INTEGRATED CERTIFICATE DIPLOMA PROGRAMME (ICD)

DIPLOMA IN INSTRUMENTATION AND PROCESS CONTROL (DIN)
&
CERTIFICATE IN SERVICING & MAINTENANCE OF MEDICAL INSTRUMENTS (CSMM)

(Applicable only to DIN-CSMM-24)

Study Scheme

DEPARTMENT OF ELECTRICAL & INSTRUMENTATION ENGINEERING

SANT LONGOWAL INSTITUTE OF ENGINEERING & TECHNOLOGY

(Deemed-to-be-University, Established by Govt. of India)

Longowal, Distt.- Sangrur, Punjab, 148106

Study Scheme of Integrated Certificate Diploma Programme (DIN-CSMM)

Semester-I							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	BSMA-101	Mathematics-I	3	1	0	4	4
2.	BSPH-103	Applied Physics-I	2	1	0	3	3
3.	BSCY-105	Applied Chemistry	2	1	0	3	3
4	HSMH-101	Communication Skills in English	2	0	0	2	2
5.	BSPH-107	Applied Physics-I Lab	0	0	2	2	1
6.	BSCY-109	Applied Chemistry Lab	0	0	2	2	1
7	HSMH-105	Communication Skills in English Lab	0	0	2	2	1
8.	ESME-101	Engineering Graphics	0	0	2	2	1
9	ESWS-103	Engineering Workshop Practice	0	0	4	4	2
10	HSSP-103	Sports and Yoga	0	0	2	2	1
		Total	9	3	14	26	**19**
11	QPIE-101	Junior Mechanic Electrical/Electronics/ Instruments **(Module-1)**	0	0	8	8	1
		Grand Total	9	3	22	**34**	**20**

Semester-II							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	BSMA-102	Mathematics-II	3	1	0	4	4
2.	BSPH-104	Applied Physics-II	2	1	0	3	3
3	ESCS-102	Introduction to IT Systems	2	0	0	2	2
4	ESEE-104	Fundamentals of Electrical Engineering	2	0	0	2	2
5	ESEC-108	Fundamentals of Electronics Engineering	2	0	0	2	2
6	ESME-106	Engineering Mechanics	2	1	0	3	3
7	BSPH-106	Applied Physics-II Lab	0	0	2	2	1
8	ESCS-110	Introduction to IT Systems Lab	0	0	2	2	1
9	ESEE-112	Fundamentals of Electrical Engineering Lab	0	0	2	2	1
10	ESEC-114	Fundamentals of Electronics Engineering Lab	0	0	2	2	1
11	ESME-116	Engineering Mechanics Lab	0	0	2	2	1
		Total	13	3	10	26	**21**
12	QPIE-102	Junior Mechanic Electrical/ Electronics/ Instruments (**Module-2**)	0	0	8	8	1
13	EAA -102	Extra Academic Activities	0	0	1	1	1 (S/US)
		Grand Total	13	3	19	**35**	**23**

Summer-I							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1	QPIE-103	Qualification Pack (4 Weeks) in Junior Mechanic Electrical/ Electronics/ Instruments (**Module-3**)	0	0	24	24	**03**

Semester-III							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	PCIE-201	Measurement Science	3	1	0	4	4
2.	PCIE-203	Sensors and Transducers	3	1	0	4	4
3.	PCIE-205	Hydraulic and Pneumatic Instruments	3	0	0	3	3
4.	PCIE-207	Human Physiology and Medical Instruments	3	0	0	3	3
5.	PCIE-209	Digital Electronics	3	0	0	3	3
6.	PCIE-211	Sensors and Transducers Lab	0	0	2	2	1
7.	PCIE-213	Hydraulic and Pneumatic Instruments Lab	0	0	2	2	1
8.	PCIE-215	Electrical and Instrumentation Drawings	0	0	2	2	1
9.	AUCH-201	Environmental Science	2	0	0	2	0 (S/US)
		Total	17	2	6	25	**20**
10	QPIE-201	Medical Equipment Technology Assistant (**Module-1**)	0	0	8	8	1
11	EAA -201	Extra Academic Activities	0	0	1	1	1 (S/US)
		Grand Total	17	2	15	**34**	**22**

Semester-IV							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	PCIE-202	Process Control Engineering	3	1	0	4	4
2.	PCIE-204	Power Plant Instrumentation	3	1	0	4	4
3.	PCIE-206	Electronic Measurements	3	0	0	3	3
4.	PEIE-202	Program Elective-I	3	1	0	4	4
5.	OEXX-202	Open Elective-I	3	0	0	3	3
6.	PCIE-208	Process Control Lab	0	0	2	2	1
7.	PCIE-210	Electronic Measurements Lab	0	0	2	2	1
8.	AUMH-202	Essence of Indian Knowledge and Tradition	2	0	0	2	0 (S/US)
		Total	17	3	4	24	**20**
9	QPIE-202	Medical Equipment Technology Assistant (**Module-2**)	0	0	8	8	1
10	EAA-202	Extra Academic Activities (A/B/C)	0	0	1	1	1 (S/US)
		Grand Total	17	3	13	33	**22**

Summer-II							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1	TPID-202	Summer Internship with OJT– II (4-6 weeks)	0	0	24	24	**03**

Semester-V							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	HSMH-301	Entrepreneurship and Start-ups	3	1	0	4	4
2.	PCIE-301	Microprocessor and Microcontroller	3	0	0	3	3
3.	PCIE-303	Control Engineering	3	0	0	3	3
4.	PEIE-301	Program Elective-II	3	1	0	4	4
5.	OEXX-301	Open Elective-II	3	0	0	3	3
6.	PCIE-305	Microprocessor and Microcontroller Lab	0	0	2	2	1
7	PRIE-301	Minor Project	0	0	4	4	2
		Total	15	2	6	23	**20**
8	QPIE-301	Instrumentation Technician Process Control	0	0	8	8	1
		Grand total	15	2	14	**31**	**21**

Semester-VI							
S. No	Code No.	Course Title	Hours per week			Hours	Credits
			L	T	P		
1.	AUMH-302	Indian Constitution	2	0	0	2	0 (S/US)
2.	PCIE-302	PLC and SCADA	3	0	0	3	3
3.	PEIE-302	Program Elective-III	3	1	0	4	4
4.	PEIE-304	Program Elective-IV	3	1	0	4	4
5.	OEXX-302	Open Elective-III	3	0	0	3	3
6.	PCIE-304	Computer Programming Lab	0	0	2	2	1
7.	PRIE-302	Major Project	0	0	8	8	4
8.	SEIE-302	Seminar	1	0	0	1	1
		Total	15	2	10	27	**20**
9	QPIE-302	Industrial Automation Specialist	0	0	8	8	1
		Grand Total	15	2	18	**35**	**21**

Electrical & Instrumentation Engg. Deptt. Sant Longowal Institute of Engg. & Tech. Longowal (Pb.)

List of Program Electives

S. No	Subject Code	Subject Name
		Elective-I
1.	PEIE-202A	Maintenance and Troubleshooting of Instruments
2.	PEIE-202B	Mechanical Precision Instruments
3.	PEIE-202C	Occupational Health and Safety
		Elective-II
4.	PEIE-301A	Analytical Instrumentation
5.	PEIE-301B	Environmental Instrumentation
6.	PEIE-301C	Automotive Instrumentation
		Elective-III
7.	PEIE-302A	Case Studies of Process Plants
8.	PEIE-302B	Instrumentation for Precision Agriculture
9.	PEIE-302C	Data Acquisition and Telemetry Systems
		Elective-IV
10.	PEIE-304A	Biomedical Instrumentation and Design
11.	PEIE-304B	Internet of Things: Fundamentals & Applications
12.	PEIE-304C	Building Automation

List of Open Electives

S. No	Subject Code	Subject Name
1.	OEIE-202	Measurement Science
2.	OEIE-301	Sensors and Transducers
3.	OEIE-302	Industrial Automation and Safety

Electrical & Instrumentation Engg. Deptt. Sant Longowal Institute of Engg. & Tech. Longowal (Pb.)

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

XX	EE (Electrical engineering)
	IE (Instrumentation Engineering)
	EC (Electronics & Communication Engineering)
	CS (Computer Science & Engineering)
	CH (Chemical Engineering)
	ME (Mechanical Engineering)
	FT (Food Technology)
	PH (Physics)
	CY (Chemistry)
	MA (Mathematics)
	MH (Management & Humanities)
	SP (Sports)

PCXX- YZZ
Y-stands for year code 1, 2 or 3
ZZ- odd for odd semester subject e.g. 101, 103, 201, 305 etc.
ZZ-Even for even semester subject e.g. 102, 112, 202, 306 etc

Electrical & Instrumentation Engg. Deptt. Sant Longowal Institute of Engg. & Tech. Longowal (Pb.)

SUMMARY

Table 1: Working weeks, days and hours in a semester				
Semester	Working Weeks / Semester	Working days/ Week	Working Hours/ Day	Hours/ semester
Odd	16	5	8	640
Even	16	5	8	640

Table 2: Relation of credits and hours in a week		
Description	Credits	Hours/ week
Theory/ Tutorial	1	1
Laboratory (Practical)	1(2)	2(3/4)
Qualification Pack	1	8

Year	Odd Semester		Even Semester		Total Credit
	Semester	Credit	Semester	Credit	
I	1	20	2	23	43
			Summer-I	03	03
II	3	22	4	22	44
			Summer-II	03	03
III	5	21	6	21	42
				Total Credits	**135**

Electrical & Instrumentation Engg. Deptt. Sant Longowal Institute of Engg. & Tech. Longowal (Pb.)

PROGRAMME OUTCOMES (POs):

Certificate holders of Servicing & Maintenance of Medical Instruments and Diploma holders of Instrumentation & Process Control of the Sant Longowal Institute of Engineering & Technology, Deemed-to-be-University, Longowal will have ability to:

(i) **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

(ii) **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.

(iii) **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

(iv) **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

(v) **Engineering practices for society, sustainability, and environment:** Apply appropriate technology in context of society, sustainability, environment, and ethical practices.

(vi) **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities

(vii) **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

On successful completion of Certificate programme in Servicing & Maintenance of Medical Instruments and Diploma programme in Instrumentation & Process Control:

(i) Graduates will have core competency in the field of instrumentation, process control and industrial automation to cater the industries, research labs and to become entrepreneur for sustainable and ethical society goal.

(ii) Graduates will be proficient in installation, testing, calibration, maintenance, and troubleshooting of various instruments in the industries to ensure safety and quality.

Electrical & Instrumentation Engg. Deptt. Sant Longowal Institute of Engg. & Tech. Longowal (Pb.)

22/05/2025

Course Title : Junior Mechanic Electrical/Electronics/ Instruments *(Module-1)*
Course Code : QPIE-101

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Discuss the fundamentals of electrical engineering.

CO2: Explain the procedure to efficiently use the measuring instruments and tools.

CO3: Examine the circuit diagrams and engineering drawings of electrical systems.

CO4: Apply the knowledge to diagnose the faults in various types of machines and equipments.

CO5: Choose the appropriate tools and methodology to fix the faults.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	1	1	1
CO2	2	2	1	2	1	1	1	2	1
CO3	3	1	1	2	2	1	1	3	2
CO4	1	2	3	3	3	1	2	3	3
CO5	3	3	3	3	3	2	3	2	3

Topics	Hands-on Practicals	Hour(s)
Basics of electricity	Demonstration of hand tools used in electrical works	20
	Familiarization with measuring tools for electrical works	
	Electrical safety precautions	
	Study of passive components and their connections in electrical circuits	
	Make connections and joints, like T, straight, and Britannia	
	Electrical wiring practices (House wiring) and distribution of electrical energy in a domestic electrical installation	
Basic laws and theorems	Verification of equivalent resistances in series and parallel connections	20
	Verification of Ohm's Law	
	Verification of Kirchoff's laws (KCL and KVL)	
	Star-delta conversion and verification	
	Verification of superposition theorem	
	Verification of Thevenin's theorem and Norton's theorem	
	Verification of reciprocity theorem and maximum power transfer theorem	
	Measurement of various characteristic values of a Sinusoidal waveform with the help of Cathode Ray Oscilloscope	
Measurement Practice	Resistance (very low to very high) measurement methods	20
	Measurement of capacitance and inductance using AC bridges	
	Appropriate use of AC or DC voltmeter for voltage measurement	
	Demonstration of various methods for AC/DC current measurement	

	Study of various methods for power measurement	
	Study of various types of energy meter	
	Power factor measurement	
	Measurement of electrical parameters in Resistance-Inductance (RL) and Resistance- Inductance-Capacitance (RLC) circuits	
Safety Measures	Study of various types of earthings and grounding.	08
	Study of various types of protection devices e.g. fuses, MCBs and ELCBs	
Electric Machines	Study of various types of DC motors and their starters	16
	Study of various types of AC motors and their starters	
	Starting and reversing various AC and DC motors	
	Study of various types of transformers and Verification of turns ratio	
Electrical Engineering Drawing	Standardized symbols for electrical equipments and accessories used in electrical works	20
	Wiring of fluorescent tube	
	Wiring of a ceiling fan controlled by necessary switches and regulators	
	Wiring of a staircase circuit	
	Design a circuit for corridor wiring	
	Design a circuit for godown wiring	
Repair and maintenance	Dismantling, assembly, testing, preparation of list of components, and their cost	24
	Electric iron (dry and steam type)	
	Electric fan (ceiling fan, table fan, and exhaust fan)	
	Electric oven (conventional and microwave)	
	Water heaters and geysers	
	Washing machine (manual and automatic)	
	UPS / Inverters / battery chargers	
	Refrigerator	
	Air conditioner	
	Total Hours	**128**

Recommended Books-

1. R.P. Singh , Electrical Workshop: A text Book, I K International Publisher House Pvt. Ltd.
2. D K Sharma, Basic Electrical and Electronics Engineering, CBS publisher.
3. G. K Mithal, Network and Circuit Theory, Khanna Publishers.
4. S K Bhattacharaya, Electrical Engineering Design and Drawing, SK Kataria and Sons.
5. R. P. Gupta, Maintenance of Electrical Equipments, Dhanpat Rai and Co.
6. C.J. Hubert, Preventive maintenance handbook and journal.

Course Title : Fundamentals of Electrical Engineering
Course Code : ESEE-104

L	T	P	Credits	Weekly Load
2	0	0	2	2

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Define the basic principles of electrical engineering to solve D.C. and A.C. Circuits.

CO2: Formulate and analyse electrical circuits.

CO3: Understand basic principles of electromagnetism to implement in electrical machines and transformers.

CO4: Identify and select various electrical machines according to the applications.

CO5: Apply the ethical principles for troubleshooting and installation of safety devices as per norms of engineering practice.

CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	2	-	-	2	-
CO2	-	3	3	-	-	-	3	-	-
CO3	1	-	-	3	3	2	1	3	3
CO4	3	2	-	2	-	2	2	-	3
CO5	-	-	2	2	-	3	-	2	2

Unit	Main Topics and Course Outlines	Hour(s)
Unit - 1	**Basic Concepts:** Electric Charge, Current and Electromotive force, Potential and Potential Difference; conductor, semiconductor insulator and dielectric; Electrical Power and Energy; Ohm's Law, Resistance, and color coding; Capacitance and Inductance, their ratings; Effects of Temperature on Resistance, Series and Parallel Connection of Resistances and capacitances, Kirchoff's Laws and their applications.	08
	AC Fundamentals: Concept of Alternating Voltage and Alternating Current (AC), Difference between AC and Direct Current (DC), Various Terms Related with AC Waves; Root Mean Square (RMS) and Average Values, Concept of Phase and Phase Difference, Single Phase and Three Phase Supply; three phase Star-Delta connections, Inter- Relation between phase voltage/current and line voltage/current; Alternating Voltage applied to Pure Resistance, Pure Inductance, Pure Capacitance and their combinations, Concept of Power and Power Factor in AC Circuit.	08
	Measuring Instruments: Principle and Construction of Instruments used for Measuring Current, Voltage, Power and Energy, Methods and precautions in use of these and other instruments e.g. digital multimeters, oscilloscopes, signal generators etc.	04

Unit - 2	**Electrical Safety:** Electrical Shock and Precautions against it, treatment of Electric Shock; Concept of Fuses and Their classification, Concept of Earthing Miniature Circuit Breakers (MCBs) and their Application.	04
	Electromagnetic Induction: Concept of Magnetic Field, Magnetic Flux, Reluctance, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws, Effects on a Conductor Moving in a Magnetic Field, various losses in magnetic circuits.	04
	Electrical Machines and Transformers: Elementary concepts of an electrical machine, Construction and Working of a Transformer, DC generator, DC Motor, their characteristics and applications.	04
	Total Hours	**32**

Recommended Books-

1. D P Kothari and I J Nagrath, *Basic Electrical Engineering,* TMH.
2. D P Kothari and I J Nagrath, *Electrical Machines,* TMH.
3. Edward Hugh, *Electrical Technology,* Pearson Education.
4. S K Bhattacharya, *Electrical Machines,* TMH.

