase system.

1.4 Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.

2. Transformers: (10 hrs)

2.1 Principle of operation and constructional details of single phase and three-phase transformer, core type and shell type transformers.

2.2 Difference between single phase and three phase transformers and their applications.

2.3 Voltage Regulation of a transformer (No Derivation).

2.4 Losses in a transformer.

2.5 Efficiency, condition for maximum efficiency and all day efficiency.

2.6 Auto transformers.

2.7 Brief introduction of CTs and PTs (Current transformer and potential transformer) and CVT (Constant Voltage Transformer)

3. Introduction to Rotating Electrical Machines: (04hrs)

3.1Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction).

3.2 Definition of motor and generator.

3.3 Basic principle of a generator and a motor.

3.4 Torque due to alignment of two magnetic fields and the concept of Torque angle.

4. DC Machines: (10 hrs)

4.1 Principle of working of D.C motors and D.C generator, their constructional details.

4.2 Function of the commutator for motoring and generating action.

4.3 Factors determining the speed of a DC motor.

4.4 Different types of excitations.

4.5 Characteristics of different types of DC machines.

4.6 Starting of DC motors and starters.

4.7 Application of DC machines.

5. A.C. Motors: (10 hrs)

5.1 Revolving magnetic field produced by poly phase supply.

5.2 Brief introduction about three phase induction motors, its principle of operation.

5.3 Types of induction motors and constructional features of squirrel cage and slip-ring motors.

5.4 Starting and speed control. Star Delta and DOL (Direct-on-line) starters.

5.5 Reversal of direction of rotation of 3-phase induction motors.

5.6 Applications of induction motors.

6. Single Phase Fractional Kilowatt Motors: (10 hrs)

6.1 Introduction to Single Phase Fractional Kilowatt Motors.

6.2 Principle of operation of single-phase motors

6.3 Types of single-phase induction motors and their constructional details (i.e., Split phase, capacitor start, capacitor start and run, shaded pole and reluctance start).

6.4 Introduction to servo- motors and stepper motors.

6.5 Concept of micro-motors.

COURSE OUTCOME:

After completing the course , a student is expected to :

1. Understand various electrical machines and their practical applications in the field of electrical and electronics engineering.
2. Acquire knowledge about working principles of various electrical machines.

3. Gain basic idea of construction, maintenance and testing of electrical machines.

BOOKS RECOMMENDED:

1. Electrical Machines by SK Bhattacharya, Tata McGraw Hill, Education Pvt Ltd. New Delhi.

2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar.

3. Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi.

4. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi.

5. Electrical Machines by SmarajitGhosh-Pearson Publishers, Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Single phase and Three Phase Supply	04	10
2	Transformers	10	20
3	Introduction to Rotating Electrical Machines	04	10
4	DC Machines	10	20
5	A.C. Motors	10	20
6	Single Phase Fractional Kilowatt Motors	10	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC402**	**Course Title :ELECTRICAL MACHINES LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course supplementing the theory subject of Electrical Machines. The practicals will reinforce the concepts treated in the theory subject.

LIST OF PRACTICALS:

1.To measure power and power factors in three phase load by two wattmeter method.

2.To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test.

3.To connect the primary and secondary windings of a three phase transformer in a suitable circuit and to verify line and phase current and voltage relationship respectively.

4. Study of dc series motor with starter (to operate the motor on load/no load)

5.Speed control of dc shunt motor (i) Armature control method (ii) Field control method

6. To connect a dc shunt motor with supply through a 3 point starter and to run the motor at different speeds with the help of a field regulator.

7. To run a 3 phase squirrel cage induction motor with the help of a star-delta starter. and to change the direction of rotation of the motor.

8.To measure power and power factor of a single phase induction motor.

9.To run a synchronous motor with a.c supply and to measure speed.

10.To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed.

11.Study construction of a stepper motor and servomotor.

COURSE OUTCOME:

Students will be able to get practical understanding about the working of three phase system, transformers and different types of motors etc.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC403**	**Course Title**: **DIGITAL AND DATA COMMUNICATION**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES:

This course is designed to develop an understanding of basic concepts in digital and data communication. This course examines the important techniques related to digital and data communication and enable students to have an insight into the theoretical concepts.

