GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN
JODHPUR

SEMESTER SCHEME-2020-21

(SESSION 2021-2022 & ONWARDS)

TEACHING AND EXAMINATION SCHEME AND SYLLABUS

INSTRUMENTATION ENGINEERING

(IE)

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Curriculum Development Cell
Board of Technical Education, Rajasthan
W-6 Residency Road,
Jodhpur

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA **IIISEMESTER (INSTRUMENTATION ENGINEERING) (IE)**
SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TUAssi	PR(S)		
PC	IE3001	Instrumentation	3	0	0	3	60	3	–	–	20	20	–	100	3
PC	IE3002	Electronic Devices& Circuits	3	0	0	3	60	3	–	–	20	20	–	100	3
PC	IE 3003	Basic Digital Electronics	3	0	0	3	60	3	–	–	20	20	–	100	3
PC	IE3004	Electrical Engineering and Measurements	3	0	0	3	60	3	–	–	20	20	–	100	3
PC	IE 3005	Network Analysis	2	1	0	3	60	3	–		20	20	–	100	3
PC	IE3006	Instrumentation Lab	0	0	2	2	–	–	40	–	–	–	60	100	1
PC	IE3007	Electronic Devices & CircuitsLab	0	0	2	2	–	–	40	–	–	–	60	100	1
PC	IE3008	Basic Digital Electronics Lab	0	0	2	2	–	–	40	–	–	–	60	100	1
PC	IE3009	Electrical Engineering and Measurements Lab	0	0	2	2	–	–	40	–	–	–	60	100	1
SI	IE3010	Summer Internship-I(4 weeks after II Sem)	–	–	–	–	–	–	100	–	–	–	–	100	2
VS	+IE3333	Anandam	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**14**	**1**	**12**	**27**	**300**		**260**		**100**	**100**	**340**	**1100**	**23**
													Grand Total :	**1100**	**23**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +IE 3333 is same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN
GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA **IV SEMESTER (INSTRUMENTATION ENGINEERING)(IE)**
SESSION 2021-2022& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs.	CT	TU/ Assi	PR(S)		
PC	IE4001	Industrial Instrumentation	3	0	0	3	60	3	–	-	20	20	–	100	3
PC	IE4002	Transducers and Telemetry	3	0	0	3	60	3	–	-	20	20	–	100	3
PE	IE4003	**Programme Elective I** IE40031- Control System Components IE40032- Industrial Automation	3	0	0	3	60	3	–	-	20	20	–	100	3
PE	IE4004	**Programme Elective II** IE 40041- Analytical and Environmental Instruments IE 40042- Optical Instruments and Devices	3	0	0	3	60	3	–	-	20	20	–	100	3
PC	IE4005	'C' Programming Lab	0	0	6	6	–	–	40	3	–	–	60	100	3
PC	IE4006	Industrial Instrumentation Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
PC	IE4007	Transducers and Telemetry Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
PE	IE4008	**Programme Elective I Lab** IE40081- Control System Components Lab IE40082- Industrial Automation Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
PE	IE4009	**Programme Elective II Lab** IE 40091- Analytical and Environmental Instruments Lab IE 40092- Optical Instruments and Devices Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
PR	IE4010	Minor Project	0	0	4	4	--	--	40	--	--	--	60	100	2
AU	+IE 4222	Essence of Indian Knowledge and Tradition	2	0	0	2		--	--	--	--	--	--	--	0
VS	+IE 4444	Anandam	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**14**	**00**	**22**	**36**	**240**		**240**		**160**	**00**	**460**	**1100**	**23**
													Grand Total :	**1100**	**23**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +IE4222 and +IE 4444 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note:Students will go for 6 Weeks Summer Internship in the Summer Vacations after Fourth Semester. The assessment of the Summer Internship will be done in Fifth Semester

GOVERNMENT OF RAJASTHAN
BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
TEACHING AND EXAMINATION SCHEME
(SEMESTER SCHEME-2020-21)
FOR DIPLOMA V SEMESTER (INSTRUMENTATION ENGINEERING)(IE)
SESSION 2022-2023& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time				Distribution of Max. Marks/ Duration							Total Marks	Credits
			Hours per week				End Semester Exam				Internal Assessment				
			L	T	P	Tot	TH	Hrs.	PR	Hrs	CT	TU/Assi	PR(S)		
PC	IE5001	Control Theory	2	1	0	3	60	3	–	-	20	20	–	100	3
PC	IE 5002	Power and Industrial Electronics	3	0	0	3	60	3	–	-	20	20	–	100	3
OE	+IE 5100	**Open Elective-I** +IE 51001- Economic Policies in India +IE 51002- Engineering Economics & Accountancy	3	0	0	3	60	3	–	-	20	20	–	100	3
PE	IE 5003	**Programme Elective III** IE50031- Microcontroller and Applications IE50032- Bio-Medical Instrumentation	3	0	0	3	60	3	–	-	20	20	–	100	3
PE	IE 5004	**Programme Elective IV** IE50041- Embedded Systems IE50042- Signal Conditioning	3	0	0	3	60	3	–	-	20	20	–	100	3
PC	IE5005	Applied Instrumentation	2	1	0	3	60	3	-	-	20	20	–	100	3
PC	IE 5006	Power and Industrial ElectronicsLab	0	0	2	2	–	–	40	3	–	–	60	100	1
PE	IE5007	**ProgrammeElective III Lab** IE50071- Microcontroller and Applications Lab IE50072 Bio-Medical Instrumentation Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
PE	IE 5008	**ProgrammeElective IV Lab** IE50081- Embedded Systems Lab IE50082- Signal Conditioning Lab	0	0	2	2	–	–	40	3	–	–	60	100	1
SI	IE5009	Summer Internship-II(6 weeks after IV Sem)	0	0	0	0	–	–	100	-	–	–	–	100	3
PR	IE 5010	Major Project	0	0	2	2	–	–	–	-	–	–	–	–	--
VS	+IE 5555	Anandam	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**16**	**2**	**12**	**30**	**360**		**220**		**120**	**120**	**280**	**1100**	**26**
													Grand Total :	**1100**	**26**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +IE 51001, +IE51002 and+IE 5555 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

Note:Major Project will be continued and Assesed in VI Semester

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

TEACHING AND EXAMINATION SCHEME

(SEMESTER SCHEME-2020-21)