Course Title : Fundamentals of Electrical Engineering Lab
Course Code : ESEE-112

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Demonstrate the ability to analyze and construct basic electrical circuits using Ohm's and Kirchhoff's Laws.

CO2: Demonstrate the ability to select and implement appropriate protection devices to ensure electrical safety and circuit protection.

CO3: Analyze the circuit diagrams and engineering drawings of electrical, electronic, and instrumentation systems.

CO4: Ability to connect and operate various types of motors and their starters.

CO5: Develop troubleshooting skills for identifying and correcting issues in electrical circuits and systems.

CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	2	-	-	2	-
CO2	-	3	3	-	-	-	3	-	-
CO3	1	-	-	3	3	2	1	3	3
CO4	3	2	-	2	-	2	2	-	3
CO5	-	-	2	2	-	3	-	2	2

List of Practicals:

1. Study of various passive components and measuring instruments and their connections in electrical circuits
2. Verification of Ohm’s Law.
3. Verification of Kirchoff’s laws (KCL and KVL).
4. Verification of equivalent resistances in series and parallel connections.
5. Measurement of various characteristic values of a Sinusoidal waveform with the help of Cathode Ray Oscilloscope (CRO)
6. Measurement of voltage, current and power in Resistance-Inductance (RL) and Resistance Inductance Capacitance (RLC) circuits and Verification of phase angle and power factor concept.
7. Study of various types of earthing.
8. Study of various types of protection devices e.g. fuses, MCBs and ELCBs
9. Verification of Faraday’s laws and Lenz’s law.
10. Study of various types of DC motors and their starters.
11. Study of various types of AC motors and their starters.
12. Study of various types of transformers and Verification of turns ratio.
13. Starting and reversing various AC and DC motors.
14. Fault diagnosis and removal in general electrical connection/apparatus.

Course Title : Junior Mechanic Electrical/Electronics/ Instruments *(Module-2)*
Course Code : QPIE-102

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Discuss the fundamentals of electronics engineering.

CO2: Explain the procedure to efficiently use the various electronic tools.

CO3: Examine the circuit diagrams and engineering drawings of electronic systems.

CO4: Apply the knowledge to troubleshoot the problems in various types of electronic circuits and gadgets.

CO5: Choose the appropriate tools and techniques to fix the faults.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	1	3	3	1
CO2	3	1	2	2	1	1	2	2	1
CO3	2	2	1	2	1	1	2	2	2
CO4	2	2	3	3	3	1	2	3	3
CO5	2	3	3	3	3	1	3	3	3

Topics	Hands-on Practicals	Hour(s)
Basics of electronics	Demonstration of essential tools used in electronic testing and repair	14
	Safety procedures in electronics	
	Familiarization with Cathode Ray Oscilloscope and function generator	
	Study of basic electronic components, like resistor, capacitor, PN junction diode, transistor etc.	
	Familiarization with digital logic circuits	
Testing of electronic components and circuits	Testing resistors: measurement techniques, tolerance, power rating	20
	Testing capacitors: measurement techniques, capacitance, leakage, dielectric absorption	
	Testing inductors: measurement techniques, inductance, quality factor	
	Diode testing methods: forward and reverse bias, identification of pins	
	Zener diode testing	
	Schottky diode testing	
	Bridge rectifier testing	
	Bipolar junction transistors (BJTs): testing for forward and reverse characteristics, identification of pins	
	Functional testing of analog ICs	

	Functional testing of digital ICs	
Printed Circuit Boards	Make circuits using breadboard	30
	Hands-on soldering practice with through-hole components	
	Desoldering methods and tools	
	Familiarization with printed circuit boards (PCBs)	
	PCB design principles and terminology	
	Design considerations for layout and routing	
	Hands-on training with PCB design software	
	PCB fabrication	
	Testing and validation of the completed PCB project	
Design Electronic Circuits	Design a circuit for half-wave and full-wave rectifiers	16
	Design a voltage regulator using zener diode	
	Design an LED flashing circuit using BJT	
	Design the 3V, 9V and 12V voltage regulator	
Operational Amplifier	Demonstration of op-amp symbols and pin configuration	24
	Construct and analyze inverting and non-inverting amplifier circuits	
	Build and test the summing amplifier circuit	
	Build comparator circuits using op-amps for digital signal processing	
	Design and analyze high-pass, low-pass, band-pass, and band-stop filter circuits using op-amps	
	Construct and analyze Wien bridge and phase-shift oscillator circuits using op-amps	
Repair and maintenance	Essential tools used to dismantle the electronic gadgets	24
	Dismantling, assembly, testing, preparation of list of components, and their cost	
	Identification of fault and replacing the electronic components: resistors, capacitors, diodes, transistors, etc.	
	Techniques for repairing printed circuit boards	
	Demonstration of fault finding and repair of Power supplies.	
	Troubleshooting in front panel control and Logic Board	
	Total Hours	**128**

Recommended Books-

1. Millman and Halkias, Electronics Devices and Circuits, McGraw Hill.
2. D K Sharma, Basic Electrical and Electronics Engineering, CBS publisher.
3. A. Anand Kumar, Fundamentals of Digital Electronics, PHI 2nd Edition.
4. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata Mc-Graw Hill.
5. Daniel R. Tomal, Aram S. Agajanian, Electronic Troubleshooting, Muh. Rusdi.
6. Homer L. Davidson, Troubleshooting and Repairing Electronic Circuits, McGraw-Hill.

Course Title : Junior Mechanic Electrical/Electronics/ Instruments *(Module-3)*
Course Code : QPIE-103

L	T	P	Credits	Weekly Load
0	0	24	3	24

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Discuss the fundamentals of electrical engineering.

CO2: Explain the procedure to efficiently use the measuring instruments and tools.

CO3: Examine the circuit diagrams and engineering drawings of electrical systems.

CO4: Apply the knowledge to diagnose the faults in various types of machines and equipments.

CO5: Choose the appropriate tools and methodology to fix the faults.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	2	1	1	1	1	1
CO2	3	2	1	2	1	1	1	2	1
CO3	2	1	1	2	2	1	1	3	2
CO4	3	3	2	3	3	1	2	3	3
CO5	3	3	3	3	3	2	3	3	3

Topics	Hands-on Practicals	Hour(s)
Measurement Science	Familiarization with basic measuring techniques and instruments	16
	Use of various chemicals in instrumentation workshop and safety precautions to be observed	
	Demonstration of measuring instruments of routine usage (weighing machine, length measurement etc.)	
	Demonstration of hand tools and measuring instruments used in electrical and electronic works	
	Study the construction and working of PMMC type instruments	
	Study the construction and working of MI type instruments	
	Study the construction and working of electrodynamometer type instruments	
Sensors and transducers	Measurement of depth, internal and external diameter using vernier caliper	16
	Viscosity measurement using Ostwald Viscometer	
	Temperature measurement: Thermometer (mercury in glass), thermistor, thermocouple, RTD	
	Pressure measurement: bourdon tube, differential pressure gauge	
	Study the characteristics of Light dependent resistor (LDR)	
	Potentiometer as an error detector	
	pH value measurement	
Hydraulic and pneumatic instruments	Familiarization with various parts of pneumatic systems such as compressor, regulator and lubricator	16

	To study 3/2 valve and 5/2 valve	
	To study single acting and doubling acting cylinder and Flow restriction valve	
	To study the use of Pneumatic Limit Switch	
	To study the Hydraulic Trainer Kit	
	To study the use of Hydraulic valve	
	To study hydraulic system using single acting and double acting cylinder	
	To study the practical application of Hydraulic system in stamping device	
Analog Controllers	Set up a P, PI, PD, and PID control loop on a hardware	12
	Study of feedback temperature control system using proportional (P) controller	
	To study the tank level control loop by using PI controller	
	Study of feedback temperature control system using PD controller	
	Study of feedback temperature control system using PID controller	
Programmable Logic Controller	Familiarization with the parts, working and programming of PLCs	24
	Demonstration of PLC based pick and place module	
	Demonstration of PLC based sorting module	
	Demonstration of PLC based stamping module	
	To write a program for Car Parking	
	Write a program and interface simulated hardware unit of Tank level control	
	Write a program to control a traffic light using PLC	
	Write a program to control an elevator using PLC	
	Write a program to control a conveyer belt using PLC	
	Write a program to control a speed of DC motor using PLC	
Testing and Calibration of instruments	Testing tools and procedures for electrical, electronic and mechanical instruments	12
	Calibration of voltmeter, ammeter, and ohmmeter	
	Calibration of temperature sensors and instruments	
	Calibration of pressure gauges using dead weight tester	
	Total Hours	**96**

Recommended Books-

1. A.K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai.
2. John P. Bentley, Principles of Measurement System, 3rd edition, Pearson Education, 2000.
3. Andrew Parr, Hydraulics and Pneumatics: A technician's and engineer's guide, 3rd edition, Butterworth-Heinemann, 2011.
4. Johnson Curtis, Process Control Instrumentation Technology, Prentice Hall.
5. Webb, John W., Programmable logic controllers : principles and applications, Prentice Hall, 1995.

Course Title : Measurement Science
Course Code : PCIE-201

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Describe the basic concept of measurement and generalized measurement system.

CO2: Classify static and dynamic characteristics of measuring instruments.

CO3: Illustrate measurement error and statistical analysis.

CO4: Describe various units and standards of measurement and their classification.

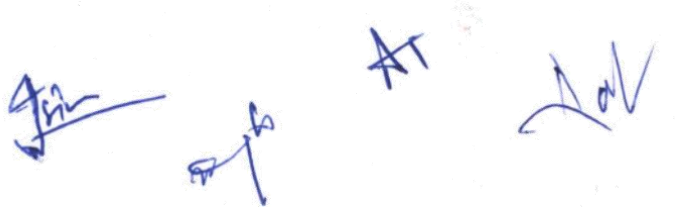
CO5: Demonstrate different types of Signals and noise in measurement systems.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	2	1
CO3	3	2	2	-	-	-	-	3	2
CO4	1	-	-	-	-	1	-	1	-
CO5	3	1	-	-	-	-	-	2	-

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Introduction to measurements, classification of the methods of measurement, types of instruments, elements of a generalized measurement system, input/output configuration of measurement systems.	08
	Units, Dimensions and standards: Units, Dimensions, systems of electrical units, dimensions in electromagnetic and electrostatic systems, Determination of absolute units, standards of measurement and their classification.	08
	Measurement error and statistical analysis: Introduction, classification of errors, types of errors, limiting errors, combination of quantities with errors, statistical analysis of data- average.	08
Unit-2	**Static Characteristics of the instruments:** Measurement system performance, static characteristics in detail, error in measurement, loading effect in measurement, input/ output impedance, loading effects due to series and shunt connected instruments.	08
	Dynamic characteristics of the instruments: Dynamic response and analysis, dynamic response to standard inputs, Transfer function, mathematical model of the generalized measurement system, Zero and first second order measurement systems,	08
	Signals and noise in measurement systems: Introduction, deterministic and random signals, classification of noise, noise sources, Types of external noises, method of reducing effects.	08
	Total Hours	**48**

Recommended Books-

1. A K Ghosh, Introduction to Instrumentation and Control, Prentice Hall of India, 2005.
2. A.K. Sawhney and PuneetSawhney, A course on electrical and electronic measurements and instrumentation, DhanpatRai, 2012.
3. David A Bell, Electronic Instrumentation and measurement, 3rd edition, Oxford University Press, 2013.
4. John P. Bentley, Principles of Measurement System, 3rd edition, Pearson Education, 2000.



Course Title : Sensors and Transducers
Course Code : PCIE- 203

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Describe the concept of transducers and the related static and dynamic characteristics.

CO2: Familiar with the specifications of sensors and transducers.

CO3: Able to design signal conditioning circuits for various sensors and transducers.

CO4: Exposed to advancements in sensor technology.

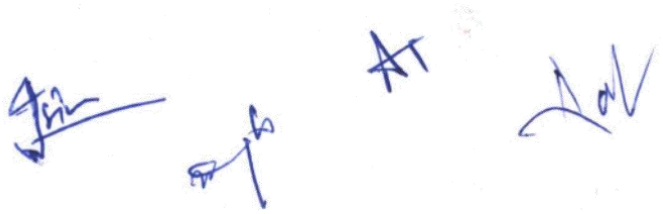
CO5: Able to identify or use a transducer for a specific measurement application.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	1	1	2	1	3	1
CO2	3	-	-	1	-	1	-	-	1
CO3	3	2	2	1	2	3	1	2	2
CO4	3	2	2	1	-	2	-	2	1
CO5	3	3	3	2	1	2	1	2	1

Unit	Main Topics & Course Outlines	Hour(s)
Unit-1	**Overview:** Terminology of Measurement Systems, Transducer Classification, General Input-Output Configuration, Static and Dynamic Characteristics of a measurement system, Characteristics and Choice of Transducers.	08
	Resistive transducers: Construction, working principles, types of potentiometers, strain gauges and Resistive temperature transducers (RTD), Study the characteristics of strain gauge and its applications: Load and torque measurement.	08
	Inductive Transducers: Basic principles of Variable Inductance Transducers, Electromagnetic pick up, Eddy Current Transducers, Linear variable differential transformer (LVDT) and Variable reluctance transducers.	08
Unit-2	**Capacitance Transducers:** Basic principles and types of Variable Capacitance Transducers, advantage and disadvantages, uses of capacitive transducers, Capacitance pick up.	08
	Piezoelectric Transducers: Basic principle and uses of piezoelectric transducers, Piezoelectric crystals and their properties, General forms of piezoelectric transducers.	08
	Other Transducers: Tacho-Generators and Stroboscope, digital encoding transducers, Load cell, inductive torque meter, magneto-strictive transducers, electrical tachometers (AC and DC both).	08
	Total Hours	**48**

Recommended Books-

1. D A Bell, “Electronic Instrumentation and measurement”, 3rd edition, Oxford University Press, 2013.
2. A K Sawhney, “A course on electrical and electronic measurements and Instrumentation”, Dhanpat Rai, 2016.
3. J B Gupta, “A Course in Electronic and Electrical Measurements & Instrumentation”, S K Kataria and Sons, 2014.
4. S M Sze, “Semiconductors sensors”, John Wiley & Sons Inc., 2008.
5. D Patranabis, “Sensors and Transducers”, Prentice Hall, 2nd edition, 2003.
6. D C Nakra and K K Chaudhary, “Instrumentation measurement and analysis” 4 edition, Tata McGraw Hill, 2016.



Course Title : Hydraulic and Pneumatic Instruments
Course Code : PCIE-205

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):
After successful completion of the course, the students should be able to

CO1: Describe the fundamentals of fluid power system.

CO2: Explain basic hydraulic system and the working of hydraulic components.

CO3: Employ of hydraulic circuits for the various applications.

CO4: Describe the basic of a pneumatic system and Compare the working of its components with hydraulic components.