DETAILED CONTENTS:

1. Introduction to Digital Communication (04 hrs)

1.1 Basic block diagram of a digital communication system.

1.2 Advantages of digital communication system over analog communication system

1.3 Definition of the terms :Bit rate, baud rate, information capacity, bandwidth, Nyquist frequency, bandwidth efficiency

2. Digital modulation techniques (10 hrs)

2.1 Definition of digital modulation.

2.2 Amplitude shift keying (ASK): basic principles ,waveforms and block diagram explanation of transmitter and receiver.

2.3 Frequency Shift keying (FSK): basic principles ,waveforms and block diagram explanation of transmitter and receiver.

2.4 Phase shift keying (PSK): BPSK, basic principles ,waveforms and block diagram explanation of transmitter and receiver

2.5 Other forms of PSK:QPSK,8-PSK and 16-PSK,(basic description only).

2.6 Basic principles of Quadrature Amplitude Modulation (QAM).

3. Pulse modulation (04 hrs)

Types of pulse modulation-PAM, PPM, PWM (Generation & Detection) and their comparison.

4. Pulse code modulation (08 hrs)

4.1 Statement of sampling theorem and elementary idea of sampling frequency for pulse code modulation.

4.2 Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM).

4.3 Pulse code Modulation (PCM) : Basic scheme of PCM system, Quantization, quantization error, block diagram of PCM communication system and function of each block. Advantages of PCM systems.

4.4 Brief idea of delta modulation and adaptive delta modulation.

5. Data Communication basics (14 hrs)

5.1 Block diagram description of a basic data communication model and its components consisting of transmitter ,receiver, medium ,message and protocol.

5.2 a) Modes of communication:simplex,half-duplex,duplex

b)Transmission modes: parallel, serial, asynchronous and synchronous

5.3 Communication media.

a)Guided transmission media: twisted pair cable, co-axial cable, fibre-optic cable

b)Unguided transmission media: radio waves, microwaves ,infrared, satellite.

c)Line of sight transmission: Point-to-point, broadcast.

5.4 Data communication codes

a) Basic codes

i)Baudot code ii)BCD code iii)ASCII code iv) EBCDIC code

b) Line codes

i)NRZ ii)RZ iii)Manchester

5.5 Error detection

a)Redundancy checking

i)VRC ii)Checksum iii)LRC iv)CRC

b)Error detection using parity

5.6 Error correction

a)Re-transmission/Automatic repeat request(ARQ)

b)Forward error correction(FEC) using Hamming code

5.7 Character synchronization

a)Asynchronous serial data b) Synchronous serial data

6. Data Communication hardware (04 hrs)

Brief description of the following:-

a)Data terminal equipment (DTE) and Data Communication Equipment(DCE)

b)UART and USRT

c)Serial data interface RS-232.

d)Modems

7. Data Networks (04 hrs)

7.1 Description of public switched data networks.

7.2 Difference between circuit switching , message switching and packet switching

7.3 Concept of ISDN and Broadband ISDN

7.4 Brief idea of Asynchronous transfer mode (ATM)

7.5 Local area networks(LAN) and ethernet.

COURSE OUTCOME:

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

1. Understand the fundamental concepts related to the data communication systems. Distinguish between analog, digital signals and the transmission thereof.
2. Interpret how and why the errors occur during the transit of signal or data and what are the remedial techniques to correct the same.

3. Understand the behavior of data communication devices and the underlying technologies involved in manufacturing of those devices.

RECOMMENDED BOOKS:

1. Dr. Sanjay Sharma, Data Communication and Computer Networks, Kataria Publications.
2. William Stallings, Data Communication and Networks, Prentice Hall India
3. Behrouz A. Forouzan, Data Communications and Networking , McGraw Hill Edn.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Introduction to Digital Communication	04	10
2	Digital Modulation Techniques	10	20
3	Pulse modulation	04	10
4	Pulse code modulation	08	15
5	Data communication basics	14	25
6	Data communication hardware	04	10
7	Data communication networks	04	10
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC404**	**Course Title :DIGITAL AND DATA COMMUNICATION LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Digital and Data communication and aims to reinforce the concepts taught in the theory with practical observations.