FOR DIPLOMA **VI SEMESTER (INSTRUMENTATION ENGINEERING) (IE)**

SESSION 2022-2023& ONWARDS

Subject Category	Subject Code	Subjects	Distribution of Time Hours per week				Distribution of Max. Marks/ Duration End Semester Exam				Internal Assessment			Total Marks	Credits
			L	T	P	Tot	TH	Hrs	PR	Hrs	CT	TU/Assi	PR(S)		
HS	+IE 6111	Entrepreneurship and Startups	3	1	0	4	60	3	–	–	20	20	—	100	4
OE	+IE 6200	**Open Elective-II** +IE 62001- Project Management +IE 62002- Renewable Energy Technologies	3	0	0	3	60	3	–	–	20	20	—	100	3
OE	+IE 6300	**Open Elective-III** +IE 63001- Product Design +IE 63002- Disaster Management	3	0	0	3	60	3	–	–	20	20	–	100	3
AU	+IE 6333	Indian Constitution	2	0	0	2	–	–	–	–	–	–	–	–	0
PC	IE 6001	Process Controller	3	0	0	3	60	3	–	–	20	20	—	100	3
PC	IE 6002	Process ControllerLab	0	0	4	4	–	–	40	3	–	–	60	100	2
PR	IE 6003	Major Project	0	0	6	6	--	--	40	--	--	--	60	100	4
SE	IE 6004	Seminar	1	0	0	1	–	–	–	–	–	–	100	100	1
VS	+IE 6666	Anandam	--	--	1	1	--	--	--	--	--	--	100	100	2
		Students Centered Activities	0	0	3	3	--	--	--	--	--	--	--	--	--
		Total	**15**	**1**	**14**	**30**	**240**	**--**	**80**		**80**	**80**	**320**	**800**	**22**
													Grand Total :	**800**	**22**

1. L : Lecture
2. T : Tutorial
3. P : Practical
4. TH : Marks for End Semester Exam for Theory
5. PR : Marks for End Semester Exam for Practical
6. CT : Marks for class tests (Internal Assessment)
7. TU/Assi : Marks for tutorials/Assignment (Internal Assessment)
8. PR(S) : Marks for practical and viva (Internal Assessment)

1. +IE 6111, +IE 62001, +IE 62002, +IE 63001, +IE 63002, +IE 6333 and +IE 6666 are same in all branches of Engineering

Student Centered Activities will be graded as A, B, C & D on the basis of attendance and interest of the student in learning.

GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

III SEMESTER

(SESSION 2021-2022 & ONWARDS)

INSTRUMENTATION

Course Code	IE 3001
Course Title	INSTRUMENTATION
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Electronic measuring instruments are used in industrial processes for the purpose of measurement and control of plant process parameters. An engineer is required to work and handle these instruments for satisfactory operation of the plant. This subject is introduced to cover some basic aspects of electronic measuring instruments.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the basic principles, construction and working of measuring instruments.
2. Identify and optimally choose the most modern measuring instrument suitable for plant process parameter.
3. Identify and use various testing instruments for signal analysis.
4. Understand the basic principle, construction and working of digital measuring instruments.

CONTENTS

1. Multimeter

- 1.1 Principle of measurement of
  - 1.1.1 D.C. Voltage and current
  - 1.1.2 A.C. Voltage and current
  - 1.1.3 Resistance
- 1.2 AC and DC sensitivity
- 1.3 Calculation of shunt and multiplier for range extension
- 1.4 Loading effect
- 1.5 Specifications

2. Electronic Voltmeter

- 2.1 Characteristics and specification of different analog electronic voltmeters
- 2.2 Circuits for DC voltmeter using BJTs and FETs (single device and balanced bridge type)
- 2.3. Ramp type Digital Volt Meter
- 2.4 Integrating type Digital Volt Meter

3. Cathode Ray Oscilloscope

- 3.1 Block diagram of CRO
- 3.2 Construction of CRT
- 3.3 Deflection sensitivity and various controls
- 3.4 Detail of X-Y section and delay line
- 3.5 Horizontal sweep section
- 3.6 Synchronization of sweep and triggered sweep
- 3.7 Measurement of voltage, current frequency and phase angle using CRO
- 3.8 CRO probe

4. Working Principle and Application of

- 4.1 Q-meter
- 4.2 Digital frequency counter
- 4.3 LCR Bridge
- 4.4 Output power meter (AF)
- 4.5 Function Generator

5. Signal Generation

- 5.1 Sine wave generators,

5.2 Frequency synthesized signal generators
5.3 Sweep frequency generators
5.4 Special waveform generators.

REFERENCE BOOKS

1. A Course in Electrical & Electronics Measurement & Instruments	A.K. Sawhney
2. Modern Electronic Instrumentation & Measurement Techniques	W.D. Cooper
3. Electronic Instrumentation Fundamentals	Malvino
4. Electronic Measurement	Ternan Pettit
5. Electronic Measurement & Instrumentation	J.G. Joshi
6. Electronic Measurements and Instrumentation	Oliver and Cage
7. Electrical and Electronics Measurement and Instrumentation	P.Pukrait, B.Biswas,S. Das, C. Koley

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ELECTRONIC DEVICES AND CIRCUITS

Course Code	IE 3002
Course Title	ELECTRONIC DEVICES AND CIRCUITS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

This subject covers the basic concepts of electronic devices and circuits for engineers. There is a lot of electronics embedded in every device and instrument these days. The subject consists of fundamental concepts of electronics which helps the student to understand the proper functioning of these instruments used in instrumentation engineering.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:
1. Analyze different types of semiconductor devices.
2. Understand the operation and design of SCR, DIAC, TRIAC, amplifier and oscillator.

CONTENTS

1. Semiconductor and Diodes
- 1.1 Definition, Extrinsic/Intrinsic, N-type &P-type
- 1.2 PN Junction Diode – Forward and Reverse Bias Characteristics
- 1.3 Zener Diode – Principle, characteristics, construction, working
- 1.4 Diode Rectifiers – Half Wave and Full Wave

2. Bipolar Junction Transistor (BJT)
- 2.1 NPN and PNP Transistor – Operation and characteristics
- 2.2 Common Base Configuration – characteristics and working
- 2.3 Common Emitter Configuration – characteristics and working
- 2.4 Common Base Configuration – characteristics and working

3. Field Effect Transistors
- 3.1 FET – Working Principle, Classification
- 3.2 MOSFET Small Signal model
- 3.3 N-Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode

4. Amplifiers and Oscillators
- 4.1 Feedback Amplifiers – Properties of negative feedback, impact of feedback on different parameters
- 4.2 Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt
- 4.3 Oscillator – Basic Principles, Hartley Oscillator, Colpitts Oscillator, Crystal Oscillator.