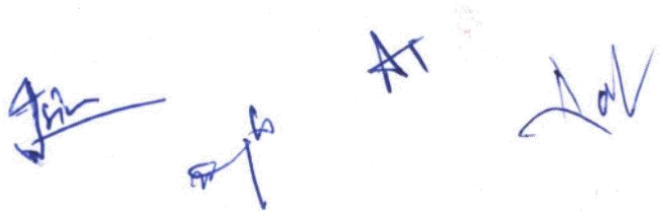
CO5: Design of the pneumatic circuits for the control of actuators.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	1	3	3	-
CO3	-	3	2	2	1	-	-	2	3
CO4	3	-	-	-	-	1	3	3	-
CO5	-	3	2	2	1	-	-	2	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction to Hydraulics:** Pressure, types of pressure, pressure creation and drop, pressure in a column of liquid, flow and flow rate, types of flow, continuity equation for flow paths, Pascal Law and its application, hydraulic power transmission, a basic Hydraulic system, hydraulic fluid properties, Hydraulic pumps and their types, loading and unloading of pumps.	12
	Hydraulic circuits and its Components: Valves: types of directional valves, construction and their symbols, Hydraulic actuators: linear and rotary, types of cylinders, motors and their ratings. Pressure control valves: relief valve, sequence valve and pressure reducing valves, Flow control valves: one way and two way valves. Uses of limit, pressure, flow switches and solenoid valves in electro hydraulics.	12
Unit-2	**Introduction to Pneumatic:** Properties of air, basic gas laws, pressure and flow, air compression, dehydration and drying, a basic compressed air system and its components- compressors and its types, coolers- inter stage, after cooler, dryers and its types, filter, regulator and lubricator units, compressed air transmission, properties of instrument air, symbols of all elements, a comparison with the hydraulic system.	12
	Pneumatic Circuits and its Components: Directional control valves and its types, mechanical and electrical operators and symbols- levers, push button, pilot and solenoid, shuttle valve, check valve, quick exhaust valve, working and construction of pneumatic actuators, Uses of limit, pressure, flow switches, speed control and position sensing of cylinders.	12
	Total Hours	**48**

Recommended Books-

1. Andrew Parr, Hydraulics and Pneumatics: A technician's and engineer's guide, 3rd edition, Butterworth-Heinemann, 2011.
2. Harry L.Stewart, Practical Guide to Fluid Power, 2nd edition, Audel, 1968.
3. K. Shanmuga Sundaram, Hydraulic And Pneumatic Controls (Understanding Made Easy), S.Chand, 2006
4. R. Srinivasan, Pneumatic and Hydraulic control, McGraw Hill Education, 2008.
5. S.R. Majumdar, Pneumatic Systems: Principles and maintenance, Tata Mcgraw Hill.



Course Title : Human Physiology and Medical Instruments
Course Code : PCIE-207

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to:

CO1: Discuss the anatomy of human body and blood compositions

CO2: Explain the working of cardiovascular, respiratory and nervous system of human body

CO3: Discuss the mechanism for muscular contraction in human body

CO4: Illustrate the working principle behind the bio-electric signal acquisition

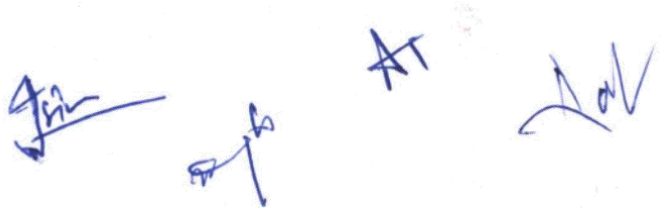
CO5: Apply the fundamentals to interpret the reports of patient monitoring systems.

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	2	1	2	3	1
CO2	3	2	3	3	3	3	3	3	3
CO3	3	2	1	2	2	1	2	3	2
CO4	3	3	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3	3

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction:** Human body, cells, Tissues, blood compositions, blood group red blood cell (RBC), white blood cell (WBC), Deoxyribonucleic Acid (DNA), GENES.	06
	Cardiovascular and Respiratory system: Introduction to Cardiovascular system, heart structure, flow of blood through heart, blood pressure. Lungs, types of respiration, measurement of respiration rate, gas exchange mechanism in lungs, lung volume capacities.	12
	Nervous system: Anatomy of nervous system, neurons, neural communication, brain, spinal cord.	06
Unit-2	**Muscular system:** Functions of muscles; muscle contraction mechanism, types of muscles: skeletal, cardiac, and smooth.	06
	Introduction to Bio-electric Signals: Origin of bio-electric signals; Electrocardiogram (ECG), Electroencephalogram (EEG) and Electromyogram (EMG); physiological electrodes and transducers, electrodes for ECG, EEG, EMG; electrode jellies and creams.	12
	Patient Monitory Systems: Measurement of blood pressure, body temperature, Pulse, respiration rate, ambulatory monitoring instruments.	06
	Total Hours	**48**

Recommended Books-

1. R S Khandpur, “Handbook of Biomedical Instrumentation”, 3rd edition, McGraw Hill Education, 2014.
2. L Cromwell, F J Weibell, E A Pfeiffer “Biomedical Instrumentation and Measurement”, 2nd edition, Pearson Education India, 2015.
3. Andrew G. Webb, “Principles of Biomedical Instrumentation”, Cambridge University Press, 2018.
4. Mandeep Singh, “Introduction to Biomedical Instrumentation”, PHI, 2014.



Course Title : Digital Electronics
Course Code : PCIE-209

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Enumerate various number systems, their conversion, representation, and binary operations.

CO2: Illustrate boolean algebra and simplification technique using K -map.

CO3: Explain the concept of registers.

CO4: Demonstrate the concept of counters.

CO5: Interpret digital ICs and various logic families.

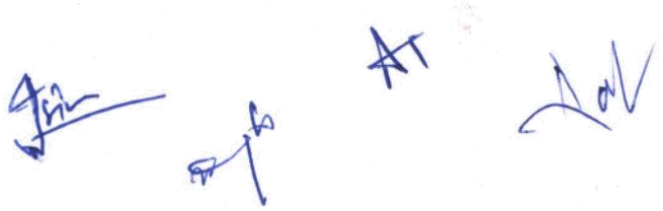
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	1	1	-
CO2	2	1	-	-	-	-	1	2	2
CO3	3	1	-	-	-	-	1	2	1
CO4	1	2	-	2	-	-	1	1	1
CO5	1	3	1	-	-	-	1	2	-

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Number Systems and Boolean Algebra:** Number Systems and Boolean Algebra, Radix conversion, Subtraction using 1's and 2's complements, Binary codes, Canonical forms.	10
	Combinational Logic: Logic Gates, Definition and symbol, truth table and waveforms of NOT, AND, OR, NAND, NOR, XOR and XNOR, Universal Logic gates, Simplification using Karnaugh map.	08
	Sequential Logic Concepts: Flip flops: SR, JK, D and T flip-flops - Level triggering and edge triggering, Excitation tables	06
Unit-2	**Registers:** Introduction and basic concepts including shift left and shift right, Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.	08
	Counters: Asynchronous and Synchronous Counters. Up Down Counter and Ripple Counter.	08
	Logic Families: Classifications of logic families, Digital IC Specifications, TTL, ECL, MOS & CMOS logic.	08
	Total Hours	**48**

Recommended Books-

1. Anand Kumar, Fundamentals of Digital Circuits, 3rd Edition, Prentice Hall of India, 2014.
2. Albert Paul Malvino, Principles of Digital Electronics, 8th Edition, Tata McGraw Hill, 2015.

3. Gayakwad, A. Ramakant, Op-Amps and Linear Integrated Circuits. PHI Learning, 2009.
4. Morris Mano, Digital Logic and Computer Design, 2nd Edition, Prentice Hall of India, 1991.
5. Ronald J. Tocci, Neal S. Widmer and Moss L. Gregor, Digital Systems: Principles and Applications, 11th Edition, Prentice Hall of India, 2010.
6. DP Kothari and J.S. Dhillon, Digital Circuit and Design, Pearson, 2015.
7. R P Jain, Modern digital Electronics, 4th edition, Tata McGraw Hill, 2009.



Course Title : Sensor and Transducer Lab
Course Code : PCIE-211

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Recall the working principle of transducers for the measurement of parameters like displacement, temperature etc.

CO2: Calculate the static and dynamic characteristics for different sensors applications.

CO3: Measure the effects of loading on the transducers.

CO4: Differentiate between ideal and real characteristics of transducers.

CO5: Design of circuits for integrating transducers in different applications for measuring and conditioning signals.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	1	1	2	1	3	1
CO2	3	-	-	1	-	1	-	-	1
CO3	3	2	2	1	2	3	1	2	2
CO4	3	2	2	1	-	2	-	2	1
CO5	3	3	3	2	1	2	1	2	1

List of Experiments-

1. To study the principle, construction, and characteristics of a thermocouple for temperature measurement.
2. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
3. To study the characteristics RTD for the measurement of temperature
4. To study the characteristics of piezoelectric measurement system.
5. To study principle, construction, and characteristics of a thermistor.
6. To study the characteristics of Hall effect sensor and determine the hall voltage developed across the sample material.
7. To study the V-1 Characteristics of Light Dependent Resistor (LDR) and study the Response characteristics of LDR
8. To study the torque measurement using strain gauges and to measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
9. To study and understand different mechanisms and principles of some types of digital proximity sensors.
10. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
11. To study the characteristics of capacitive measurement systems.
12. To understand the loading effects of potentiometer.
13. To study of speed measuring devices and gyroscope.

Course Title : Hydraulic and Pneumatic Instruments Lab
Course Code : PCIE-213

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Describe the fundamentals of fluid power system.

CO2: Explain basic hydraulic system and the working of hydraulic components.

CO3: Employ of hydraulic circuits for the various applications.

CO4: Describe the basic of a pneumatic system and compare the working of its components with hydraulic components.

CO5: Design of the pneumatic circuits for the control of actuators.

CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	1	3	3	-
CO3	-	3	2	2	1	-	-	2	3
CO4	3	-	-	-	-	1	3	3	-
CO5	-	3	2	2	1	-	-	2	3

List of Practicals:

1. Familiarization with pneumatic system's various parts such as compressor, storage tank, filer, regulator, lubricator, piping and fittings.
2. To study the working of 3/2 valve and 5/2 directional valve.(solenoid type, pilot type, lever type, push button type).
3. To control the movement of single acting and double acting cylinder with 3/2 valve and 5/2 directional valves.
4. To control the speed of single acting and double acting cylinders in both the directions.
5. To study the Hydraulic Trainer Kit and identifications the hydraulic system's parts.
6. To study the working of 2/2 valve and 4/2 directional valves (solenoid type, pilot type, lever type, push button type).
7. To control the movement and speed of single acting and double acting cylinders in both the directions
8. Continuous cycling of a double acting cylinder.

Course Title : Electrical and Instrumentation Drawings
Course Code : PCIE-215

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Define the fundamental concepts of electrical and Instrumentation Drawings.

CO2: Develop the complete knowledge of rules involved in drawing the various layouts from scaling up to the complete electrical installations and electrical wiring.

CO3: Identify and understand different Process flow diagrams.

CO4: Formulate and solve the engineering problems of different Process flow diagrams.

CO5: Identify different pneumatic and hydraulic components.

CO/PO Mapping: (Strong(1) / Medium(2) / Weak(3) indicates strength of correlation):									
	Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	1	1	1	2	3	-	3
CO2	3	3	-	2	1	-	2	3	1
CO3	3	2	1	-	1	-	2	2	-
CO4	3	3	1	2	2	-	2	2	2
CO5	3	2	-	1	1	1	2	3	-

List of practical experiments:

1. To learn and draw basic electrical symbols used in circuit diagrams.
2. To design wiring diagrams for single-phase and three-phase systems.
3. To develop control circuit diagrams for DOL and star-delta starters.
4. To design input/output wiring diagrams for a PLC system.
5. To create the layout drawing of an electrical distribution panel.
6. To draw loop diagrams for temperature and pressure control systems.
7. To create P&ID for a simple process control system.
8. To design cable tray routing for industrial instrumentation systems.
9. To draw the earthing and grounding layout for a building or system.
10. To create a block diagram for a power distribution system.
11. To draw control circuits using relays and contactors for automation systems.
12. To create the single-line diagram of a substation or industrial plant.
13. To design a signal flow diagram for a process control loop.

Course Title : Medical Equipment Technology Assistant *(Module-1)*
Course Code : QPIE-201

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Describe the fundamentals of Bio-instrumentation engineering.

CO2: Explain the procedure to perform the experiments on medical equipments.

CO3: Effectively use the bio-medical equipment to perform the tests on human beings.

CO4: Analyze the outcomes/reports of bio-medical equipments.

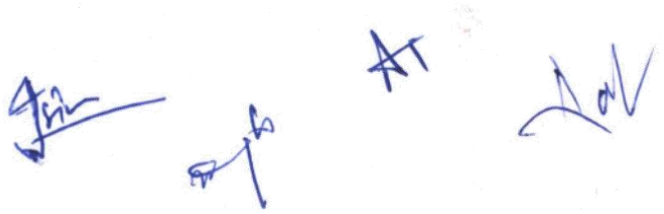
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	1	3	3	1
CO2	3	1	1	2	1	1	2	2	1
CO3	2	2	3	3	3	2	2	2	2
CO4	2	3	1	3	3	1	2	1	3

Topics	Hands-on Practicals	Hour(s)
Basics of Bio-medical instrumentation	Familiarization with basic bio-medical equipments, like thermometer (contact/ non-contact), BP measuring instruments.	32
	Familiarization with ECG, EEG, and EMG machines	
	Demonstration of medical imaging modalities	
	Standard operating procedures for medical data acquisition	
	Subject's preparation prior to testing	
	Demonstration of Bio-feedback kits	
Monitoring Equipment	Blood pressure measurement using Sphygmomanometer	32
	Blood pressure measurement using automatic machine	
	Core body temperature measurement using mercury-in-glass thermometer	
	Non-contact temperature measurement using IR thermometer	
	Blood glucose measurement	
	Study and analyze the significance of BMI	
	Respiration rate measurement with the help of thermistor	
	Pulse rate measurement	
	Pulmonary function test using spirometer	
Bio-electric measurement	Study the various types of bio-potential electrodes	32
	Demonstration of generalized bio-electric data acquisition system	
	Placement of electrodes and identify the region of interest	
	ECG data acquisition system: procedure, parameters settings, electrode placement	

	EMG data acquisition system: procedure, parameters settings, electrode placement	
	EEG data acquisition system: procedure, parameters settings, electrode placement	
Interpretation of tests and reports	Interpret the blood glucose test	32
	Analyze the systolic and diastolic BP values	
	Analysis of pulmonary functioning using spirometer	
	Interpret the ECG reports	
	Interpret the EEG reports	
	Interpret the EMG reports	
	Total Hours	**128**

Recommended Books-

1. R S Khandpur, “Handbook of Biomedical Instrumentation”, 3rd edition, McGraw Hill Education, 2014.
2. L Cromwell, F J Weibell, E A Pfeiffer “Biomedical Instrumentation and Measurement”, 2nd edition, Pearson Education India, 2015.
3. Andrew G. Webb, “Principles of Biomedical Instrumentation”, Cambridge University Press, 2018.
4. Mandeep Singh, “Introduction to Biomedical Instrumentation”, PHI, 2014.



Course Title : Process Control Engineering
Course Code : PCIE-202

L	T	P	Credits	Weekly Load
3	1	0	4	4

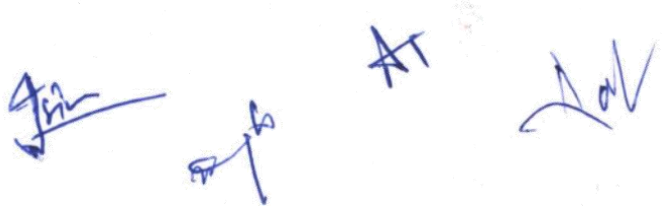
Course Outcomes (COs):
After successful completion of the course, the students should be able to
CO1: Understand the basic knowledge of the components used in process industries.
CO2: Explain different controller modes and their applications in different fields.
CO3: Learn and compare different types of control schemes.
CO4: Analyze different types of control valves used for different processes.
CO5: Study the control schemes for typical processes and P & I Diagram.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	2	2	2	1	3	2	3	2
CO2	1	3	1	3	1	3	2	3	2
CO3	2	3	1	2	1	3	2	3	3
CO4	2	3	2	2	1	3	3	2	3
CO5	2	3	1	3	1	3	2	2	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Industrial Processes, process variables, process characteristics, automatic process control, control objectives, types of control loops, and hardware elements of the control loop- measuring means, transmitters, controllers, converters, transmission lines and final control elements, single and multi-loop control.	12
	Feedback control systems in chemical processes: Feedback elements and control loops for Liquid level, pressure, flow, temperature and composition, control loops in chemical equipments like tank, interacting and non interacting tanks, heat exchanger, reactor, mixer and Distillation column, introduction to mathematical modeling, piping and Instrumentation Drawing (P&I D) of control loops.	12
Unit-2	**Basic Controller Modes and Characteristics:** Role of a controller, controller principles- On–off control, on-off with hysteresis, multi-position control, Proportional, integral, derivative and composite controllers, implementation with operational amplifier, tuning of controller, relative merits and demerits of the control modes, suitability of various control actions for different application.	12
	Final control elements: Current to pneumatic converter, types and working of actuators: pneumatic, electro-pneumatic hydraulic and motor actuators, control valve, role of a positioner, types of control valves – sliding stem and butterfly valves, selection criteria for control valves.	12
	Total Hours	**48**

Recommended Books-

1. Donald P. Eckman , Automatic Process Control, Wiley .
2. Curtis D, Johnson , Process control instrumentation technology, Prentice Hall of India
3. B. Wayn Bequette, Process Control: Modeling, Design and Simulation, Prentice HallInternational series, 3rd edition, 2003.
4. George Stephanopoulos, Chemical Process Control, An Introduction to the Theory and Practice, Prentice Hall International Inc., 1st edition, 2008.
5. Donald R. Coughanowr, Process Systems Analysis and Control, 3rd Edition, McGraw Hill Inc., 2013.
6. Peter Harriott, Process Control, Tata McGraw Hill 26th Reprint, 2005.