LIST OF PRACTICALS:

1. Observe Pulse Amplitude Modulation (PAM)signal.
2. Observe Pulse Width Modulation (PWM)signal.
3. Observe Pulse Position Modulation (PPM)Signal.
4. Observe wave forms at input and output of ASK modulator and demodulator.
5. Observe wave forms at input and output of FSK modulator and demodulator.
6. Observe wave forms at input and output of BPSK modulator and demodulator
7. To feed signal to the input of a PCM transmitter and compare the signal at the output of PCM receiver with it.
8. To transmit parallel data on a serial link using USART.
9. Transmission of Hamming code on a serial link and its reconversion at the receiving end.
10. Perform the transfer of a file from PC to another PC using serial port RS-232.

COURSE OUTCOME:

After the completion of the course the student will be able to understand the basics of types of signals, network devices, modulators etc. Students will be able to work on practical projects related to networking of computers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC405**	**Course Title**: **MICROCONTROLLERS AND EMBEDDED SYSTEMS**
Semester: 4TH	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES:

Micro-controllers and Embedded systems have also assumed a great significance in the electronic and consumer goods industry and are a very vital field in modern era. The subject aims to expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

DETAILED CONTENTS:

1. Introduction to the Architecture of 8051 Microcontroller. (12 hrs)

1.1. Comparison of a microprocessor and a microcontroller

1.2. Overview of 8051 family and their comparison.

1.3. Study of architecture of 8051 using its block diagram.

1.4. Pin details ;function of each pin of an 8051 microcontroler.

1.5. I/O Port structure.

1.6. Memory Organization(Concept of internal and external memory).

1.7. Various registers and Special Function Registers (SFRs) in an 8051.

2. 8051 Instruction Set And Programs.

2.1 Overview of 8051 instruction set.

2.2 Various addressing modes.

2.3 Classification of instructions(brief explanation and one or two examples of each type).

Data transfer instructions
Arithmetic instructions
Logical instructions
Branching instructions
Bit manipulation instructions

Stack, subroutine and interrupt related instructions

2.4 Simple Programs based on above instructions.

3.Assembly/C programming for Micro controller: (12 hrs)

3.1 Use of software development tools like Editor, Assembler, Linker, Loader and Hex- converters for writing and executing programs for the microcontroller.

3.2 Various directives of Assembly language programming for 8051 programming.

3.3 Brief idea of use of compiler, debugger and simulator in running microcontroller programs.

3.4 Simple programs in assembly and C for 8051.

4. Microcontroller Operations: (08 hrs)

4.1 I/O ports in 8051: their function and use with related SFRs.

4.2 Timers/counters in 8051:their function, programming modes, operations and use with related SFRs

4.2 Serial communication in 8051.

4.3 Description of interrupts in 8051.

5. Application of Micro controllers and Embedded systems. (05 hrs)

5.1Brief description of an embedded system.

5.2Application of Micro controllers and Embedded systems in consumer electronics.

6. Design of embedded systems using Arduino

6.1 Arduino board layout and description of onboard components

6.2 Pin details of Arduino.

6.3Concept of interfacing LEDs, IR sensors, LCD module, buzzer, push button, motor with Arduino.

6.4 Familiarisation with Arduino IDE and simple programming examples (sketches) with Arduino.

6.5 Design example of a simple embedded system using an Arduino.

COURSE OUTCOMES

On completing the course a student is expected to :

1. Gain substantial knowledge of microcontrollers, their architecture ,working and their programming.
2. Understand embedded systems and their practical applications.
3. Design simple programs for 8051 microcontroller.
4. Fabricate a small electronics circuit using Arduino boards.