REFERENCE BOOKS

1. Analog Circuits	A.K. Maini
2. Electronic Devices and Circuits	S. Salivahanan and N. Suresh Kumar
3. Electronics Devices and circuit theory	Boyestad&Nashelsky
4. Electronic Principles	Albert Malvino& David Bates
5. Electronics Devices & Circuits	Jacob Millman

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BASIC DIGITAL ELECTRONICS

Course Code	IE 3003
Course Title	BASIC DIGITAL ELECTRONICS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Basic digital electronics is the requirement of modern computer, microprocessor and digital communication systems. On account of reliability and accuracy, digital electronic systems are replacing conventional analog systems at a very fast pace. A diploma student having knowledge of digital systems will be of immense use to the industry.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the different number systems and conversion of numbers between them.
2. Understand the concept of Boolean algebra and related rules and theorems.
3. Understand concepts of logic gates and combinational and sequential circuits.
4. Know the concepts of memory organization in digital devices.

CONTENTS

1. Number Systems & Boolean Algebra

1.1 Introduction to different number systems – Binary, Octal, Decimal, Hexadecimal
1.2 Conversion from one number system to another
1.3 Boolean variables – Rules and laws of Boolean Algebra
1.4 De-Morgan's Theorem
1.5 Karnaugh Maps and their use for simplification of Boolean expressions

2. Logic Gates

2.1 Logic Gates – AND, OR, NOT, NAND, NOR, XOR, XNOR: Symbols and truth table
2.2 Implementation of Boolean expressions and Logic Functions using Logic Gates Simplification of expressions

3. Combinational Logic Circuits

3.1 Arithmetic Circuits – Addition, Subtraction, 1's 2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders
3.2 Encoder, Decoder
3.3 Multiplexer – 2 to 1, 4 to 1 and 8 to 1 multiplexers
3.4 Demultiplexer – 1 to 2, 1 to 4 and 1 to 8 demultiplexers

4. Sequential Logic Circuits

4.1 Flip Flops – RS, JK, MS JK, D and T flip flops
4.2 Edge and Level Triggering
4.3 Counters – Up-Down Counters, Asynchronous/ Ripple Counter, Decade Counter- Mod3, Mod 7 Counter, Ring Counter
4.4 Shift Register: Serial In - Serial Out, Serial in - Parallel Out, Parallel In - Serial Out,Parallel In - Parallel Out

REFERENCE BOOKS

1. Analog Circuits	A.K. Maini
2. Electronic Devices and Circuits	S. Salivahanan and N. Suresh Kumar
3. Electronics Devices and circuit theory	Boyestad&Nashelsky
4. Electronic Principles	Albert Malvino& David Bates
5. Electronics Devices & Circuits	Jacob Millman
6. Digital principles & Applications	Albert Paul Malvino& Donald P. Leach
7. Digital Electronics	R. Anand

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ELECTRICAL ENGINEERING AND MEASUREMENTS

Course Code	IE 3004
Course Title	ELECTRICAL ENGINEERING AND MEASUREMENTS
Number of Credits	3 (L:3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

This course aims to familiarize the students about the basic principles of electrical engineering, electrical machines and most generally used instrument for measurement of electrical quantity in industry. This curriculum helps them to operate the machines and different measuring instruments.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the principles of D.C. and A.C. machines.
2. Know about three phase electrical circuits.
3. Understand the concepts of bridge circuits and their use.
4. Understand different measuring instruments and to change their measuring ranges.

CONTENTS

1. D.C. Machine

1.1 Principle of D.C. motor
1.2 Construction of D.C. motor
1.3 Back EMF, speed, torque and power relationship
1.4 Characteristics of D.C. motor
1.5 Type and application of D.C. motor
1.6 Need of motor starter
1.7 Three Point starter

2. A.C. Machine

2.1 Construction and Principle of Operation of
2.2 Single phase transformer
2.3 Three phase induction motor

3. Polyphase Circuit

3.1 Need of Three Phase Circuit
3.2 Star delta connection
3.3 Current, voltage and power relation for star delta connection
3.4 Simple problems on star delta circuit (Balanced Circuit)

4. A.C. Bridges

4.1 Generalized treatment of four arm A.C. bridges
4.2 Maxwell's inductance and capacitance bridges
4.3 Schering bridge
4.4 De-Sauty's bridge
4.5 Wein's bridge

5. Measuring Instruments

5.1 Classification of measuring instruments
5.2 General consideration of torques employed in indicating type instruments (deflection torque, controlling torque, damping torque)
5.3 Construction and working of voltmeter and ammeter
    5.3.1 Moving iron type
    5.3.2 Moving coil type

5.4 Construction and working of Dynamometer type wattmeter
5.5 Construction and working of Induction type energy meter
5.6 Construction and working of Megger

6. Range Extension and Calibration

6.1 Significance of range extension
6.2 Use of series and shunt multipliers
6.3 Instrument transformer for range extension
6.4 Working principle of D.C. Potentiometer
6.5 Calibration method of ammeter and voltmeter (D.C.) by potentiometer
6.6 Simple problems

REFERENCE BOOKS

1. A Course in Electrical Engineering	K.D. Sharma
2. Electrical Technology	S.L. Uppal
3. Electrical Technology	J.B. Gupta
4. Electrical & Electronics Measurements& Instrumentation	A.K. Sawhney
5. Electrical Machine	I.J. Nagpal
6. Electrical Technology	B.L. Thareja

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NETWORK ANALYSIS

Course Code	IE 3005
Course Title	NETWORK ANALYSIS
Number of Credits	3 (L: 2, T: 1, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Analysis of any electronics circuit is essential for any electronics engineer. To analyze any circuit, the knowledge of network elements and their behavior, different types of networks and networks configuration is essential. Different network theorem and laws guide the proper way to analyze the networks. Laplace transformation helps an engineer to reduce the mathematical calculations.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Calculate voltages and currents in different parts of a circuit using KVL / KCL and several other theorems.
2. Use Laplace transformation techniques to prepare mathematical models of electrical circuits.
3. Handle multi-portal electrical networks analytically.