Course Title : Power Plant Instrumentation
Course Code : PCIE-204

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to:

CO1: Describe the fundamentals of power generation through various methods.

CO2: Explain the role of measurement and instrumentation control in the various types of power plants.

CO3: Illustrate the control and management of boilers.

CO4: Discuss the various types of turbine control techniques.

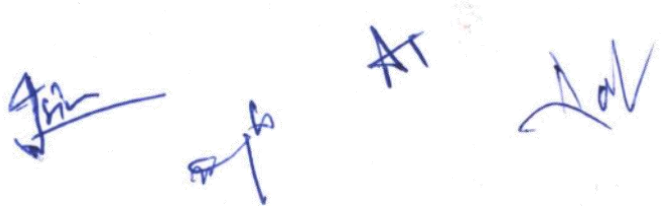
CO5: Outline the parameters to be monitored and controlled in a thermal power plant.

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	2	1	2	3	1
CO2	3	2	3	3	3	3	3	3	3
CO3	3	2	1	2	2	1	2	3	2
CO4	3	3	3	2	2	1	1	3	3
CO5	3	2	3	3	3	3	3	3	3

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Overview of Power Generation:** Survey of methods of power generation: hydro, thermal, nuclear, solar and wind power, role of instrumentation in power generation, thermal power plant, building blocks, combined cycle system, combined heat and power system, sub critical and supercritical boilers.	12
	Measurements in Power Plants: Measurement of feed water flow, air flow, steam flow and coal flow drum level measurement, steam pressure and temperature measurement, turbine speed and vibration measurement, flue gas analyzer, fuel composition analyzer.	12
Unit-2	**Boiler Control I:** Combustion of fuel and excess air, firing rate demand, steam temperature control, control of deaerator, drum level control, single, two and three element control, furnace draft control, implosion, flue gas dew point control, trimming of combustion air, soot blowing.	08
	Boiler Control II: Burners for liquid and solid fuels, burner management, furnace safety interlocks, coal pulverizer control, combustion control for liquid and solid fuel fired boilers, air/fuel ratio control, fluidized bed boiler.	08
	Control of Turbine: types of steam turbines, impulse and reaction turbines, compounding, turbine governing system, speed and load control, transient speed rise, free governor mode operation, automatic load frequency control, turbine oil system, oil cooling system, turbine run up system.	08
	Total Hours	**48**

Recommended Books-

1. R K Rajput., “A Text Book of Power Plant Engineering.” 5th edition, Lakshmi Publications, 2013.
2. P K Nag, “Power Plant Engineering”, McGraw-Hill Education, 4th edition, 2014.
3. E B Woodruff, H B Lammers and T F Lammers, “Steam Plant Operation”, 9th edition, McGraw Hill Education, 2011.
4. P Tamilmani,” Power Plant Instrumentation”, Sams Publishers, 2018.
5. D Lindsely, J Grist and D Parker, “Thermal Power Plant Control and Instrumentation: The control of boilers and HRSGs (Energy Engineering)”, 2nd edition, Institution of Engineering and Technology, 2018.



Course Title : Electronic Measurements
Course Code : PCIE-206

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Understand the basic electronic instruments and their working principle.

CO2: Explain the construction, working principle and types of oscilloscopes.

CO3: Learn about the generation of different waveforms.

CO4: Analyze different types of waveforms using signal analyzers.

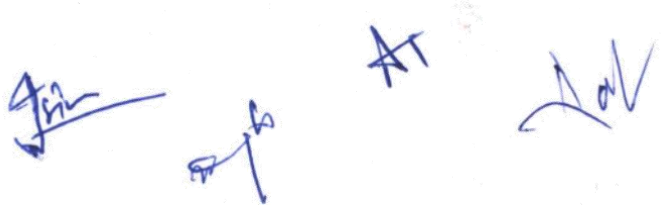
CO5: Manage the frequency measurements and error analysis.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	3	2	3	2
CO2	3	2	1	2	1	2	2	3	2
CO3	3	1	1	2	1	3	2	3	3
CO4	3	2	1	2	1	2	2	3	3
CO5	3	1	1	2	1	3	2	3	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Electronic analog meters**: Electronic analog meters: DC voltmeters- Loading- Transfer volt meter- Chopper type- DC amplifier voltmeter- Solid state voltmeter – Differential voltmeter – Peak responding voltmeter – True root mean square (RMS) voltmeter – Calibration of DC instrument	08
	Digital voltmeter (DVM): Introduction – Ramp technique – Dual slope - Integrating type DVM –Successive approximations type DVM – Resolution and sensitivity of digital meters – General specifications of a DVM.	08
	Cathode Ray Oscilloscope (CRO): Introduction, CRO block diagram, cathode ray tube (CRT) circuits, observation of waveform on CRO, Measurement of voltage, current, phase and frequency.	08
Unit-2	**Instruments for generation and analysis of waveforms**: Oscillators, classification of oscillators, square wave and pulse generator, triangular wave shape generator, Signal generators.	08
	Signal analyzers: Signal analyzers Wave analyser, harmonic distortion analyzer, spectrum analyzer, logic analyzer, X-Y recorders and plotters.	08
	Errors in measurement System Errors in measurement, absolute error and limiting errors.	08
	Total Hours	**48**

Recommended Books-

1. Golding E.W. and Wides F.C., "Electrical Measuring Instruments and Measurements", Wheeler.
2. H.S. Kalsi, "Electronic Instrumentation", EXCEL BOOKS.
3. Singh, "Industrial Instrumentation and control", 2nd edition, Tata Mcgraw-Hill, New Delhi.
4. A K Sawhney, A course in Electrical and Electronic Measurements and Instruments, Dhanpatrai.
5. David A. Bell, "Electronic Instrumentation and Measurements", 2nd edition PHI, New Delhi, 2008.
6. Oliver and Cage, "Electronic Instrumentation and Measurements", TMH, 2009.



Course Title : Maintenance and Troubleshooting of Instruments
Course Code : PEIE-202A

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Familiarize with basic tools and chemicals used for testing instruments.

CO2: Develop a systematic approach to troubleshooting.

CO3: Identify the common causes of sensor, transmitter, controller, and final control element problems.

CO4: Identify different PCB fabrication materials and instruments and know the fabrication technique.

CO5: Understand some sophisticated instruments and their testing and troubleshooting.

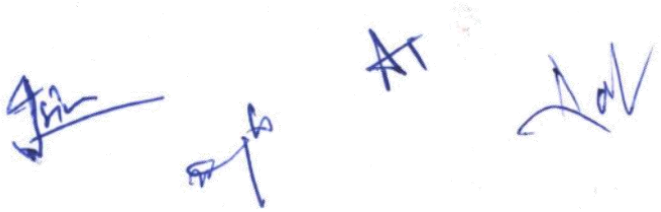
CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	-	1	1	-	3	3	1
CO2	3	2	1	3	2	2	2	3	2
CO3	3	3	2	1	1	1	1	3	-
CO4	3	1	1	2	1	1	2	3	1
CO5	3	1	2	2	2	2	1	3	3

Unit	Main Topics & Course Outlines	Hour(s)
Unit-1	**Basic Concepts of Instrumentation:** Definitions and scope of instrumentation. Types of instruments (electrical, electronic, mechanical, etc.). Use of Various hand tools for manufacturing and testing e.g. pliers, cutter, crimpers, stripper, screw driver etc. Familiarization, use and practice of measuring instruments for testing and measurement e.g. Analog and Digital Multimeter, CRO, frequency meter, signal generators, signal sources, LCR meter and IC tester.	08
	Maintenance Practices for Instruments: **Preventive Maintenance:** Importance and need for preventive maintenance., Steps for maintaining different instruments, Tools and techniques for preventive maintenance. **Predictive Maintenance:** Use of condition monitoring techniques, Vibration analysis, thermography, and other predictive maintenance tools. **Corrective Maintenance:** Identification of faulty components. Replacing defective parts and restoring functionality.	08
	Calibration of Instruments: **Concept of Calibration** Importance of calibration in instrumentation. Calibration standards and procedures. **Calibration of Process Instruments** Techniques to calibrate temperature, pressure, flow, and level instruments. Hands-on calibration exercises using standard calibrators. **Calibration Equipment** Calibration of analog vs. digital instruments, Using calibration devices like multimeters, oscilloscopes, and calibrators.	08

Unit-2	**Instrument Troubleshooting Techniques** **General Troubleshooting Steps:** Understanding of basic principles of troubleshooting, Identifying symptoms and analysing root causes. **Troubleshooting Common Instruments:** Troubleshooting of temperature, pressure, flow, and level measuring instruments. Fault detection in electrical, mechanical, and pneumatic instruments. Use of Diagnostic Equipment like Multimeter, Megger, Oscilloscope, Clamp Meter, and other diagnostic tools. **Common Faults and Rectification:** Mechanical faults: wear and tear, leakage, broken parts. Electrical faults: open circuits, short circuits, power issues.	08
	Safety and Best Practices **Safety Standards:** Importance of safety in instrumentation maintenance. Safety standards like IEC, ANSI, and OSHA. **Personal Protective Equipment (PPE):** Guidelines on the use of PPE during maintenance. **Hazardous Area Instrumentation:** Handling of instruments in explosive and hazardous environments. Intrinsically safe instruments and their maintenance.	08
	Case Studies and Practical Applications **Practical Troubleshooting:** Case studies related to common faults in process industries. **Hands-on Sessions:** Practical sessions on diagnosing, repairing, and calibrating faulty instruments. **Documentation:** Preparing maintenance and calibration reports, Recording troubleshooting logs and maintenance history.	08
	Total Hours	**48**

Recommended Books-

1. "Practical Troubleshooting of Electrical Equipment and Control Circuits" by Mark Brown, Jawahar Rawtani, and Dinesh Patil, Elsevier Science.
2. "Instrumentation and Control Systems" by W. Bolton, Elsevier Science.
3. "Maintenance of Instruments and Systems" by L.D. Goettsche, ISA-The Instrumentation, Systems, and Automation Society.
4. "Industrial Instrumentation" by Donald P. Eckman.
5. "Industrial Instrumentation and Control" by S.K. Singh, McGraw Hill.



Course Title : Mechanical Precision Instruments
Course Code : PEIE-202B

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Acquire knowledge about various mechanical precision instruments

CO2: Design the circuits for mechanical precision instruments

CO3: Implement the circuits for mechanical precision instruments

CO4: Identify the basic design problems in the field of mechanical precision instruments

CO5: Acquire the knowledge about mathematics involved in the design of mechanical precision instruments

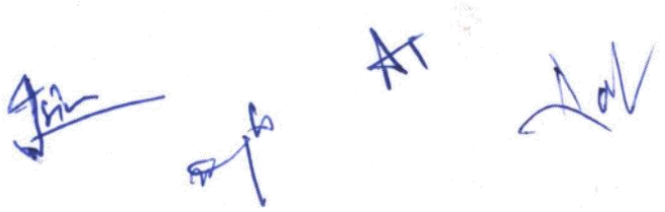
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	1	2	3	3	3	3
CO2	2	3	3	2	3	3	1	3	2
CO3	3	2	2	2	2	1	1	3	1
CO4	2	1	2	1	2	2	2	2	2
CO5	2	2	3	1	3	1	3	3	2

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction to Precision Instruments:** Overview of Precision Measurement, Importance of precision measurement in engineering and manufacturing, Classification of Precision Instruments, Types of precision instruments based on measurement principles (mechanical, optical, electrical).	12
	Linear Measurement Instruments: Vernier Calipers, Types of vernier scales, Micrometers, Zero error correction, Dial Indicators, Applications in mechanical measurements, Calibration and accuracy considerations.	12
Unit-2	**Angular Measurement Instruments:** Protractors, Types of protractors (vernier, digital, optical), Sine Bars and Sine Plates, Applications in angular measurement and alignment, Calculation of angles using sine bar formula.	08
	Surface Measurement Instruments: Surface Roughness Testers, Principles of surface roughness measurement, Profilometers, Working principle, Applications in surface profilometry, Analysis of surface texture and form, Coordinate Measuring Machines (CMMs).	08
	Optical Measurement Instruments: Optical Comparators, Measurement of dimensions and contours, Interferometers, Applications in precision length measurement (metrology-grade interferometers), Fringe counting and calibration procedures, Laser interferometers for linear displacement measurement	08
	Total Hours	**48**

Recommended Books-

1. "Precision Engineering" by V.C. Venkatesh, Publisher: McGraw-Hill Education.

2. "Mechanical Measurements" by Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V, Pearson.
3. "Precision Machining Technology" by Peter J. Hoffman, Eric S. Hopewell, Brian Janes, Cengage Learning.
4. "Precision Manufacturing" by Bryan A. Gleason, CRC Press.
5. "Precision Engineering", by I.S. Grigoriev, V.N. Afanasev, A.I. Mikrin, CRC Press.



Course Title : Occupational Health and Safety
Course Code : PEIE-202C

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes (COs):
After successful completion of the course, the students should be able to

CO1: Identify the diseases associated with occupation.

CO2: Identify the hazards in industrial operation and propose prevention measures.

CO3: Learn about the health problems associated with occupations and safety aspects of workers.

CO4: Explain the various risk detection and analysis techniques.

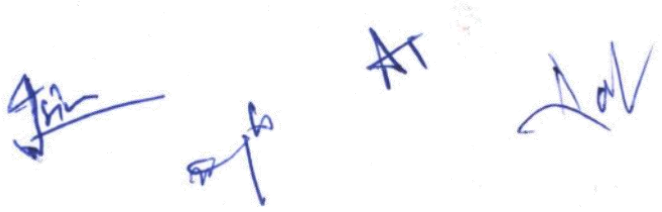
CO5: Manage safety in industries by suggesting safety measures and personal protective equipment.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	3	1	3	2	1	2
CO2	3	2	1	3	1	3	1	2	2
CO3	3	1	1	3	2	3	3	1	3
CO4	3	1	1	3	2	3	1	1	3
CO5	3	2	1	3	2	3	1	1	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Occupational Health**: Classification of occupational health hazards, dangerous properties of chemical and their health effects, routes of entry of toxic material into human body, permissible exposure limits, Threshold limit value, lethal dose and lethal concentration, Ergonomics, constituents of ergonomics, application of ergonomics for safety & health, occupational diseases due to metals & dusts.	08
	Concept, Philosophy & Psychology of safety: Concept of safety, Nature of concept of safety, Philosophy of safety, safety terminology, philosophy of total safety concept, safety psychology, accident causative factors, general psychological factors.	08
	Electrical Safety and Management: Electricity and Hazardous, Indian standards, effects of electrical parameters on human body, concept of management, element of management, functions, management principles, safety management & its responsibilities, safety organization.	08
Unit-2	**Fire and Explosion**: Fire phenomena, classification of fire and extinguishers, statutory and other standards, fire prevention & protection system, explosion phenomena, explosion control devices, fire awareness signs.	08
	Hazards & Risk identification, Assessment and control techniques: Hazards, Risks & detection techniques, Fault tree analysis, Event tree analysis (ETA), major accident hazard control, on-site and off-site emergency plans.	08
	Personal Protective Equipment: Need of PPE, Indian standards, factors of selection of PPE, non-respiratory equipment's, respiratory equipment's. **Case Study**: Safety in different industries as case study	08
	Total Hours	**48**

Recommended Books-

1. Dr. K. U. Mistry, “Fundaments of Industrial safety & health”, vol I & II Global Commerce, 2022.
2. Yashpal Bedi, “Handbook of Preventive & Social Medicines”, 17th edition CBS Publishers and distributers Pvt. Ltd, 2020.
3. S.K Haldar, “Occupational Health & Hygiene in Industry”, CBS Publishers and distributers Pvt. Ltd, 2022.
4. Ann Fingret & Alan Smith , “Occupational Health, a Practical Guide for Managers”, 1st edition Taylor & Francis, 2003 .
5. Y P Kudesia & Ritu Kudesia, “Environmental Health & Technology”, Pragati Publishers,2007.
6. Norman M Triff, “Environment & Health”, Anna Arbor Science Publisher, 1980.