RECOMMENDED BOOKS

1. Microcontrollers by Deshmukh, Tata McGraw Hill Education Pvt Ltd, New Delhi.

2. Microcontrollers by Ayala.

3. Microcontrollers by Mazidi, Pearson Education, Delhi.

4. Microcontrollers by Neil Makanzi, Pearson Education, Delhi.

5. Embedded GSM Applications.

6. Microcontrollers and Embedded Systems by Sangar and Sahdev, Unique Publications, Jalandhar.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	**Time Allotted (Hrs)**	**Marks Allotted (%)**
1	Introduction to the Architecture of 8051 Microcontroller	10	20
2	8051 Instruction Set And Programs	10	20
3	Assembly/C programming for Micro controller	06	15
4	Microcontroller Operations	08	15
5	Application of Micro controllers and Embedded system	04	10
6	Design of embedded system using Arduino	10	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC406**	**Course Title: MICROCONTROLLERS AND EMBEDDED SYSTEM LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Microcontrollers and Embedded System.There will be more emphasis on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini-projects based on microprocessor and micro-controller operations may be identified and given to students as assignments.

LIST OF PRACTICALS

1. Familiarization with 8051micro-controller Kit.

2. Assembly Language Programming (PC Based) for writing programs for 8051 using an assembler.

3. C Language Programming- (PC Based) for writing programs for 8051 using a C compiler.

4. Adding two 8 bit and 16 bit numbers.

5. Subtraction of two 8 bit and 16 bit numbers.

6.Multiplication of two 8 bit and 16 bit unsigned numbers.

7. Multiplication of two 8 bit and 16 bit signed numbers.

8.Dividing 16 bit unsigned number with an 8 bit unsigned numbers.

9.Program on placing contents of external memory in the accumulator.

10.Exchange of contents of memory locations

11.Program using ports in an 8051

Other programs can be devised by the teacher as per his choice.

12 .Blinking an LED using any Arduino.

13.Displaying Temperature on an LCD module using data from temperature sensor.

14.Increasing/decreasing the speed of motor using PWM pins of Arduino

COURSE OUTCOMES:

Students will be able to understand the basis of Assembly level programming and will be able to work on microcontroller kits. Knowledge of Assembly level programming will help them in programming Arduinos Microcontrollers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC407**	**Course Title**: **POWER ELECTRONICS**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES : Diploma holders in Electronics and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further re-inforce the knowledge and skill of the students.

COURSE CONTENTS

1. Basics of Power Electronics Devices: (12hrs)

1.1. Construction, Working principles of SCR, two transistor analogy of SCR
1.2. V-I characteristics of SCR.
1.3. SCR specifications & ratings.
1.4. Different methods of SCR triggering.
1.5. Different commutation circuits for SCR.
1.6. Series & parallel operation of SCR.

2. DIAC,TRAIC& UJT and other Power Electronics Devices: (12 hrs)

2.1. Construction & working principle of DIAC and its V-I characteristics.
2.2. Construction & working principle of TRAIC and its V-I characteristics.
2.3. Construction, working principle of UJT and its V-I characteristics.
2.4. UJT as relaxation oscillator.
2.5. Basic idea about the selection of Heat sink for thyristors.
2.6. Applications of SCR,DIAC and TRAIC.

3. Controlled Rectifiers (10hrs)

3.1. Single phase half wave controlled rectifier with load (R, R-L)

3.2. Fully controlled full wave bridge rectifier.

3.3. Single phase full wave center tap rectifier.

4. **Dual Converters and Cyclo converters:(12 hrs)**

4.1. Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel. Inverters & their applications.

4.2. Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.

4.3. Brief Introduction of Dual Converters and cyclo converters.

5. **Applications:** (08 hrs)

5.1. Battery charger ,Emergency light system, Temperature controller using SCR .

5.2. Illumination control / fan speed control using TRIAC.

5.3. Thyristorized control of electric drives.

5.4. UPS: Offline and Online.

5.5. Concept of SMPS.

COURSE OUTCOME:

- Acquire knowledge about fundamental concepts and techniques used in power electronics.
- Understand the operation of power electronic devices and applications
- Ability to analyze various power converter circuits and understand their application.
- Ability to identify basic requirements for power electronics based design application.

Recommended Books:

1) Power Electronics by P.C. Sen, Tata McGraw Hill Education Pvt Ltd. New Delhi
2) Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi
3) Power Electronics – Principles and Applications by Vithayathi, Tata McGraw Hill Education Pvt Ltd. New Delhi
4) Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Basics of Power Electronics Devices	10	20
2	DIAC,TRAIC & UJT and other Power Electronics	10	20
3	Controlled Rectifiers	10	20
4	Inverters, Choppers, Dual Converters and Cyclo-converters.	10	20
5	Applications	08	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC408**	**Course Title: POWER ELECTRONICS LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Power Electronics Subject.