CONTENTS

1. General Network Concept

- 1.1 Network Elements (Definition and examples) - Active and passive, Linear and non-linear, Unilateral and bilateral, Lumped and distributed
- 1.2 Voltage and current sources (ideal and practical)
- 1.3 Source conversion techniques
- 1.4 Kirchhoff's Voltage and Current laws
- 1.5 Simple problems up to three variables using Cramer's rules

2. Laplace Transformation

- 2.1 Introduction to Laplace transformation
- 2.2 Laplace transform of -
  - 2.2.1 Unit step function
  - 2.2.2 Ramp function
  - 2.2.3 Exponential function
  - 2.2.4 Sinusoidal functions
  - 2.2.5 Parabolic function
  - 2.2.6 Derivative of a function
  - 2.2.7 Integral of a function
- 2.3 Laplace transform theorems
  - 2.3.1 Shifting theorem
  - 2.3.2 Initial and final value theorem
- 2.4 Inverse Laplace transformation for simple, multiple and conjugate complex roots.
- 2.5 Application of Laplace transformation for simple RL, RC and RLC series circuits with D.C. excitation

3. Network Theorems

Statement and simple numerical problems related to

- 3.1 Superposition theorem
- 3.2 Thevenin's theorem
- 3.3 Norton's theorem
- 3.4 Millman's theorem
- 3.5 Maximum power transfer theorem
- 3.6 Star Delta transformation

4. Two Port Networks

4.1 Introduction
4.2 Open circuit impedance (Z) parameters
4.3 Short circuit admittance (Y) parameters
4.4 Hybrid (h) parameters (only definition)
4.5Determination of Z and Y parameters

5. Resonance

5.1 Series resonance in uncoupled circuits - Definition, reactance curves, resonance condition, selectivity and bandwidth
5.2 Q factor, Q factor on energy basis

REFERENCE BOOKS

1. Engineering Circuit Analysis	W. H. Hayt, J. E. Kemmerly
2. Network Analysis	Van Valkenburg
3. Electric Circuits	Joseph Edminister
4.A Course in Circuit Analysis	Soni & Gupta
5. Network Analysis	Arumugam& Prem Kumar
6. A Course in Circuit Analysis	Umesh & Sinha

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INSTRUMENTATION LAB

Course Code	IE 3006
Course Title	INSTRUMENTATION LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

Electronic measuring instruments are used in industrial processes for the purpose of measurement and control of plant process parameters. An engineer is required to work and handle these instruments for satisfactory operation of the plant. This subject lab is introduced to cover some basic practical aspects of electronic measuring instruments.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:
1. Understand the basic principle, construction and working of measuring instruments.
2. Observe, Identify and optimally choose the most modern measuring instrument suitable for plant process parameter.
3. Observe, identify and use various testing instruments for signal analysis.
4. Understand the basic principle, construction and working of digital measuring instruments.

CONTENTS

1. Measurement of DC voltage and current by multimeter
2. Measurement of AC voltage and current by multimeter
3. Measurement of resistance by multimeter
4. Complete study of multimeter and specification.
5. Study of electronic voltmeter
6. Study and use of CRO for voltage, frequency and phase angle measurement
7. Measurement of phase and frequency using Lissajous figure by CRO
8. Study of seven-segment display (LED and LCD)
9. Study of digital frequency meter
10. Study of digital voltmeter

REFERENCE BOOKS

1. A Course in Electrical & Electronics Measurement & Instruments — A.K. Sawhney
2. Electronic Instrumentation Fundamentals — Malvino
3. Electronic Measurement — Ternan Pettit
4. Electronic Measurement & Instrumentation — J.G. Joshi
5. Electrical and Electronics Measurement and Instrumentation — Pukrait, B. Biswas, S. Das, C. Koley

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ELECTRONIC DEVICES AND CIRCUITS LAB

Course Code	IE 3007
Course Title	ELECTRONIC DEVICES AND CIRCUITS LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

This subject covers the practical aspects of electronic devices and circuits. Every electronic device and instrument is composed of several small components and circuits. In this subject student will get hand on knowledge of different components and circuits.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:
1.Analyze different types of electronic devices by experimental knowledge.
2. Design and analyze various electronic circuits and hence understand the practical aspects of basic electronics theories.

CONTENTS

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode and find the cut in voltage
2. Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage
3. Construct a Half Wave Rectifier and obtain regulation characteristics without filters
4. Construct a Half Wave Rectifier and obtain regulation characteristics with filters
5. Construct a Full Wave Rectifier and obtain regulation characteristics without filters
6. Construct a Full Wave Rectifier and obtain regulation characteristics with filters
7. Construct a Bridge Rectifier and obtain regulation characteristics without filters
8. Construct a Bridge Rectifier and obtain regulation characteristics with filters
9. Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots.
10. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots.

REFERENCE BOOKS

1. Analog Circuits	A.K. Maini
2. Electronic Devices and Circuits	S. Salivahanan and N. Suresh Kumar
3. Electronics Devices and circuit theory	Boyestad & Nashelsky
4. Electronic Principles	Albert Malvino & David Bates
5. Electronics Devices & Circuits	Jacob Millman

6. https://www.electronics-tutorials.ws/
7. https://www.youtube.com/watch?v=Rx43l-QpeWQ
8. https://electronicsforu.com/resources/electronic-devices-and-circuit-theory

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BASIC DIGITAL ELECTRONICS LAB

Course Code	IE 3008
Course Title	BASIC DIGITAL ELECTRONICS LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

Basic digital electronics is the requirement of modern computer, microprocessor and digital communication systems. On account of reliability and accuracy, digital electronic systems are replacing conventional analog systems at a very fast pace.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Prepare truth tables and to verify them practically for different digital circuits.
2. Realize digital expressions using hardware.
3. Verify the functions of Flip Flops, registers and counters.