Course Title : Measurement Science
Course Code : OEIE-202

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Describe the basic concept of measurement and generalized measurement system.

CO2: Classify static and dynamic characteristics of measuring instruments.

CO3: Illustrate measurement error and statistical analysis.

CO4: Describe various units and standards of measurement and their classification.

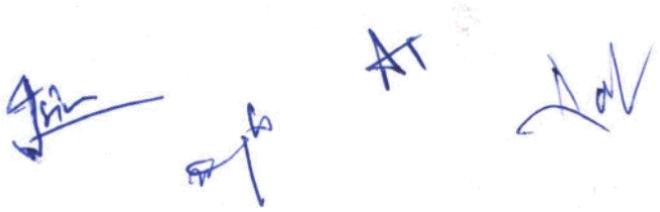
CO5: Demonstrate different types of Signals and noise in measurement systems.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	2	1
CO3	3	2	2	-	-	-	-	3	2
CO4	1	-	-	-	-	1	-	1	-
CO5	3	1	-	-	-	-	-	2	-

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Introduction to measurements, classification of the methods of measurement, types of instruments, elements of a generalized measurement system, input/output configuration of measurement systems.	08
	Units, Dimensions and standards: Units, Dimensions, systems of electrical units, dimensions in electromagnetic and electrostatic systems, standards of measurement and their classification.	08
	Measurement error and statistical analysis: Classification of errors, common causes of errors in measurement, limiting errors, combination of quantities with errors.	08
Unit-2	**Static Characteristics of the instruments:** Static characteristics (accuracy, sensitivity, threshold etc.), loading effect in measurement, input/ output impedance, loading effects due to series and shunt connected instruments.	08
	Dynamic characteristics of the instruments: Dynamic response and analysis, dynamic response to standard inputs, Transfer function, mathematical model of the generalized measurement system, Zero measurement systems.	08
	Signals and noise in measurement systems: Deterministic and random signals, classification of noise, noise sources, method of reducing effects.	08
	Total Hours	**48**

Recommended Books-

1. A K Ghosh, Introduction to Instrumentation and Control, Prentice Hall of India, 2005.
2. A.K. Sawhney and PuneetSawhney, A course on electrical and electronic measurements and instrumentation, DhanpatRai, 2012.
3. David A Bell, Electronic Instrumentation and measurement, 3rd edition, Oxford University Press, 2013.
4. John P. Bentley, Principles of Measurement System, 3rd edition, Pearson Education, 2000.



Course Title : Process Control Lab
Course Code : PCIE-208

L	T	P	Credits	Weekly Load
0	0	2	2	1

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Understand the basic knowledge of the components used in process industries.

CO2: Explain different controller modes and their applications in different fields.

CO3: Learn and compare different types of control schemes.

CO4: Analyze different types of control valves used for different processes.

CO5: Study the control schemes for typical processes and P & I Diagram.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	-	2	3	-	2	1
CO2	2	2	1	-	2	2	-	3	3
CO3	3	2	1	-	2	1	-	3	2
CO4	2	2	3	3	2	1	-	3	2
CO5	3	2	3	3	2	1	-	3	1

List of Practicals-.

1. To study the calibration of input/output (I/P) (Current to Pneumatic) converter.
2. To study the calibration of Differential Pressure Transmitter.
3. Study of Control Valve characteristics.
4. To study the tank level control loop (proportional-integral (PI) control).
5. To study the pressure control loop on Process Simulation kit.
6. Study of feedback flow control loop and its elements.
7. Study of feedback temperature control system using proportional-integral (PI) controller.
8. Study of feedback temperature control system using proportional (P) controller.
9. Study of feedback temperature control system using proportional-integral-derivative (PID) controller.
10. Study of feedback temperature control system using PD controller.

Course Title : Electronic Measurements Lab
Course Code : PCIE-210

L	T	P	Credits	Weekly Load
0	0	2	2	1

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Understand the basic electronic instruments and their working principle.

CO2: Explain the construction, working principle and types of oscilloscopes.

CO3: Learn about the generation of different waveforms.

CO4: Analyze different types of waveforms using signal analyzers.

CO5: Manage the frequency measurements and error analysis.

CO/PO Mapping: (Strong (3) / Medium (2) / Weak (1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	2	1	3	2	3	2
CO2	3	2	1	2	1	2	2	3	2
CO3	3	1	1	2	1	3	2	3	3
CO4	3	2	1	2	1	2	2	3	3
CO5	3	1	1	2	1	3	2	3	3

List of Practicals-

1. Study of principle of operation of various types of electro-mechanical measuring instruments.
2. Measurement of resistance using Wheatstone Bridge.
3. Measurement of resistance using kelvin's Bridge.
4. Measurement of self-inductance using Anderson's Bridge.
5. Measurement of capacitance using Schering Bridge.
6. Plotting of Hysteresis loop for a magnetic material using flux meter.
7. Measurement of frequency using Wein's Bridge.
8. To study the connections and use of Current and potential transformers and to find out ratio error.
9. Determination of frequency and phase angle using CRO.
10. Measurement of unknown voltage using potentiometer.
11. To find 'Q' of an inductance coil and verify its value using Q- meter.

Course Title : Medical Equipment Technology Assistant *(Module-2)*
Course Code : QPIE-202

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Discuss the various protocols and compliance with medical standards.

CO2: Explain the working principle behind the various medical imaging equipments.

CO3: Prepare a model o perform the image processing and analysis.

CO4: Perform experiments on various types of bio-feedback systems.

CO5: Effectively devise the repair, maintenance and testing of medical equipments.

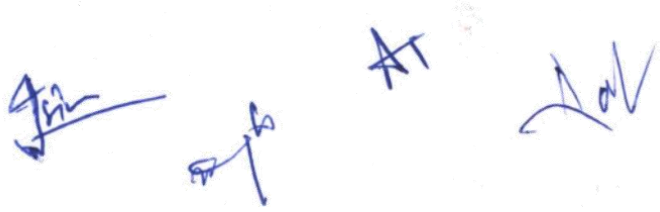
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	2	1	3	3	1
CO2	3	1	1	1	2	1	3	3	1
CO3	2	3	3	2	2	2	3	3	1
CO4	2	2	2	1	3	2	2	2	2
CO5	2	3	3	3	3	3	3	3	3

Topics	Hands-on Practicals	Hour(s)
Medical Device Safety Testing	Familiarization with standards of FDA, CDSCO, ISO, IEC, and other regulatory bodies	14
	Protocols and compliance with medical standards	
	Case studies of medical device failures	
	Practical exercises on electrical safety testing	
Patient Safety Measures	Electric shock hazards	14
	Safety codes for medical equipment	
	Electrical safety analyzer	
	Testing of bio-medical systems	
Imaging Modalities	X-ray machine: procedure, safety measures, report generation, X-ray interpretation	22
	Familiarization with MRI and CT scans, Radiation exposure and associated safety measures	
	Familiarization with medical thermal imaging	
	Thermal imaging camera: hands-on and parameters setting	
	Imaging protocol for thermograms acquisition	
Image processing and analysis	Image segmentation using MATLAB and Python	20
	Pattern recognition using MATLAB and Python	
	Contrast enhancement of thermograms	

	Image filtering and edge detection	
	Data compression techniques	
Bio-feedback trainers	Study of bio-feedback using GSR	18
	Study of bio-feedback using pulse rate	
	Study of bio-feedback based on skin temperature	
Internet of Medical Things (IoMTs)	Demonstration of IoT kits for medical applications	24
	Hands-on practice to interface and program the various sensors with the kit	
	Prepare a project for real-time illustration of physiological parameters	
Servicing and maintenance of bio-medical equipment	Tools and techniques for effective troubleshooting	16
	Diagnosing and repairing common faults	
	Creating maintenance logs and reports	
	Total Hours	**128**

Recommended Books-

1. R S Khandpur, “Handbook of Biomedical Instrumentation”, 3rd edition, McGraw Hill Education, 2014.
2. J L Semmlow and B Griffel, “Biosignal and Medical Image Processing”, 3rd edition, CRC Press, 2014.
3. L Cromwell, F J Weibell, E A Pfeiffer “Biomedical Instrumentation and Measurement”, 2nd edition, Pearson Education India, 2015.
4. Andrew G. Webb, “Principles of Biomedical Instrumentation”, Cambridge University Press, 2018.



Course Title : Microprocessor and Microcontroller
Course Code : PCIE-301

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to:

CO1: Discuss the internal architecture, timing diagrams and interrupts of 8051 and 8085.

CO2: Explain the instruction sets, addressing modes and program development tools for 8051 and 8085.

CO3: Develop the programming loop structure with counting and indexing for 8085 microprocessor

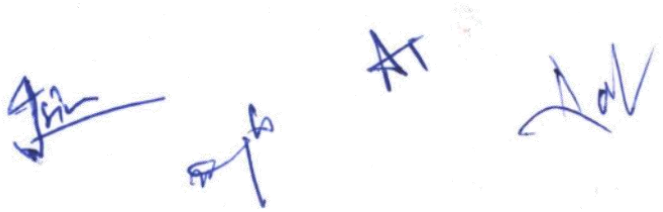
CO4: Develop the program of 8051 microcontroller for various applications.

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	2	1	2	3	1
CO2	3	2	3	3	3	3	3	3	3
CO3	3	2	1	2	2	1	2	3	2
CO4	3	3	3	3	3	3	3	3	3

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**8085 microprocessor:** Hardware Architecture pintouts - Signals – Memory interfacing – input/output (I/O) ports and data transfer concepts, Timing Diagram, Interrupt structure.	12
	Programming of 8085 Processor: Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation and control instructions – Programming: Loop structure with counting and Indexing – Look up table - Subroutine instructions - stack.	12
Unit-2	**Microcontroller 8051 hardware and architecture:** Introduction to 8051 microcontroller, Architecture and Memory Organization, Special function registers, Port operations.	12
	Programming of 8051 microcontroller: Programming model of 8051, operand types, operand addressing, Data transfer instructions, Arithmetic Instructions, Logic Instructions, Control transfer instructions, Programming.	12
	Total Hours	**48**

Recommended Books-

1. B.Ram., Fundamentals of Microprocessors and Microcomputers. Dhanpat Rai and Sons, 1998.
2. Douglas V. Hall, Microprocessors and interfacing: Programming and Hardware, Tata McGraw Hill, 2007.
3. Gaonkar and Ramesh S., Microprocessor Architecture, Programming and Applications with the 8085, Penram International.
4. Ray A.K. and Bhurchandi K.M., Advanced Microprocessors and Peripherals, Tata McGraw Hill.



Course Title : Control Engineering
Course Code : PCIE- 303

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Reproduce the theoretical aspects of Control systems and feedback.

CO2: Calculate the transfer function from block diagram reduction technique and mason's gain formula.

CO3: Solve the steady state and transient analysis of a system for standard inputs.

CO4: Identify the stability analysis of a system using concepts of root locus and zeros & poles.

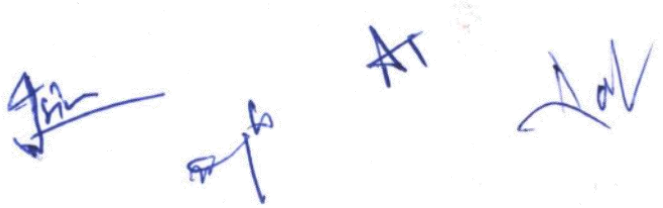
CO5: Articulate the essential knowledge to understand AC, DC servo motors.

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	2	2	1	1	3	3	1
CO2	3	2	3	3	-	-	1	3	3
CO3	3	1	-	3	1	2	1	3	2
CO4	3	2	3	3	-	1	1	3	3
CO5	3	1	2	-	-	-	2	3	2

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Introduction to control system – Basic components of control systems, open loop and closed loop control system, types of feedback control systems, mathematical modelling of physical systems, Analogous systems, Laplace transformation, Transfer functions, Transfer functions of electrical, mechanical and electro-mechanical systems.	08
	Block diagram and Signal flow graphs: Block diagrams of control systems, block diagram reduction, signal flow graph, Mason's gain formula, drawing signal flow graph from given block diagram.	08
	Time domain Analysis: Type and order of a system, standard test signals for the time response of control system - Unit step, unit ramp response of first and second order systems, time domain specifications, steady state errors and error constants.	08
Unit-2	**Poles, Zeros and stability:** Introduction, characteristic equation, absolute and relative stability, concepts of stability, necessary condition for stability, poles and zeros plots, correlation of poles and zeros with stability, Routh Hurwitz stability criterion.	08
	Root Locus technique: Basic theory and properties of root loci, procedure for construction of root loci, interpretation of the root locus diagrams.	08
	Control system components: Error detectors, DC and AC servo motors, Stepper motor, synchro's.	08
	Total Hours	**48**

Recommended Books-

1. Benjamin C. Kuo, Automatic Control System, 8th edition, John Wiley and Sons, 2002.
2. J. Nagrath and M. Gopal, Control System Engineering, New Age, 2009.
3. K. Ogata, Modern Control Engineering, 5th edition, Prentice Hall (PHI), 2010.



Course Title : Analytical Instrumentation
Course Code : PEIE-301A

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Explain the use of statistical analysis of analytical instruments.

CO2: Describe spectrophotometers for analytical measurement.

CO3: Illustrate the applications of various analyzers.

CO4: Enumerate the applications of density and viscosity measurement.

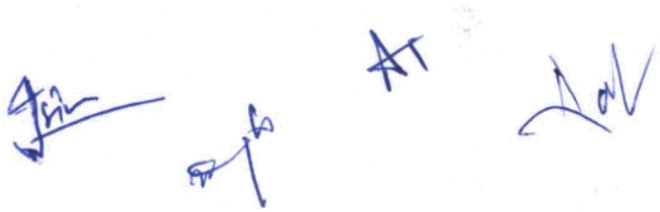
CO5: List uses of chromatographic techniques.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	1	1	1	-	1	1	1
CO2	1	2	1	1	1	-	1	2	1
CO3	1	1	2	1	1	-	2	3	2
CO4	1	2	2	1	1	-	1	3	3
CO5	1	2	2	1	1	-	1	2	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction**: Elements of an analytical instrument, statistical analysis, applications of analytical instruments.	08
	Spectrophotometer: Electromagnetic radiation, electromagnetic spectrum, interaction of radiation with matter, laws relating to absorption of radiation, Beer-Lambert's law, absorption instruments, colorimeters, spectrophotometer, UV-Visible and IR spectrophotometers.	08
	Analyzers1: pH analyzer**,** principle of pH measurement, electrodes for pH measurement, electronics circuit for pH measurement, calibration. Electrical conductivity analyzes, introduction to conductivity cell, methods of measurement of conductance, null method and direct reading method, applications of conductivity analyzers.	08
Unit - 2	**Analyzers 2:** Gas analyzers, O_2 and CO_2 analyzers, thermal conductivity analysis, principle and applications of hot wire thermal conductivity analyzer.	08
	Viscosity and density measurement: Viscosity measurement techniques. Redwood and Saybolt viscometer, density and specific gravity measurement techniques, pressure head type densitometer, displacer type densitometer, float type densitometer.	08
	Chromatography: Basic concepts and types of chromatography block diagram, various parts and detectors of gas and liquid chromatography.	08
	Total Hours	**48**

Recommended Books-

1. R. orth, 1988.S Khandpur, Handbook of Analytical Instruments, McGraw-Hill Education, 2015.
2. R P Khare, Analysis Instrumentation: An Introduction., CBS Publisher, 2008.
3. Patranabis, Principles of Industrial Instrumentation, Tata McGraw-Hill Education, 2001.
4. Willard, H.H., L.L. Jr. Merritt, J.A. Dean, and F.A. Jr. Settle, Instrumental methods of analysis. Wads W.