LIST OF PRACTICALS:

1) To plot VI characteristic of an SCR.
2) To plot VI characteristics of DIAC.
3) To plot VI characteristics of TRIAC.
4) To plot VI characteristics of UJT.
5) Observation of wave shapes of voltage and relevant points of single Phase full wave controlled rectifier and effect of change of firing angle.
6) Study of UJT relaxation oscillator. And observe I/P and O/P wave forms
7) Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle.
8) Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
9) Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for varying lamp intensity and AC fan speed control.
10) Installation of UPS system and routine maintenance of batteries.

Course Outcome:

The student shall be able to:

1)Understand various Power Electronic Devices and Equipment's which are used in the Electrical and Electronics Industry.

2) Able to know the characteristics of Power Electronic Devices like SCR, DIAC,TRAIC etc.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code:**PE409**	Course Title: **ELECTIVE** **a) PRINCIPLES OF INSTRUMENTATION**
Semester: 4th	Credits: 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

In the real world of work the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. the study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

1. Basics of Instrumentation and Measurements: **(06hrs)**

1.1 Measurement, method of measurement, types of instruments.

1.2 Basic Measurement System, functions of its elements namely the transducer, signal conditioner, display or read-out and power supply.

1.3 Specifications of instruments: Accuracy, precision, sensitivity, resolution, range.

1.4 Errors in measurement, loading effect.

2. Digital Instruments **(10hrs)**

2.1 Comparison of analog and digital instruments.

2.2 Brief overview of analog instruments.

2.3 Working principles of digital instruments.

2.4 Block diagram and working of digital voltmeters (DVMs).

2.5 Block diagram and working of digital multimeter.

2.5 Measurement of time interval, time period and frequency using frequency counter

2.6 Working principle of logic probe, logic pulser, logic analyzer.

2.7 Working of a digital LCR meter and a digital Q-meter.

3. Oscilloscopes (08hrs)

3.1 Working principle of an oscilloscope and measurement of voltage, frequency, time period and phase difference using CRO.

3.2 Brief idea of working of Cathode Ray Tube(CRT) oscilloscopes, single and dual trace.

3.3 Digital storage oscilloscope (DSO) : block diagram and working principle.

3.4 Brief definition of other types of CRO:

i) Mixed-domain oscilloscopes ii) mixed-signal oscilloscopes iii) Handheld oscilloscopes iv) PC-based oscilloscopes.

3.5 CRO probes, their types and features

4. Signal Generators and Analytical Instruments (06 hrs)

4.1 Block diagram explanation and working of a function generator.

4.2 Block diagram explanation and working of a wave analyzer and spectrum analyzer and their working principle.

5. Transducers (12 hrs)

5.1 Distinction between active and passive transducers with examples.

5.2 Basic requirements of a transducer.

5.3 Variable Resistance Type:

Principle of operation of Potentiometer, Strain gauge and Thermistor.

5.4 Variable capacitance type:

Principle of operation of dielectric guage, capacitor microphone and capacitive touchscreens.

5.5 Variable inductance type:

Principle of operation of Linear Variable differential transformer (LVDT).

5.6 Knowledge of **applications** of other different types of transducers**(definitions only**)

i)Electromagnetic(Antenna, disk read/write heads,Hall effect sensors)

ii)Electrochemical (PH probes, gas sensors)

iii)Electromechanical(accelerometers ,air flow sensors, load cells, gyroscope)

iv)Electro-acoustic (Loudspeakers, microphone ,vibrators or buzzers, hydrophone, ultrasonic sensors)

v)Electro-optical(Lamps , LEDs, laser diodes ,photodiode, phototransistor, LDRs)

vi)Thermoelectric(thermistors, thermocouple)

vii)Tactile sensors(touch screens)

viii)Humidity sensors(hygroscopes)

6.Telemetry and smart meters

6.1 Definition of telemetry or remote measurement; Block diagram working of a telemetry system.

6.2 Applications of telemetry in modern world.

6.3 Brief description of advanced metering infrastructure(AMI) or smart meters.

COURSE OUTCOME:

1. The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.
2. Students will be able to understand the basic uses and applications of Cathode ray oscilloscope,DSO,different types of transducers.