CONTENTS

1. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR and XNOR using CMOS Logic Gates and TTL Logic Gates
2. Implement and realize Boolean Expressions with Logic Gates
3. Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs
4. Implement parallel and serial full-adder using ICs
5. Design and development of Multiplexer and De-multiplexer using multiplexer ICs
6. Verification of the function of RS, D, JK and T Flip Flops
7. Design controlled shift registers
8. Construct a Single Digit Decade Counter (0-9) with 7 segment display
9. To design a programmable Up-Down Counter with a 7 segment display.

REFERENCE BOOKS

1. Analog Circuits — A.K. Maini
2. Electronic Devices and Circuits — S. Salivahan and N. Suresh Kumar
3. Electronics Devices and circuit theory — Boyestad&Nashelsky
4. Electronic Principles — Albert Malvino& David Bates
5. Electronics Devices & Circuits — Jacob Millman
6. Digital principles & Applications — Albert Paul Malvino& Donald P. Leach
7. Digital Electronics — R. Anand
8. https://www.electronics-tutorials.ws/
9. https://www.youtube.com/watch?v=Rx43l-QpeWQ
10. https://electronicsforu.com/resources/electronic-devices-and-circuit-theory

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ELECTRICAL ENGINEERING AND MEASUREMENTS LAB

Course Code	IE 3009
Course Title	ELECTRICAL ENGINEERING AND MEASUREMENT LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

This course aims to familiarize the students about the basic principles of electrical engineering, electrical machines and most generally used instrument for measurement of electrical quantity in industry. This curriculum helps them to acquire hands on experience to operate the machines and different measuring instruments.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand calibration process of different electrical instruments practically.
2. Measure different electrical quantities in laboratory.
3. Make electrical connections of DC / AC motors and operate them.

CONTENTS

1. Calibration of voltmeter and ammeter
2. Connecting, starting and reversing the direction of D.C. shunt motor
3. Determination of transformation ratio of single-phase transformer
4. Perform open circuit test and short circuit test on single phase transformer
5. Measurement of insulation resistance by megger
6. Measurement of power in three phase circuit for balanced load
7. Measurement of resistance by Wheatstone bridge
8. Connecting, starting and reversing the direction of a 3-phase induction motor

REFERENCE BOOKS

1. A Course in Electrical Engineering	K.D. Sharma
2. Electrical Technology	S.L. Uppal
3. Electrical Technology	J.B. Gupta
4. Electrical & Electronics Measurements &Instruments	A.K. Sawhney
5. Electrical Machine	I.J. Nagpal
6. Electrical Technology	B.L. Thareja

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

IV SEMESTER

(SESSION 2021-2022 & ONWARDS)

INDUSTRIAL INSTRUMENTATION

Course Code	IE 4001
Course Title	INDUSTRIAL INSTRUMENTATION
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

In order to carry out the preventive maintenance of electronic gadgets, fault location, testing and calibration, knowledge and skill of electronic instruments is essential. The contents of this subject are to cover some of the aspects of electronic and process instruments.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Know about various process parameters in process industry.
2. Understand different techniques of measurement of these parameters.
3. Know about construction and working of instruments and devices used for process measurements.

CONTENTS

1. Basics of Instrumentation

- 1.1 Important process parameters, their units, sensors used to measure them and their ranges
- 1.2 Direct & indirect measurement
- 1.3 Static & dynamic characteristics
- 1.4 Actuating, controlling & damping methods
- 1.5 Errors – Sources, Classification and remedies

2. Flow

- 2.1 Orifice plates
- 2.2 Venturi tubes
- 2.3 Flow nozzles
- 2.4 Pitot tubes
- 2.5 Rotameter
- 2.6 Electromagnetic and ultrasonic flow meters

3. Level

- 3.1 Float type
- 3.2 Hydrostatic type
- 3.3 Diaphragm type
- 3.4 Differential pressure method
- 3.5 Electrical conductivity method
- 3.6 Capacitance level
- 3.7 Ultrasonic and nucleonic gauges

4. Pressure

- 4.1 Manometer
- 4.2 C-type Bourdon tube, Diaphragm, Bellows
- 4.3 Measurement of vacuum
- 4.4 Force balance pressure gauges
- 4.5 Electrical pressure transducers
  - 4.5.1 Strain gauge pressure transducer
  - 4.5.2 Potentiometric pressure transducer
  - 4.5.3 Capacitive pressure transducer
  - 4.5.4 Piezo electric pressure transducers

5. Temperature

- 5.1 Temperature scales

5.2Filled system thermometer
5.3 Resistance thermometer
5.4 Bimetallic thermometer
5.5 Radiation pyrometer
5.6 Optical pyrometer

6. Speed Measurements

6.1 Mechanical tachometers
6.2 Electrical tachometers
6.3 Contact less tachometers
6.4 Frequency type tachometers

REFERENCE BOOKS

1. Electrical & Electronics Measurement & Instruments	A.K. Sawhney
2. Mechanical and Industrial Measurements	R.K. Jain
3. Industrial Instrumentation and Control	S.K. Singh

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TRANSDUCERS AND TELEMETRY

Course Code	IE 4002
Course Title	TRANSDUCERS AND TELEMETRY
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

The students should know the types of signals received from the primary instruments and their treatment so that these can be used for indication, recording and/or control purposes. In this subject he will study about different signal generating transducers. In instrumentation systems, various components and systems are usually located at a distance from control room. Telemetry teaches a student about techniques involved in measurement from distance.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Know about different transducers used in process parameter measurement.
2. Understand the concept of telemetry and different channels used for transmission of signals.
3. Understand the concept of process lags.

CONTENTS

1. Transducers
- 1.1 Definition
- 1.2 Classification of transducers

2. Variable Resistive Transducers
- 2.1 Potentiometers
- 2.2 Strain gauges
- 2.3 Resistance thermometers
- 2.4 Thermistors
- 2.5 Hot wire anemometers
- 2.6 Photo conductive cell

3. Variable Reluctance Transducers
- 3.1 Linear variable Differential transformer
- 3.2 Synchro transmitter

4. Variable Capacitance Transducers
- 4.1 Variable plate area
- 4.2 Variable distance between plates
- 4.3 Variable dielectric strength

5. Voltage and Current Generating Transducers
- 5.1 Piezoelectric transducers
- 5.2 Photo tubes and Photo multiplier tubes
- 5.3 Thermocouple

6. Frequency Generating and Digital Transducers
- 6.1 Reluctance pulse picks up transducers
- 6.2 Phototube pulse picks up transducers
- 6.3 Geiger counters
- 6.4 Scintillation counters