Course Title : Environmental Instrumentation
Course Code : PEIE-301B

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Discuss the role of instrumentation in environmental monitoring and management.

CO2: Explain the various phenomenon of instrumentation for detection of air pollutants.

CO3: List out the various sensors for water quality monitoring.

CO4: Apply the knowledge of instrumentation in the monitoring and management of soil quality.

CO5: Explain the working of sound meters and acoustic cameras for noise measurement.

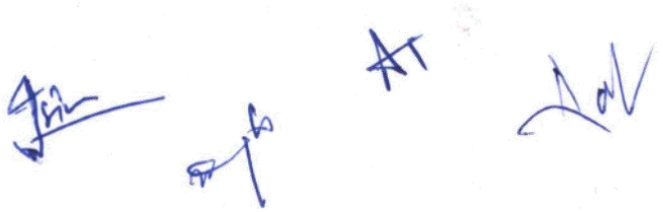
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	2	3	3	3	3	2
CO2	3	2	3	1	3	1	3	3	3
CO3	3	1	-	1	2	-	1	2	-
CO4	3	3	3	3	3	3	3	3	2
CO5	3	2	1	1	3	1	1	3	1

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Definition of environmental instrumentation, need of environmental instrumentation, meteorological stations, role of instrumentation in environmental monitoring and management.	08
	Measurement: Measurement of environmental parameters (air, water, soil, etc.), extractive and in situ measurement, types of sensors used in environmental monitoring, signal conditioning and data acquisition systems.	08
	Air Quality Monitoring Instruments: Various principles for air quality monitoring (Optical scattering, non-disperssive IR absorption, and electro-chemical), sensors for measuring air pollutants, (e.g., particulate matter, SO_2, NO_2, CO, CO_2), working principles of gas analyzers and particulate matter sensors, PM2.5 and PM10 Sensors.	08
Unit - 2	**Water Quality Monitoring Instruments:** Thermal conductivity detector, pH meter, opacity monitor, turbidity sensor, dissolved oxygen sensor, different techniques for detecting heavy metals and organic pollutants in water.	08
	Soil Quality Monitoring Instruments: Soil moisture sensor- capacitive sensor & time domain reflectometer, soil pH sensor, nutrient level measurement using electrical conductivity, soil nitrogen sensor- Ion-selective electrodes & optical sensor.	08
	Noise and Vibration Monitoring: Class 1 and Class 2 sound level meters,	08

	microphones, noise dosimeter, acoustic cameras, seismic sensors for ground vibration detection, capacitive and piezoelectric accelerometer.	
	Total Hours	**48**

Recommended Books-

1. "Environmental Instrumentation and Analysis Handbook" by Randy D. Down and Jay H. Lehr.
2. "Introduction to Environmental Engineering and Science" by Gilbert M. Masters.
3. "Principles of Environmental Monitoring" by A. C. McDonald.



Course Title : Automotive Instrumentation
Course Code : PEIE-301C

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Describe the automobile systems, its subsystems and components.

CO2: Explain the concepts of various sensors used in automobile systems.

CO3: Use of power electronics controlled motors in EV and HEV systems.

CO4: Outline the basic and advanced controls in automotive systems.

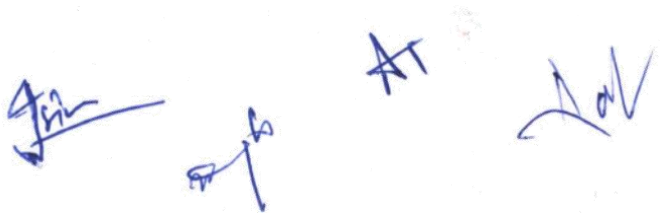
CO5: Develop the clear understanding about the automotive safety systems.

CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	2	-
CO2	3	-	-	-	2	1	3	3	2
CO3	2	3	2	2	2	-	-	3	2
CO4	2	-	-	2	-	1	3	2	2
CO5	2	2	2	2	2	-	2	2	2

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction to Automobile System:** Overview of automotive systems, power train systems- internal combustion, electrical vehicle, hybrid electric vehicles, engine components and its functions, transmission, driveshaft, chassis and suspension systems, current trends in automobiles, role of instrumentation in automotives.	12
	Sensors for Engine Management System: Basic sensor for speed, crank angle position, fuel metering, fuel flow, temperature, air mass flow, throttle position, eccentric shaft and emission control, algorithms for engine control and emission control.	12
Unit-2	**Electric and Hybrid Electric Vehicle Systems:** Role of power electronics, EV and HEV motors and their control, transmission, type of batteries and charging management system.	12
	Active and Passive Safety System: Dashboard electronic instrument clusters, safety interlock system, lighting control, immobilizers, anti-lock braking system, (ESP) electronic stability program, air bags etc.	12
	Total Hours	**48**

Recommended Books-

1. "Automotive Instrumentation and Data Acquisition" by David J. Smith
2. "Automotive Electronics Handbook" by Ronald K. Jurgen.
3. “Electric and Hybris Electric Vehicles” by James D. Halderman, Curt Ward.



Course Title : Sensors and Transducers
Course Code : OEIE- 301

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Describe the concept of transducers and the related static and dynamic characteristics.

CO2: Familiar with the specifications of sensors and transducers.

CO3: Able to design signal conditioning circuits for various sensors and transducers.

CO4: Exposed to advancements in sensor technology.

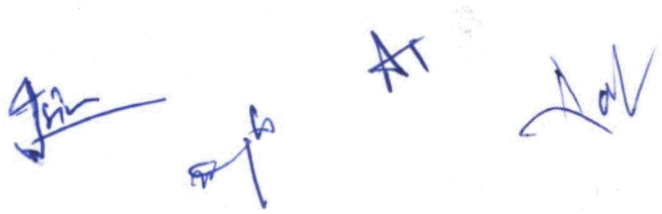
CO5: Able to identify or use a transducer for a specific measurement application.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	1	1	2	1	3	1
CO2	3	-	-	1	-	1	-	-	1
CO3	3	2	2	1	2	3	1	2	2
CO4	3	2	2	1	-	2	-	2	1
CO5	3	3	3	2	1	2	1	2	1

Unit	Main Topics & Course Outlines	Hour(s)
Unit-1	**Overview:** Terminology of Measurement Systems, Transducer Classification, General Input-Output Configuration, Static and Dynamic Characteristics of a measurement system, Characteristics and Choice of Transducers.	08
	Resistive transducers: Construction, working principles, types of potentiometers, strain gauges and Resistive temperature transducers (RTD), Study the characteristics of strain gauge and its applications: Load and torque measurement.	08
	Inductive Transducers: Basic principles of Variable Inductance Transducers, Electromagnetic pick up, Eddy Current Transducers, Linear variable differential transformer (LVDT) and Variable reluctance transducers.	08
Unit-2	**Capacitance Transducers:** Basic principles and types of Variable Capacitance Transducers, advantage and disadvantages, uses of capacitive transducers, Capacitance pick up.	08
	Piezoelectric Transducers: Basic principle and uses of piezoelectric transducers, Piezoelectric crystals and their properties, General forms of piezoelectric transducers.	08
	Other Transducers: Tacho-Generators and Stroboscope, digital encoding transducers, Load cell, inductive torque meter, magneto-strictive transducers, electrical tachometers (AC and DC both).	08
	Total Hours	**48**

Recommended Books-

1. D A Bell, “Electronic Instrumentation and measurement”, 3rd edition, Oxford University Press, 2013.
2. A K Sawhney, “A course on electrical and electronic measurements and Instrumentation”, Dhanpat Rai, 2016.
3. J B Gupta, “A Course in Electronic and Electrical Measurements & Instrumentation”, S K Kataria and Sons, 2014.
4. S M Sze, “Semiconductors sensors”, John Wiley & Sons Inc., 2008.
5. D Patranabis, “Sensors and Transducers”, Prentice Hall, 2nd edition, 2003.
6. D C Nakra and K K Chaudhary, “Instrumentation measurement and analysis” 4 edition, Tata McGraw Hill, 2016.



Course Title : Microprocessor and Microcontroller Lab
Course Code : PCIE-305

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:

After successful completion of course, the students should be able to:

CO1: Explain the working of 8051 and 8085 study kits.

CO2: Develop the programs based on 8085 instruction set.

CO3: Develop the 8085 assembly language program and execute it on study kit

CO4: Develop the programs based on 8051 instruction set.

CO5: Develop the 8085 assembly language program and execute it on study kit

CO/PO Mapping Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (Pos)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	2	1	2	3	1
CO2	3	3	3	3	3	3	3	3	3
CO3	3	2	1	2	2	1	2	3	2
CO4	3	3	3	3	3	3	3	3	3
CO5	3	2	1	2	2	1	2	3	2

List of Practical:

1. Study of 8085 microprocessor kit to understand the capabilities.
2. Write a program and assemble, enter and execute it using 8085 Microprocessor for Decimal, Hexadecimal addition of two Numbers.
3. Write a program and assemble, enter and execute it using 8085 Microprocessor for subtraction of two Hexadecimal Numbers.
4. Write a program and assemble, enter and execute it using 8085 Microprocessor for addition and subtraction of two BCD numbers.
5. To perform multiplication of two 8 bit numbers using 8085 study kit.
6. To find the largest and smallest number in an array of data using 8085 study kit.
7. To write a program to arrange an array of data in ascending and descending order and execute it on 8085 study kit.
8. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 study kit.
9. Write an ALP to move a block of data from one internal memory location to other and execute it with 8051 study kit.
10. Write an ALP to move a block of data from one external memory location to other and execute it with 8051 study kit.
11. Write an ALP to find addition of two 8 bit numbers and execute it with 8051 study kit.
12. Write an ALP to find multiplication of two 8 bit numbers and execute it with 8051 study kit.

Course Title : Minor Project
Course Code : PRIE-301

L	T	P	Credits	Weekly Load
0	0	4	2	4

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Apply knowledge from core subjects to solve a real-world problem within their field of study.

CO2: Develop a project plan, define clear objectives, and manage resources efficiently to meet project deadlines.

CO3: Work effectively as a part of a team and demonstrating communication skills to achieve common project goals.

CO4: Demonstrate the ability to use appropriate tools, techniques, and technologies relevant to the project's domain.

CO5: Present project results effectively, both orally and in writing, to various audiences, including peers, faculty, and external evaluators.

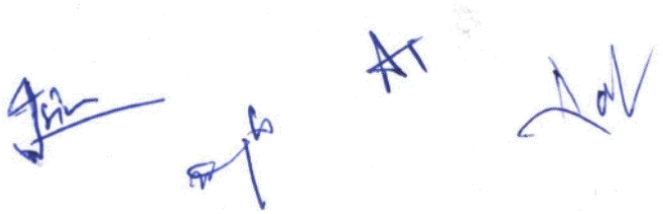
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	-	3	1	3	3	1
CO2	1	3	3	2	1	3	2	1	-
CO3	1	-	1	1	3	3	3	-	1
CO4	2	1	2	3	-	1	3	3	2
CO5	3	2	-	2	2	2	3	2	-

Rubrics

Mid-Semester Evaluation : 50 Marks
Final Evaluation : 50 Marks

	Assessment Matrix	**Excellent (81% - 100%)**	**Good (61% - 80%)**	**Satisfactory (41% - 60%)**	**Not-satisfatory (less than 41%)**	**Marks Distribution**
Mid-Semester Evaluation	**Problem identification & objectives**	Problem is clearly defined with precise and measurable objectives	Problem is defined, but objectives are somewhat incomplete	Problem is defined, but objectives are unclear	Problem is not clearly defined, and objectives are unclear	10
	Novelty	Highly creative and innovative approach, with novel solutions	Adequate creativity with some original ideas	Limited creativity	No new ideas or innovation presented	10
	Appropriate coverage of project work	Objectives achieved as per time frame	Presence of minor flaws	Presence of major flaws	Objectives not achieved as per time frame	10
	Presentation	Contents of	Presentation is	Presentation is	Contents of	20

		presentations are appropriate and well delivered	appropriate, but could be better structured	unclear in parts	presentations are not appropriate and not well delivered	
Final Evaluation	**Technical Implementation**	High-level technical implementation with excellent execution	Good technical skills and executed with minor errors	Satisfactory technical skills and executed partially	Poor technical skills with major errors in implementation	20
	Presentation	Contents of presentation are appropriate and well delivered	Presentation is appropriate, but could be better structured	Presentation is unclear in parts	Contents of presentation are not appropriate and not well delivered	15
	Project Report	Complete and well-organized report	Report with minor omissions or errors	Report with partial data and results	Incomplete or poorly written report	15
					Total Marks	**100**



Course Title : Instrumentation Technician Process Control
Course Code : QPIE-301

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Identification of the instrument symbols for instrumentation drawings.

CO2: Explain the working and characteristics of the transmitters.

CO3: Illustrate the types of and working of final control elements.

CO4: Apply the safety measures in operation of the instruments.

CO5: Outline the preventive maintenance procedure for the instruments.

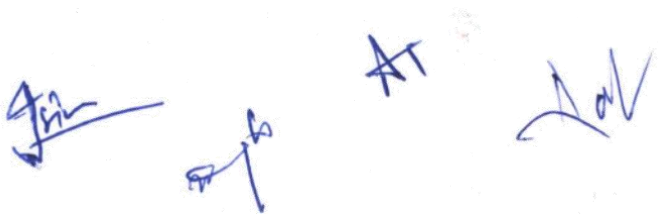
CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	1	3	1	1	1	3	3
CO2	3	3	2	2	1	1	3	3	3
CO3	3	3	2	2	1	1	3	3	3
CO4	2	3	1	1	1	1	3	3	2
CO5	3	2	2	2	1	2	3	3	3

Topics	Hands-on Practicals	Hour(s)
Study of Drawings	Study of specification data sheets of equipment and instrumentation. To prepare the specifications of the instruments/equipment required	20
	Panel Wiring diagrams including relay wiring and PLC wiring.	
Transmitters	Study of electronic transmitter, two wire system, 4-20 mA signal transmission and its trouble shooting	20
	Study of Pneumatic transmitter, 3-15 psi pneumatic signal transmission and its trouble shooting	
Final Control Elements	Study of control valves and their types, Control Valve accessories, Solenoid Valves, Fail safe shut down devices, Pneumatic and Digital Valve positioners /Control Valve Data Sheet, control Valve characteristics.	24
Preventive Maintenance	Preventive Maintenance scheduling, prepare Preventive maintenance Process list	16
	Preventive maintenance procedures like check for abnormal vibration, check for gland leak /instrument air leaks/ control valve bonnet and body flange leaks etc.	
Industrial safety	Hazard identification techniques (e.g., HAZOP, FMEA, etc.)	16
	Familiarization and importance of safety equipment in industrial scenario. Standards for equipment and enclosures in different	

	work areas	
Hydraulic and Pneumatic Systems	Familiarization with various parts of pneumatic systems such as compressor, regulator and lubricator	32
	To study 3/2 valve and 5/2 valve	
	To study single acting and doubling acting cylinder and Flow restriction valve	
	To study the use of Pneumatic Limit Switch	
	To study the Hydraulic Trainer Kit	
	To study the use of Hydraulic valve	
	To study hydraulic system using single acting and double acting cylinder	
	To study the practical application of Hydraulic system in stamping device	
	Total Hours	**128**

Recommended Books-

1. Donald P. Eckman, Automatic Process Control, Wiley.
2. Curtis D, Johnson , Process control instrumentation technology, Prentice Hall of India.
3. Frank Petruzella, Programmable logic controller, Mcgraw Hill.
4. George Stephanopoulos, Chemical Process Control , Prentice Hall of India.
5. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publisher.
6. Bela. G. Liptik, Process Control, Butterworth Heinemann.



Course Title : PLC and SCADA
Course Code : PCIE-302

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes (COs):
After successful completion of the course, the students should be able to
CO1: Explain the basics of PLC architecture and PLC programming.
CO2: Rewrite a PLC program for an automatic control system of a medium degree of complexity.
CO3: Illustrate the key components and functions of a SCADA system.
CO4: Describe the architecture, communication protocols, and data acquisition processes
CO5: Summarize applications of PLC and SCADA system for industrial automation.