RECOMMENDED BOOKS:

1. Electronics Measurement and Instrumentation by AK Sawhney, DhanpatRai and Sons, New Delhi.

2. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi.

3. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi.

4.. Electronics Instrumentation by JB Gupta, SatyaPrakashan, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Basics of Instrumentation and Measurements	06	10
2	Digital Instruments	10	20
3	Oscilloscopes	08	15
4	Signal Generators and Analytical Instruments	06	15
5	Transducers	12	25
6	Telemetry and smart meters	06	10
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PE410(a)**	**Course Title :ELECTIVE LAB** **PRINCIPLES OF INSTRUMENTATION LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Principles of Instrumentation. There will be more emphasis on practical aspects along with the theory input.

LIST OF PRACTICALS

1. Measurement of voltage, frequency, time period and phase using CRO.
3. Measurement of voltage, frequency, time and phase using DSO.
4. Measurement of Q of a coil and its dependence on frequency using a digital Q-meter.
5. Measurement of capacitance and inductance using digital LRC meter
6. Use of logic pulser and logic probe.
7. Measurement of time period, frequency, average period using universal counter/ frequency counter.
8. Measurement of strain using strain gauge.
9. Measurement of temperature using thermistor and thermocouple.
10. To assemble and test instrumentation amplifier measure its gain, input and output Impedance.
11. Study of remote metering and smart meters for electrical consumption.

COURSE OUTCOMES:

Students will be able to understand the basic uses and applications of Cathode ray oscilloscope, DSO, different types of transducers etc which will be of great importance considering their practical applications in the Engineering field.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code:**PE409(b)**	Course Title: **ELECTIVE** **b) LINEAR INTEGTRATED CIRCUITS**
Semester: 4th	Credits: 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

The student should be made to: To expose the students to linear and integrated circuits. To understand the basics of linear integrated circuits and available IC's.To understand characteristics of operational amplifier.To apply operational amplifiers in linear and nonlinear applications. To acquire the basic knowledge of special function IC.

PRIOR LEARNING REQUIREMENT: NIL

1. CHARACTERISTICS OF OP-AMP: (16 hrs)

1.1 Introduction to operational amplifier, Ideal OP-AMP characteristics, DC and AC characteristics.

1.2 Differential amplifier, Balanced and unbalanced Input/output configuration, frequency response of OP-AMP.

1.3 Brief introduction of instrumentation amplifier and isolation amplifier.

2. APPLICATIONS OF OP-AMP: (18 hrs)

2.1 Use of op-amp as Sign Changer, Scale Changer.

2.2 Use of op-amp as Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor.

2.3 Use of op-amp as Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier.

2.4 Use of op-amp as Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper.

2.5 Use of op-amp as Low-pass, high-pass and band-pass Butterworth filters

3. WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs (10 hrs)

3.1 Sine-wave generators, Multivibrators and Triangular wave generator.

3.2 Saw-tooth wave generator, ICL8038 function generator.

3.3 IC 723 general purpose regulator monolithic switching regulator.

3.4 Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters.

3.5 Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-coupler ICs.

3.6 IC-566 voltage-controlled oscillator & IC 565-phase locked loop.

3.4 IC AD633 Analog multiplier.

3. APPLICATION INTEGRATED CIRCUITS(IC'S) (10 hrs)

4.1 AD623 Instrumentation Amplifier and its application as load cell weight measurement .

4.2 IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply .

4.3 LM317, 723 Variable voltage regulators.

4.4 Switching regulator- SMPS — ICL 8038 function generator IC.

COURSE OUTCOME:

The student should be able to:

1. Design oscillators and amplifiers using operational amplifiers
2. Design filters using Op-amp and perform experiment on frequency response
3. Design DC power supply using ICs.

BOOKS RECOMMENDED:

1.Ramakant A. Gayakwad, "Op-Amps and Linear integrated circuits", PHI, 4th Edition, 2000.