7. Telemetry System
- 7.1 Land line telemetry
  - 7.1.1 Pneumatic system

7.1.1.1 Flapper nozzle
7.1.1.2 Non bleed type Relay
7.1.1.3Continuous Bleed type Relay
7.1.2 Electric system
7.1.2.1 Current system
7.1.2.2 Voltage system
7.1.2.3Position system or ratio system

8. Transmitters

8.1 Pneumatic Differential Pressure transmitters
8.2 Electronic Differential Pressure transmitters

9. Process Lags

9.1 Capacity lag
9.2 Distance velocity lag

REFERENCE BOOKS

1. Mechanical & Industrial Measurements	R.K. Jain
2. Fundamentals of Instrumentation	A.E. Fribance
3. Electrical Measurements and Instrumentation	A.K. Sawhney
4. Industrial Instrumentation and Control	S.K. Singh

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CONTROL SYSTEM COMPONENTS

Course Code	IE40031
Course Title	CONTROL SYSTEM COMPONENTS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

Every control system comprises of several components to successfully accomplish the task of process control. The function of final control element is to faithfully carryout the commands given to it by process controller. Sluggish response by the elements can be harmful to the system. Final control elements are major link in the control loop. This subject gives a detailed study of these elements.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the basic principle, construction and working of various control components used in process industry.
2. Identify and optimally choose the most modern instrumentation and controlling of process using suitable control components.
3. Study of final control elements with their working and construction in details.

CONTENTS

1. Error Sensing Devices
- 1.1 Potentiometer as an error detector
- 1.2 Synchro as an error detector

2. Servo Motors
- 2.1 D.C. Servomotor
  - 2.1.1 Construction and working of D.C. servomotor
  - 2.1.2 Circuit diagram and working of field-controlled D.C. servomotor
  - 2.1.3 Circuit diagram and transfer function of armature-controlled D.C. motor
  - 2.1.4 Torque speed characteristics of D.C. servomotor
  - 2.1.5 Applications of D.C. servo motors
- 2.2 A.C. Servomotor
  - 2.2.1 Schematic diagram and working of two-phase servo motor
  - 2.2.2 Types of rotors
  - 2.2.3 Torque speed characteristics of A.C. servo motor
  - 2.2.4 Applications of A.C. servo motor
- 2.3 Construction and working of shaded pole induction motor

3. Stepper Motors
- 3.1 Construction and working principle
- 3.2 Speed and static torque angle characteristics
- 3.3 Application

4. Final Control Elements
- 4.1 Air operated valve
  - 4.1.1 Construction
  - 4.1.2 Characteristics
  - 4.1.3 Sizing and selection
  - 4.1.4 Materials and services
  - 4.1.5 Different types of plugs and their applications
- 4.2 Actuators
- 4.3 Valve positioners
- 4.4 Power cylinders

4.5 Special control valves
- 4.5.1 Small flow valves
- 4.5.2 Saunders patent valve
- 4.5.3 Butterfly valves
- 4.5.4 Solenoid valve
- 4.5.5 Motorized valve
- 4.5.6 Dampers

4.6 Installation of above valves

5. Switches

5.1 Pressure switches
5.2 Temperature switches
5.3 Flow switches
5.4 Level switches
5.5 Limit switches

REFERENCE BOOKS

1. Control System Component	Gibson &Teuter
2. Control Engineering	Tandan, Subbarao, Kulkarni, Desai
3. Control Component	B. Chatterjee
4. Handbook of Instrumentation and control	H. P. Kallen
5. Process Instruments and controls Handbook	D.M. Considine

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INDUSTRIAL AUTOMATION

Course Code	IE 40032
Course Title	INDUSTRIAL AUTOMATION
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

This course aims to familiarize the students with the basic principles of industrial automation. PLCs, electric drives and SCADA are main constituents of automated industrial control. This curriculum emphasizes upon all these important aspects.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the concept of PLCs and its programming.
2. Implement a few PLC based applications.
3. Understand the use of electric drives and their speed control.
4. Implement SCADA to achieve optimum control.

CONTENTS

1. Introduction to Industrial Automation

- 1.1 Automation: Need and benefits.
- 1.2 Types of automation system: Fixed, Programmable, Flexible
- 1.3 Different systems used for Industrial automation: PLC, HMI, SCADA, DCS, Drives.
- 1.4 Evolution of PLC.

2. PLC Fundamentals

- 2.1 Building blocks of PLC
  - 2.1.1 CPU
  - 2.1.2 Memory organization
  - 2.1.3 Input- output modules (discrete and analog)
  - 2.1.4 Specialty I/O Modules
  - 2.1.5 Power supply
- 2.2 Fixed and Modular PLC and their types
- 2.3 Redundancy in PLC module
- 2.4 I/O module selection criteria
- 2.5 Interfacing different I/O devices with appropriate I/O modules

3. PLC Programming and Applications

- 3.1PLC I/O addressing
- 3.2 PLC programming Instructions
  - 3.2.1 Relay type instructions
  - 3.2.2 Timer instructions: On delay, off delay, retentive
  - 3.2.3 Counter instructions: Up, Down, High speed
  - 3.2.4 Logical instructions
  - 3.2.5 Comparison Instructions
  - 3.2.6 Data handling Instructions
  - 3.2.7 Arithmetic instructions.
- 3.3 PLC Based Applications
  - 3.3.1 Motor sequence control
  - 3.3.2 Traffic light control
  - 3.3.3 Elevator control
  - 3.3.4 Tank Level control
  - 3.3.5 Conveyor system
  - 3.3.6 Stepper motor control

4. Supervisory Control and Data Acquisition System (SCADA)

- 4.1 Typical SCADA architecture/block diagram
- 4.2 Benefits of SCADA
- 4.3 Various editors of SCADA
- 4.4 Interfacing SCADA system with PLC:
  - 4.4.1 Typical connection diagram
  - 4.4.2 Object Linking & embedding for Process Control (OPC) architecture
  - 4.4.3 Creating SCADA Screen for simple object
  - 4.4.4 Linking SCADA object with PLC ladder program using OPC.
- 4.5 Applications of SCADA
  - 4.5.1 Traffic light control
  - 4.5.2 Water distribution
  - 4.5.3 Pipeline control.