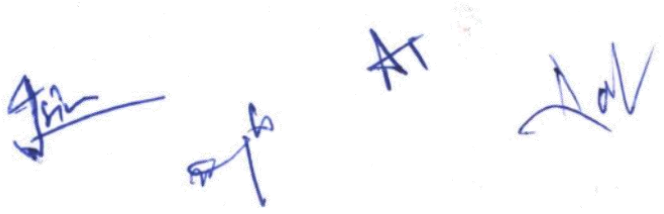
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	1	2	3	3	2	3	3	2
CO2	3	3	3	3	3	3	3	3	3
CO3	3	2	2	3	3	2	3	3	2
CO4	3	2	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction to Programmable Logic Controllers (PLC):** Definition, History of PLC, Advantages and disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC.	06
	PLC programming methodologies: Ladder diagram, Statement List (STL), functional block diagram, creating ladder diagram from process control descriptions, introduction to IEC61131 international standard for PLC.	08
	PLC functions: Bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer and Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and updown counter, counter examples, register basics.	10
Unit-2	**Introduction to SCADA Systems:** Definition and purpose of SCADA, Historical evolution and applications for automation, Scada Architecture, System Components, RTUs, PLCs, sensors, and I/O devices, Human-Machine Interface (HMI) and data acquisition software.	08

	Communication and Security in SCADA Systems: SCADA Server, Evolution of SCADA communication protocols, SCADA Communication protocols-Modbus, DNP3, Profibus, and IEC 61850, Introduction to SCADA Security.	08
	SCADA Applications: Case Studies of SCADA in power utilities, SCADA in manufacturing and process industries.	08
	Total Hours	**48**

Recommended Books-

1. John W. Webb and Ronald A. Reis, Programmable Logic Controllers - Principles and Applications, Prentice Hall Inc., New Jersey, 5th Edition, 2015.
2. R.G. Jamkar, Industrial Automation Using PLC SCADA & DCS, Global Education Limited; second edition. 2018.
3. Ronald L Krutz, Securing SCADA System, Wiley Publication, 2005, 1st Edition.
4. F. Petruzella, Programmable Logic Controllers, McGraw Hill,2023, 6th Edition.
5. K. S. Manoj, Industrial Automation with SCADA, Notion Press, 2019.
6. Gordon Clarke, Deon Reynders, Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems (IDC Technology), Newnes, 2004.
7. Mini S. Thomas, John Douglas McDonald, Power System SCADA and Smart Grids, CRC Press, 2017.



Course Title : Case Studies of Process Plants
Course Code : PEIE-302A

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Describe the working of different types of process equipment used in process plants.

CO2: Explain the basic block diagram, layout and P and ID diagram of process plants.

CO3: Identify the instrumentation and control used in different types of plants.

CO4: Describe the safety standards employed in process plants.

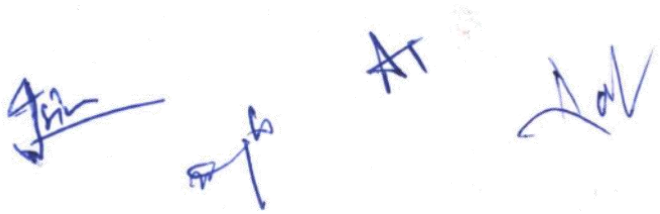
CO5: Relate the engineered solutions of real-world case studies.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSO's)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	3	2	-	-	2	1	3	3	2
CO2	3	2	-	-	-	1	3	3	3
CO3	1	3	3	1	2	1	3	3	3
CO4	3	2	2	1	3	1	3	3	3
CO5	2	3	2	2	3	3	3	3	3

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction:** Study of different types of distillation columns, boilers, chillers, reactors, heat exchangers, compressors etc.	08
	Practices in Industries: Introduction to P&ID diagram, symbols of chemical apparatus and equipment, importance of quality control in process industries, safety standards in process industries, hazardous areas and classification, non-hazardous areas.	08
	Thermal and Hydro Power Plant: Introduction to thermal power plant processes, importance of instrumentation in power generation – details of boiler processes, major P & I diagram for a boiler, introduction to hydro power plant processes, basics of hydro turbine.	08
Unit-2	**Petrochemical Industries:** Petroleum exploration, petroleum production, petroleum refining and its methods, parameters to be measured in petrochemical industry, instrumentation and control of petrochemical industries.	08
	Sugar and Food Industries: Necessity of instrumentation and control for food processing plants, measurements in food processing, block diagram, flow diagram, instrumentation and control of sugar plant.	08
	Paper and Pulp Plant: Raw materials for paper making, steps of paper making process, conventional measurements in wet end, conventional measurements in dry end, pumps and control valves used in paper industry.	08
	Total Hours	**48**

Recommended Books-

1. Noltingk B.E., Instrumentation Reference Book, Butterworth Heinemann, 2nd Edition, 1995.
2. Liptak B.G, Process Measurement and Analysis, Chilton Book Company, Radnor, Pennsylvania, 4th Edition, 2003.
3. Dr.Divya Prasad , Instrumentation and Control System, AICTE Continuity Education Program.
4. G. N. Pandey , A Textbook of Chemical Technology,vol I and II, Vikas Publishing House.
5. Gregory K. Mcmillan, Douglas M. Considine, Process/Industrial Instruments and Controls Handbook, 5th edition, McGraw-Hill Professional, 1999.
6. Waddams A. L, Chemical from petroleum, Butter and Janner Ltd., 1968.
7. Manabendra Bhuyan., Measurement and control in food processing, CRC/Taylor & Francis Publications, 2007.
8. E. J. Cole, William Harold Mehaffey. Pulp and Paper Mill Instrumentation, Lockwood Trade Journal Company. (1957).



Course Title : Instrumentation for Precision Agriculture
Course Code : PEIE-302B

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Acquire knowledge of precision agriculture tools.

CO2: Apply skills in data-driven farming.

CO3: Develop solutions for local agricultural challenges.

CO4: Implement agricultural data collection methods.

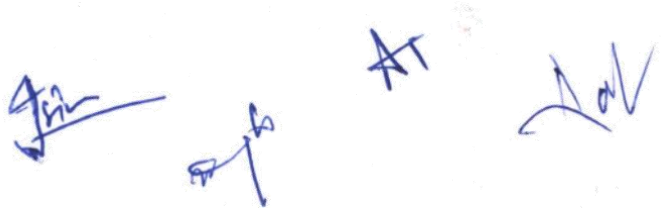
CO5: Acquire skills in using precision farming equipment.

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	1	2	3	1	3	3
CO2	2	3	3	3	3	3	3	3	3
CO3	3	2	2	2	2	1	1	3	1
CO4	2	1	2	2	2	2	2	2	2
CO5	2	2	3	1	3	1	1	3	2

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction to Precision Agriculture:** Definition and Concept of Precision Agriculture, Importance and Benefits of Precision Agriculture, Key Technologies in Precision Agriculture, Role of Sensors and Instrumentation, Challenges in Traditional Farming, Overview of Smart Farming Systems	12
	Sensors and Instrumentation in Agriculture: Introduction to Agricultural Sensors, Types of Sensors: Optical, Electrochemical, and Mechanical, Soil Moisture Sensors, Temperature and Humidity Sensors, Nutrient Sensing in Soil, Field Scanners and Crop Sensors	12
Unit-2	**Data Collection and Analysis:** Importance of Data in Precision Agriculture, Methods of Data Collection: Manual vs. Automated, Role of Drones in Data Collection, Remote Sensing Techniques for Crop Monitoring, Geographic Information Systems (GIS)	08
	Precision Farming Equipment and Machinery: Introduction to Precision Farming Equipment, GPS-Guided Tractors and Autonomous Machinery, Variable Rate Technology (VRT), Smart Irrigation Systems, Maintenance and Calibration of Agricultural Equipment	08
	Applications and Challenges of Precision Agriculture: Precision Irrigation Techniques, Weed and Pest Detection Using Sensors, Crop Health Monitoring with Imaging Sensors, Environmental Impact of Precision Agriculture, Challenges in Implementing Precision Agriculture	08
	Total Hours	**48**

Recommended Books-

1. Precision Agriculture Basics by D. Kent Shannon, David E. Clay, Newell R. Kitchen.
2. Precision Agriculture Technology for Crop Farming by Qin Zhang.
3. A Textbook on Precision Agriculture Technology by Kishore Chandra Swain.
4. Precision Farming Techniques for Protected Cultivation by R. SURESH, S.K. NIRALA.
5. Precision Agriculture for Sustainability and Environmental Protection by Margaret Oliver, Thomas Bishop, et al.



Course Title : Data Acquisition and Telemetry Systems
Course Code : PEIE-302C

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Explain the basics of data acquisition system

CO2: Describe how data is to be transmitted through different techniques.

CO3: Illustrate the working principle of data converters and data recorders.

CO4: Enumerate the applications of various data acquisition systems

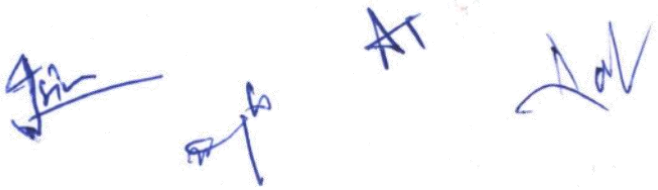
CO5: List the applications of telemetry for industry

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	1	1	1	-	1	-	1	3	3
CO2	1	2	2	1	1	1	1	3	2
CO3	2	2	2	1	1	-	1	2	-
CO4	1	2	1	-	1	-	1	2	1
CO5	1	2	2	1	1	1	1	1	-

Unit	Main Topics and Course Outlines	Hour(s)
Unit-1	**Introduction**: General concept, importance of data acquisition system (DAS) to instrumentation, components of analog and digital DAS, uses of DAS.	08
	Types of DAS: Single channel and multichannel DAS, computer based DAS.	04
	Data Transmission: Introduction to modulation and demodulation, analog and digital modulation techniques, amplitude, frequency and phase modulations. Pulse modulation Frequency division and time division multiplexing (FDM and TDM).	12
Unit - 2	**Converters:** Digital to analog converters (DAC), R-2R type and binary weighted type DAC, analog to digital converters (ADC), parallel type, dual slope type and successive approximation type ADCs.	08
	Recorders: Working principle, construction, operation and salient features of X-T strip chart recorder, X-Y strip chart recorder and magnetic recorder.	08
	Telemetry Systems: Definition, generalized block diagram of telemetry System, classification of telemetry system, voltage, current and position telemetry system, introduction to satellite telemetry and fiber optic telemetry system.	08
	Total Hours	**48**

Recommended Books-

1. A K Sawhney, “Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai, 2016.
2. D Patranabis, “Telemetry Principles”, Tata McGraw Hill., 1999.
3. E L Gruenberg, “Handbook of Telemetry & Remote Control”, Tata McGraw Hill, digitized 2007.
4. H S Kalsi, “Electronic Instrumentation and Measurement”,4 th edition, Tata McGraw Hill, 2019.
5. R N Baral, “Telemetry and Data Transmission”, S K Kataria and Sons, 2012.



Course Title : Biomedical Instrumentation and Design
Course Code : PEIE-304A

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Acquire knowledge about various biomedical instruments.

CO2: Develop the circuits for biomedical signal processing and filtering

CO3: Implement the circuits for signal analysis and biomedical image analysis

CO4: Identify the basic design problems in the field of biomedical instrumentation systems

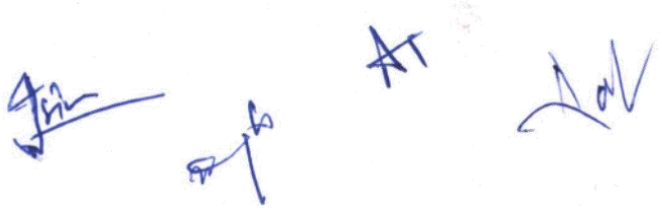
CO5: Acquire the knowledge about mathematics involved in the design of biomedical circuits

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	1	2	3	1	3	1
CO2	2	3	3	2	3	3	2	3	2
CO3	3	2	2	2	2	1	1	3	1
CO4	2	1	2	1	2	2	2	2	2
CO5	2	2	3	3	3	1	3	3	2

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction to Biomedical Instrumentation:** Definition and scope, Importance in healthcare and research, Impact on healthcare outcomes, Regulatory Aspects and Standards, FDA regulations and approvals, International standards (ISO, IEC) for medical devices.	12
	Sensors and Transducers: Introduction to Sensors and Transducers, Principles of operation, Types of Sensors, Resistive sensors, Capacitive sensors, Inductive sensors, Transduction Principles, Factors influencing sensor selection, range, resolution, linearity, hysteresis, etc.	08
Unit-2	**Signal Conditioning:** Basics of Signal Conditioning, Importance of signal conditioning in instrumentation, Amplification and Attenuation, Filtering Techniques, Sources of noise in biomedical signals, Noise reduction methods: shielding, grounding, averaging, etc.	12
	Bioelectric Signals: Introduction to Bioelectric Signals, Overview of bioelectric phenomena, Common bioelectric signals: ECG, EEG, EMG, etc., Electrode Types and Placement, Instrumentation for signal acquisition, Techniques for artifact reduction and elimination	08
	Medical Imaging: Principles of Medical Imaging, Overview of medical imaging modalities, X-ray Imaging, Basics of X-ray production and detection, radiography, fluoroscopy, CT.	08
	Total Hours	**48**

Recommended Books-

1. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer.
2. "Introduction to Biomedical Engineering" by John Enderle and Joseph Bronzino.
3. "Medical Instrumentation: Application and Design" by John G. Webster.
4. "Biomedical Sensors and Instruments" by Tatsuo Tagawa.
5. "Principles of Biomedical Instrumentation and Measurement" by Richard Aston.
6. "Medical Instrumentation: Accessibility and Usability Considerations" by Jack M. Winters.
7. "Biomedical Instrumentation: Technology and Applications" by R. Khandpur.
8. "Biomedical Instrumentation Systems" by Shakti Chatterjee.
9. "Biomedical Engineering: Bridging Medicine and Technology" by W. Mark Saltzman.
10. "Biomedical Signal Processing: Principles and Techniques" by Saeid Sanei and J. A. Chambers.



Course Title : Internet of Things: Fundamentals and Applications
Course Code : PEIE-304B

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:

After successful completion of course, the students should be able to:

CO1: Describe the internet of Things and its hardware and software requirement

CO2: Explain the interfacing of I/O devices, sensors & communication modules for different applications

CO3: Illustrate the role of various types of networking and communication protocols in IoT

CO4: Analyze the security concerns in the implementation of IoT and choose an appropriate framework

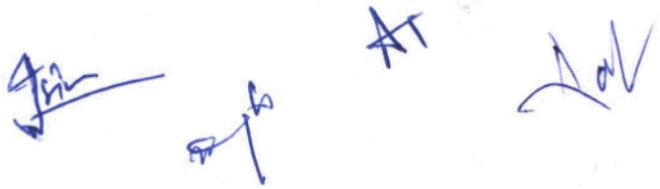
CO5: Develop a real-time IoT based projects

CO/PO Mapping:(Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	2	2	1	2	3	1
CO2	3	2	3	3	3	3	3	3	3
CO3	3	2	1	2	2	1	2	3	2
CO4	3	3	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	3	3	3

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Fundamentals of Internet of Things (IoT)**: Basics of IoT, history and evolution of IoT, basic building blocks, major components, architecture- SOA based and API oriented, recent trends in IoT, challenges in IoT implementation.	12
	Hardware Elements of IoT: Interfacing of I/O components, sensors and actuators-types, role of micro-controller and embedded systems in IoT, development boards-Arduino Uno and Raspberry pi, communication devices.	12
Unit-2	**IoT Protocols:** Simplified OSI model, network topologies, standards, types of internet networking – WiFi, local networking, Bluetooth, Bluetooth Low Energy (BLE), IoT network architecture and protocols, security concerns in the implementation of IoT.	12
	Applications of IoT: Role of IoT in industries, introduction of Industrial IoT, Case studies of IoT implementation: oil refineries, food packaging, and manufacturing industries.	12
	Total Hours	**48**

Recommended Books-

1. Joe Biron & Jonathan Follett, “Foundational Elements of an IoT Solution – The Edge, The Cloud and Application Development”, Oreilly, 1st Edition, 2016.
2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things, A Hands on Approach”, University Press.
3. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs.
4. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press.
5. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi.
6. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill.