2. Donald.E. Neaman, "Electronic Circuit, Analysis and Design", Tata McGraw Hill Publishing Company Limited, Second Edition, 2002.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Characteristics of OP-AMP	10	20
2	Applications of OP-AMP	10	20
3	Waveform Generators And Special Function ICs	14	30
4	Application Integrated Circuits	14	30
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PE410(b)**	**Course Title : ELECTIVE LAB** **b)LINEAR INTEGRATED CIRCUITS LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Linear Integrated Circuits. There will be more emphasis on practical aspects along with the theory input.

PRIOR LEARNING REQUIREMENT: NIL

LIST OF PRACTICALS:

1. To demonstrate the use of op-amp as Integrator and Differentiator.

2. To obtain the output of voltage comparator and zero crossing detector.

3. To know the operation of clippers and clampers.

4. To study the application of IC565 as an PLL.

5. To demonstrate the use of op-amp as low pass and high pass filter.

6. To design a high current, low voltage and high voltage linear variable dc regulated power supply and test its line and load regulation.

7. To study the operations of at least four analog ICs currently being used .

COURSE OUTCOMES:

Students will be able to understand and perform practicals using OP-Amp and will be able to know the various applications of Operational amplifiers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **FI/PR411**	**Course Title**: **FUNDAMENTALS OF ELECTRONIC EQUIPMENT MAINTENANCE LAB**
Semester: 4th	**Credits:** 2
Periods Per Week : 4 (L:0 , T:0, P: 4)	

COURSE OBJECTIVES:

This course aims at making the students introduced to the working of electronic products used in daily life and to the repair and maintenance of these products.

COURSE CONTENTS:

UNIT 1 Basic concepts in repair, servicing and maintenance (10 hrs)

1.1 Role and scope of maintenance and repair in modern electronic equipment.
1.2 Concept of terms like Mean time between failures (MTBF), Mean time to repair (MTR),preventive maintenance, corrective maintenance.
1.3 Circuit tracing techniques-Divergent, convergent and feedback path circuit analysis
1.4 Fault location techniques like functional Areas approach, split half method, measurements of parameters at different points in a circuit ,signal injection etc.

UNIT 2 Fault finding aids and tools (10 hrs)

2.1 Interpretation of data sheets of various electronic components
2.2 Utility of information available in service / operation manuals of various electronic gadgets.
2.3 Proficiency in the use of test and measuring instruments in fault finding like multimeter, oscilloscope ,signal generator, fixed and dc power supplies, logic probes ,IC testers etc.

UNIT 3 Installation of different electronic equipment (30 hrs)

Most of the installations can be demonstrated either practically, through industrial visit or through video resources available on the internet.

3.1 Study of installation of CCTV equipment.

3.2 Study of installation of DTH receiver/set top box and satellite dish antenna.

3.3 Study of installation of computer LAN network .

3.4 Study of installation of solar power plant(domestic or commercial).

3.5 Study of installation of IFPDs (interactive flat panel device), smart classrooms, digital and audio podiums.

3.6 Study of installation of public address system .

3.7 Study of installation of audio system in a conference setting.

3.8 Study of installation of video conferencing system.

3.9 Study of installation of home automation system.

3.10 Study of installation of fire alarms, gas leakage alarms, burglar alarms.

More studies can be added by the teacher as per his choice so as to expose a student to the ubiquitous world of Electronics.

UNIT 4 Repair and Maintenance of Electronic equipment/gadgets (14 hrs)

1. Fault finding and repair of simple household gadgets like electric iron, electric kettle, electric geyser, electric heaters , electric rice cookers/milk boilers, electric fans, electric water pumps ,mixers cum grinders etc.
2. Fault finding and repair of simple electronics circuits like power supply, timer circuit ,op-amp circuit, amplifier circuit, oscillator circuit etc.

3. Demonstration of repair and maintenance using learning resources/videos/practical demonstrations of electronic systems covered in chapter 3.

COURSE OUTCOME:

At the end of the course, the participant shall be able to identify the fault, repair &carry out the installation and maintenance of simple electronic products.