REFERENCE BOOKS

1. Industrial Instrumentation, Control and Automation	Mukhopadhyay, Sen and Deb
2. Electric Motor Drives, Modelling,Analysis and Control	R. Krishnan
3. Introduction to Programmable Logic Controllers	Dunning, G.
4. Programmable Logic Controller	Jadhav, V. R.
5. Programmable Logic Controllers	Petruzella, F.D.
6. Programmable Logic Controllers	Hackworth
7. Industrial automation and Process control	Stenerson Jon
8. Prog. Logic Controllers and Industrial Automation	Mitra and Sengupta
9. Supervisory Control and Data Acquisition	Boyar, S. A.
10.Practical SCADA for industry	Bailey David, Wright Edwin

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ANALYTICAL AND ENVIRONMENTAL INSTRUMENTS

Course Code	IE40041
Course Title	ANALYTICAL AND ENVIRONMENTAL INSTRUMENTS
Number of Credits	3 (L:3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

Today the whole world is facing the problem of pollution. The pollution may be of air, water etc. Whenever installation of a new industry takes place problem of waste and gasses come in picture. It therefore becomes essential to study different methods of analyzing the gas and water. After study of this subject a student will be in a position to analysis and control the harmful elements.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the construction and working principle of various analyzers used in process industries.
2. Know about the sources and handling methods of polluting waste in process industry.
3. Study about various commonly used optical devices in industry.

CONTENTS

1. Spectroscopic Analysis
- 1.1 Absorption spectroscopy
- 1.2 Emission spectroscopy
- 1.3 Mass spectroscopy

2. Gas Analysis
- 2.1 Infrared gas analyzer
- 2.2 Paramagnetic oxygen analyzer
  - 2.2.1 Magnetic force type
  - 2.2.2 Magnetic wind type
- 2.3 Thermal conductivity analyzer

3. Chromatography
- 3.1 Introduction
- 3.2 Analysis section
- 3.3 Control section

4. Liquid Analysis
- 4.1 Electrical conductivity
- 4.2 Ph electrode potentials

5. Environmental Pollution Instruments
- 5.1 Types and concentration of various gas pollutants in atmosphere
- 5.2 Ionization smoke detectors
  - 5.2.1 Principle
  - 5.2.2 Application
  - 5.2.3 Special features
- 5.3 Smoke meters
- 5.4 Dust measurement

6. Optical Analysis Instruments
- 6.1 Optical Pyrometer
- 6.2 Infra-red thermometer
- 6.3 Spectrophotometer

REFERENCE BOOKS

1. Mechanical & Industrial Measurements	R.K. Jain
2. Principles of Industrial Instrumentation	D. Patranabis
3. Handbook of Analytical Instrument	R.S. Khandpur
4. Optical Production Theory	Horn
5. Opto Electronics an Introduction	Wilson, Hawkes

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OPTICAL INSTRUMENTS AND DEVICES

Course Code	IE 40042
Course Title	OPTICAL INSTRUMENTS AND DEVICES
Number of Credits	3 (L:3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

To impart knowledge about optoelectronic devices and fiber optics in the field of measurement and instrumentation technology this subject is included. Different optical sources, sensors and devices are discussed besides fundamental optical concepts.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the various optical effects encountered in nature.
2. Know about the sources and detectors of light energy.
3. Know about optical fiber, Laser and other optical devices used in industries.

CONTENTS

1. Fundamentals of Optics
- 1.1 Polarization
- 1.2 Diffraction
- 1.3 Interference
- 1.4 Dispersion

2. Optical Sources
- 2.1 Light Emitting Diodes (LEDs)
  - 2.1.1 Structure
  - 2.1.2 Materials
  - 2.1.3 Characteristics
- 2.2 Lasers
  - 2.2.1 Fundamentals of Laser emission
  - 2.2.2 Gas Laser
  - 2.2.3 Liquid Laser
  - 2.2.4 Semiconductor Laser

3. Photo Detectors
- 3.1 Photo Voltaic detectors
- 3.2 Photo Multiplier Tube
- 3.3 Photo Conductive detector
- 3.4 PIN Diode

4. Optical Fibers
- 4.1 Classification of optical fiber
- 4.2 Principle of light transmission through optical fiber
- 4.3 Material consideration
- 4.4 Light sources for optical fibers
- 4.5 Source Coupling
- 4.6 Splices and Connectors

6. Optical Instruments
- 6.1 Polarimeter
- 6.2 Light intensity meter
- 6.3 Periscope
- 6.4 Optical Filters
- 6.5 Beam Splitters

REFERENCE BOOKS

1. Optical Fiber Communication	John M Senior
2. Optical Fiber Communication	J. Gower
3. Optical Fiber Communication	Gerd Keiser
4. Optical Communications – Components and Systems	JH Franz and VK Jain
5. Optical Fiber Communication Systems	GP Agrawal
6. Optical Fiber Communication and Its Applications	S C Gupta

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'C' PROGRAMMING LAB

Course Code	IE 4005
Course Title	'C' PROGRAMMING LAB
Number of Credits	3 (L:0, T: 0, P: 6)
Course Category	PC
Prerequisites	NONE

RATIONALE

'C' is a structured computer programming language. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in various engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the basic concepts of 'C' programming.
2. Use different control flow statements in simple programs.
3. Understand the concepts of Arrays, Functions and Pointers and implement them in various programs.
4. Understand the concept of structure.

CONTENTS

Writing and executing Programs in 'C' to learn all the concepts mentioned below and their applications:

1. Elements of 'C'
- 1.1 Character set
- 1.2 Key words
- 1.3 Data types
- 1.4 Constants and Variables
- 1.5 Operators: unary, binary, ternary
- 1.6 Operator precedence

2. Console Input-Output
- 2.1 Types of I-O
- 2.2 Console I-O
- 2.3 Unformatted console I-O: getchar(), putchar(), gets(), puts(), getch(), getche()
- 2.4 Formatted I-O: scanf(), printf()

3. Control Flow
- 3.1 Statements and blocks
- 3.2 if statement
- 3.3 switch statement
- 3.4 Loops: for, while, do-while
- 3.5 goto and labels
- 3.6 break, continue, exit

4. Arrays
- 4.1 Memory representation
- 4.2 One dimensional array
- 4.3 Two-Dimensional array

5. Functions:
- 5.1 Basic concepts - Declaration and prototypes
- 5.2 Arguments
- 5.3 Calling
- 5.4 Scope rules

5.5 Recursion
5.6 Storage classes types
5.7 Library of functions: math, string, system

REFERENCE BOOKS

1. Programming with 'C'	Schaum's Series
2. 'C' Programming	V.Balaguruswami
3. 'C' Programming	Kernigham& Ritchie
4. Let us 'C'	YashwantKanetkar

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INDUSTRIAL INSTRUMENTATION LAB

Course Code	IE 4006
Course Title	INDUSTRIAL INSTRUMENTATION LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

In order to carry out the preventive maintenance of electronic gadgets, fault location, testing and calibration, knowledge and skill of electronic instruments is essential. The contents of this subject are to provide practical knowledge of various measuring devices.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Measure various process parameters which are common in process industry.
2. Understand different techniques of measurement of these parameters.
3. Know about construction and working of instruments and devices used for process measurements.