Course Title : Building Automation
Course Code : PEIE-304C

L	T	P	Credits	Weekly Load
3	1	0	4	4

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Acquire the knowledge of dynamic performance of building processes and control strategies for better energy efficiency and building environmental performance.

CO2: Design and analyse the heating, ventilating and air conditioned (HVAC) system.

CO3: Implement control for building management.

CO4: Design and analyse fire alarm system (FAS) and various Security systems

CO5: Acquire the knowledge of energy management and calculate project life cycle.

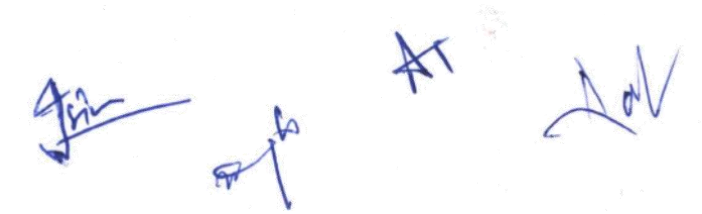
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Programme Outcomes (POs)/ Program Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	3	3	1	2	3	1	3	-
CO2	2	3	3	2	3	3	-	3	-
CO3	3	2	2	2	2	1	1	3	1
CO4	2	1	2	-	2	2	2	2	2
CO5	2	2	3	-	3	1	-	3	2

Unit	Main Topics & Course Outline	Hour(s)
Unit-1	**Introduction to Heating, Ventilating and Air Conditioned (HVAC) System:** Introduction to HVAC, Basic Processes: Heating, cooling, ventilation, Air Properties & Psychrometric Chart, Human Comfort: Basic understanding of comfort zones, Heat Loss & Applications: Overview of heating and cooling systems, Ventilation: Key systems like central fans, AHU, VAV, FCU.	12
	Control Theory: Overview of instrumentation basics, field components, Direct Digital Control (DDC), System Architecture, Introduction to Honeywell Architecture and BMS components, Simplified explanation of HVAC control panel and MCC, Basics of BACnet, Modbus, and LON.	12
Unit-2	**Fire Alarm System (FAS):** Fire Alarm System Fundamentals: Introduction to fire modes, components, and operation, FAS Components, FAS Architecture (conventional vs. addressable), FAS Loops, Classification of loops and basic power supply design, Fire Standards, Overview of NFPA, BS, and IS.	08
	Energy Management: Energy management: advantages of building management (BMS), energy Savings concept & methods, lighting control, building efficiency improvement, green building concept & examples.	08
	Applications: Project life cycle: Integrated BMS (IBMS) (HVAC, Fire & Security) project cycle, project steps BMS verticals: applications of BMS, examples	08

	integration: IBMS architecture, normal & emergency operation.	
	Total Hours	**48**

Recommended Books-

1. Chartered Institution of Building Services Engineers, “Building Control Systems, Applications Guide”, Butterworth-Heinemann Ltd, 2000.
2. In Partnership with NJATC, “Building Automation: Control Devices and Applications”, Amer Technical Pub, 2008.
3. John E. Traister, “Security/Fire Alarm Systems: Design, Installation, and Maintenance”, 2nd sub edition, McGraw-Hill, 1995.
4. John I. Levenhagen, “HVAC Control System Design Diagrams”, New edition, McGraw-Hill Professional, 1998.
5. John J. McGowan, “Building Automation Online”, Fairmont Press, 2004.
6. Michael F. Hordeski, “HVAC Control in the New Millennium”, Prentice Hall, 2001.
7. Robert M Gagnon, “Design of Special Hazards and Fire Alarm Systems”, 2nd edition, Thomson Delmar Learning, 2007.
8. Reinhold A. Carlson, Robert A. Di Giandomenico, “Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs)”, R.S. Means Company, 1991.



Course Title : Industrial Automation and Safety
Course Code : OEIE-302

L	T	P	Credits	Weekly Load
3	0	0	3	3

Course Outcomes:
After successful completion of course, the students should be able to

CO1: Understand the basics of PLC architecture and PLC programming.

CO2: Develop a PLC program for an automatic control system of a medium degree of complexity

CO3: Understand the Distributed Control System and illustrate the different parts .

CO4: Discuss automation system as network communication and safety and protection against interference.

CO5: Understand the safety standards, workplace injury prevention and incident investigation.

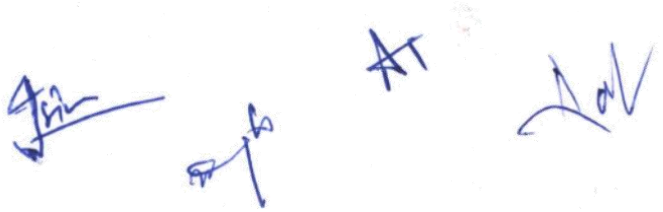
CO/PO Mapping : (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	2	-	-	2	-
CO2	-	3	3	-	-	-	3	-	-
CO3	1	-	-	3	3	2	1	3	3
CO4	3	2	-	2	-	2	2	-	3
CO5	-	-	2	2	-	3	-	2	2

Unit	Main Topics & Course Outlines	Hour(s)
Unit-1	**Introduction to Programmable Logic Controllers:** PLC versus relay – characteristic functions of a PLC – PLC versus PC, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC, input and output module (discrete and analog), Different types of PLC – system installation recommendations	08
	PLC programming methodologies: Types of PLC software – programming languages – ladder programming Ladder diagram, STL, functional block diagram, creating ladder diagram from process control descriptions.	08
	PLC functions: Bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up-down counter, counter examples, register basics..	08
Unit-2	**Introduction to Supervisory Control and Data Acquisition (SCADA) system:** PLC versus SCADA verse DCS, elements of SCADA system block diagram, – communication in SCADA – SCADA hardware and Software, applications.	12
	Area classification and Intrinsic Safety: Need – safety provisions in the factory	12

	Act-Laws related to the industrial safety, Measurement of safety performance, injury and accidents, prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, NEMA enclosures, Ingress Protection, Purging and intrinsic safety.	
	Total Hours	**48**

Recommended Books-

1. W.Bolton, Programmable Logic Controllers, 4th edition, ELSEVIER.
2. Frank Petruzella, Programmable Logic Controllers, 6th Edition, Mcgrew Hill.
3. Gary Dunning, Introduction to Programmable Logic Controllers, Cengage.
4. DOEBLIN: Measurement Systems: Application and Design, TMH.
5. Thomas J. Anton, Occupational Safety and Health Management, McGraw Hill,1979.
6. Olushola Akande, Industrial Automation from Scratch, Packt Publishing, 2023.



Course Title : Computer Programming Lab
Course Code : PCIE-304

L	T	P	Credits	Weekly Load
0	0	2	1	2

Course Outcomes:

After successful completion of course, the students should be able to

CO1: Understand fundamental programming concepts.

CO2: Apply problem-solving techniques using programming.

CO3: Design algorithms and write efficient code.

CO4: Utilize standard libraries and debugging tools.

CO5: Develop basic programs for real-world applications.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation):									
COs	**Programme Outcomes (POs)/ Programme Specific Outcomes (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	2
CO2	3	2	1	-	1	-	2	3	3
CO3	3	-	-	1	-	-	2	-	3
CO4	3	2	-	-	-	2	-	1	-
CO5	2	1	3	-	-	3	-	2	2

List of Practicals:

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate ofInterest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formulaC/5= (F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to thefollowing criteria:

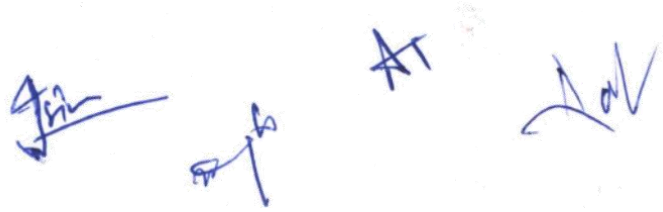
    Between 90-100%---------- Print ‘A’

    80-90%----------Print ‘B’

    60-80%----------Print ‘C’ Below 60% Print ‘D’
11. WAP that takes two operands and one operator from the user and perform the operation and

prints the result by using Switch statement.

12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order n x n.
27. WAP that finds the sum of diagonal elements of an m x n matrix.
28. WAP to implement strlen (), strcat (), strcpy () using the concept of Functions.



Course Title : Major Project
Course Code : PRIE-302

L	T	P	Credits	Weekly Load
0	0	8	4	8

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Apply knowledge from core subjects to solve a real-world problem within their field of study.

CO2: Develop a project plan, define clear objectives, and manage resources efficiently to meet project deadlines.

CO3: Work effectively as a part of a team and demonstrating communication skills to achieve common project goals.

CO4: Demonstrate the ability to use appropriate tools, techniques, and technologies relevant to the project's domain.

CO5: Present project results effectively, both orally and in writing, to various audiences, including peers, faculty, and external evaluators.

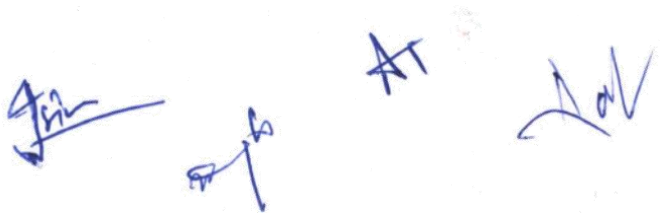
CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	3	-	3	1	3	3	1
CO2	1	3	3	2	1	3	2	1	-
CO3	1	-	1	1	3	3	3	-	1
CO4	2	1	2	3	-	1	3	3	2
CO5	3	2	-	2	2	2	3	2	-

Rubrics

Mid-Semester Evaluation : 50 Marks
Final Evaluation : 50 Marks

	Assessment Matrix	**Excellent (81% - 100%)**	**Good (61% - 80%)**	**Satisfactory (41% - 60%)**	**Not-satisfatory (less than 41%)**	**Marks Distribution**
Mid-Semester Evaluation	**Problem identification & objectives**	Problem is clearly defined with precise and measurable objectives	Problem is defined, but objectives are somewhat incomplete	Problem is defined, but objectives are unclear	Problem is not clearly defined, and objectives are unclear	10
	Novelty	Highly creative and innovative approach, with novel solutions	Adequate creativity with some original ideas	Limited creativity	No new ideas or innovation presented	10
	Appropriate coverage of project work	Objectives achieved as per time frame	Presence of minor flaws	Presence of major flaws	Objectives not achieved as per time frame	10
	Presentation	Contents of	Presentation is	Presentation is	Contents of	20

		presentations are appropriate and well delivered	appropriate, but could be better structured	unclear in parts	presentations are not appropriate and not well delivered	
Final Evaluation	**Technical Implementation**	High-level technical implementation with excellent execution	Good technical skills and executed with minor errors	Satisfactory technical skills and executed partially	Poor technical skills with major errors in implementation	20
	Presentation	Contents of presentation are appropriate and well delivered	Presentation is appropriate, but could be better structured	Presentation is unclear in parts	Contents of presentation are not appropriate and not well delivered	15
	Project Report	Complete and well-organized report	Report with minor omissions or errors	Report with partial data and results	Incomplete or poorly written report	15
					Total Marks	**100**



Course Title : Seminar
Course Code : SEIE-302

L	T	P	Credits	Weekly Load
1	0	0	1	1

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Demonstrate effective oral communication skills through the preparation and presentation of seminar.

CO2: Independently research, gather, and critically analyze the relevant information from various sources on a given topic.

CO3: Create well-structured, engaging presentations that effectively convey their findings to an audience.

CO4: Exhibit improved time management and organizational skills by preparing and delivering their seminar within the given time frame.

CO5: Apply critical thinking to evaluate information, draw conclusions, and present logical arguments during the seminar.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	1	-	-	2	3	-	-
CO2	1	2	3	1	1	3	1	-	1
CO3	-	1	1	-	-	2	1	-	-
CO4	-	1	1	-	1	3	2	-	-
CO5	1	2	2	2	1	1	2	-	-

Rubrics

Assessment Matrix	Excellent (81% - 100%)	Good (61% - 80%)	Satisfactory (41% - 60%)	Not-satisfatory (less than 41%)	Marks Distribution
Content of the subject	In-depth understanding and accurate content	Relevant and mostly accurate content	Content is somewhat accurate, but lacking in depth	Incorrect content	30
Presentation Skills	Highly confident, clear voice, maintains good eye contact	Confident with clear voice, some minor issues in delivery	Adequate delivery, but lacks confidence or clarity	Poor presentation with lack of clarity or confidence	30
Language Proficiency	Fluent, uses accurate vocabulary and grammar	Good language skills with minor errors	Adequate language proficiency with noticeable errors	Poor language skills, frequent grammar or vocabulary errors	20
Questions & Answers (Q&A)	Handles Q&A effectively, demonstrates critical thinking	Handles most questions well, some difficulty	Answers basic questions, struggles with critical ones	Fails to handle questions or shows lack of critical thinking	20
				Total Marks	**100**

Course Title : Industrial Automation Specialist
Course Code : QPIE-302

L	T	P	Credits	Weekly Load
0	0	8	1	8

Course Outcomes (COs):
After successful completion of the course, the students should be able to
CO1: Discuss the architecture of industrial automation system.
CO2: Explain the industrial data communication protocols.
CO3: Interpret the ladder logic diagrams.
CO4: Implement the ladder logic code to make working projects.
CO5: Choose the appropriate tools and methodology.

CO/PO Mapping: (Strong(3) / Medium(2) / Weak(1) indicates strength of correlation)									
COs	**Program Outcomes (POs)/Program Specific Outcome (PSOs)**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	1	2	1	1	1	1	1
CO2	2	2	1	2	2	1	1	2	1
CO3	3	1	1	2	1	1	2	3	2
CO4	1	2	3	3	2	2	2	3	3
CO5	3	3	3	3	3	2	3	2	3

Topics	Hands-on Practical	Hour(s)
Basic architecture of industrial automation system	The Functional Elements of Industrial Automation	24
	Basics of Industrial Actuator Systems	
	Basics of Sequence / Logic Control, Supervisory Control, Production Control, Ratio control, Cascade, Override and Split Range Control	
	The Architecture of Elements: The Automation Pyramid	
Data communication	Introduction to Industrial Communication	32
	Introduction to OSI model	
	RS-232, RS-485 Protocols	
	Common Industrial Communication Protocols: HART (Highway Addressable Remote Transducer), Modbus, PROFIBUS (Process Field Bus), PROFINET (Process Field Net) Ethernet/IP (Ethernet Industrial Protocol)	
Programmable logic controllers	Familiarization with the parts, working and programming of PLCs	36
	Demonstration of PLC based pick and place module	
	Demonstration of PLC based sorting module	
	Demonstration of PLC based stamping module	
	To write a program for Car Parking	
	Write a program and interface simulated hardware unit	

	of Tank level control	
	Write a program to control a traffic light using PLC	
	Write a program to control an elevator using PLC	
	Write a program to control a conveyer belt using PLC	
	Write a program to control a speed of DC motor using PLC	
Internet of Things	Study of Arduino UNO R3 and functioning of various pins	36
	Interfacing and displaying data on a 4-digit 7-segment LED display with the Arduino UNO	
	To interface and control the Stepper Motor with Arduino UNO	
	Interfacing and displaying data on 16 X 2 LCD with the Arduino UNO	
	Fire detection using Arduino UNO and flame sensor	
	To control the direction and speed of DC Geared motor using Arduino	
	Obstacle detection using IR Sensor and Arduino	
	Interfacing and programming of RFID Sensor with Arduino	
	Measuring room temperature and humidity by using DHT11 sensor with Arduino	
	Distance measurement using ultrasonic sensor with Arduino	
	To measure the light intensity using an LDR with Arduino	
	Interfacing of Matrix Keypad with Arduino UNO to read the inputs	
	Total Hours	**128**

Recommended Books-

1. Olushola Akande, “Industrial Automation from Scratch”, Packt Publishing, 2023.
2. Deon Reynders, Steve Mackay, Edwin Wright, "Practical Industrial Data Communications: Best Practice Techniques", Elsevier, 2005.
3. Webb, John W., Programmable logic controllers: principles and applications, Prentice Hall, 1995.
4. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, Orient Blackswan Private Limited - New Delhi, 2015.