CONTENTS

1. Measurement of flow by rotameter
2. Measurement of flow by orifice method
3. Measurement of flow by magnetic flow meter
4. Measuring of speed of a motor by hand tachometer
5. Measurement of speed of a motor fan by electronic stroboscope method
6. Measurement of temperature by thermistor
7. Measurement of pressure by Bourdon tube pressure gauge
8. Measurement of pressure by manometer

REFERENCE BOOKS

1. Mechanical and Industrial Measurements R.K. Jain
2. Industrial Instrumentation and Control S.K. Singh

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TRANSDUCERS AND TELEMETRY LAB

Course Code	IE 4007
Course Title	TRANSDUCERS AND TELEMETRY LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

This course is designed to give practical knowledge of measurement of various process parameters such as temperature, pressure, and displacement etc. Also, a fair practical study of telemetry instruments is included to strengthen the concepts.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Measure various process parameters and draw characteristic curves of transducers used.
2. Realize process lags in laboratory.
3. Measure pressure and differential pressure using pneumatic devices.

CONTENTS

1. To draw input output characteristics of linear variable differential transformer.
2. To draw the resistance temperature characteristics of RTD
3. To draw the resistance temperature characteristics of thermistor
4. To draw the temperature characteristics of thermocouple
5. Measurement of stress / pressure / weight by strain gauge
6. To measure angular displacement using synchro transmitter
7. Realization of various process lags
8. Measurement of pressure using pneumatic transmitter
9. Measurement of differential pressure using PDPT
10. Study of different types of pilot relays

REFERENCE BOOKS

1. Mechanical & Industrial Measurements R.K. Jain
3. Fundamentals of Instrumentation A.E. Fribance
4. Electrical Measurements and Instrumentation A.K. Sawhney
5. Industrial Instrumentation and Control S.K. Singh

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CONTROL SYSTEM COMPONENTS LAB

Course Code	IE 40081
Course Title	CONTROL SYSTEM COMPONENTS LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

This subject consists of various control components and final control elements used in industry for controlling the process parameters. Detailed hands-on study of all control components is necessary to equip an instrumentation engineer against industrial challenges.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Realize error detecting devices using pots and synchros and understand the concept of error detection
2. Use servo motors, techogenerators and stepper motors in control loops.
3. Understand the working of different types of control valves and their use in control of flow.

PRACTICALS

1. Realization of an error detector using potentiometer
2. Realization of an error detector using synchro
3. To draw the torque speed characterization of a D.C. servo motor
4. Speed control of stepper motor.
5. Study of butterfly valves
6. Control of flow by pneumatic control valve
7. Control of level by solenoid valve
8. To draw the characteristic of pneumatic control valve
9. To calibrate a control valve
10. To draw the characteristic of pneumatic valve positioner
11. To make a control circuit using various switches

REFERENCE BOOKS

1. Control System Component	Gibson &Teuter
2. Control Engineering	Tandan, Subba Rao,Kulkarni, Desai
3. Control Component	B. Chatterjee
4. Handbook of Instrumentation and control	H. P. Kallen
5. Process Instruments and controls Handbook	D.M. Considine

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INDUSTRIAL AUTOMATION LAB

Course Code	IE 40082
Course Title	INDUSTRIAL AUTOMATION LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

This course aims to familiarize the students with PLC programming and use of electric drive and SCADA in real life applications. Developing and testing PLC ladder programs significantly upgrades the skills of an instrumentation engineer.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Develop and test PLC ladder programs for various application areas.
2. Control the speed of motors using variable frequency drives.
3. Develop and implement SCADA programs for level and flow controls applications.

CONTENTS

1. Identify various automation systems available in different appliances/ devices/ machines in day-to-day use.
2. Identify various parts of the given PLC and front panel status indicators.
3. Use PLC to test the START STOP logic using two inputs and one output.
4. Develop/Execute a ladder program for the given application using following: - timer, counter, comparison, logical, arithmetic instructions.
5. Use PLC to control the following devices like lamp, motor, push button switches, proximity sensor.
6. Measure the temperature of the given liquid using RTD or Thermocouple and PLC.
7. Develop/test ladder program to blink the LED/lamp.
8. Develop / test the Ladder program for sequential control application of lamps/ DC motors.
9. Develop ladder program for Traffic light control system.
10. Develop and test ladder program for pulse counting using limit switch /Proximity sensor.
11. Develop /test ladder program for Automated car parking system.
12. Develop / test ladder program for Automated elevator control.
13. Develop / test ladder program for rotating stepper motor in forward and reverse directional constant speed.
14. Develop /test ladder program for tank water level control.
15. Develop / test ladder program for control of speed of stepper motor with suitable drivers.
16. Develop a SCADA mimic diagram for Tank level control.
17. Develop SCADA mimic diagram for Flow control in a given system.
18. Simulate Tank level control using available SCADA system.

REFERENCE BOOKS

1. Industrial Instrumentation, Control and Automation	Mukhopadhyay, Sen and Deb
2. Electric Motor Drives, Modelling, Analysis and Control	R. Krishnan
3. Introduction to Programmable Logic Controllers	Dunning, G.
4. Programmable Logic Controller	Jadhav, V. R.
5. Programmable Logic Controllers	Petruzella, F.D.
6. Programmable Logic Controllers	Hackworth
7. Industrial automation and Process control	Stenerson Jon
8. Prog. Logic Controllers and Industrial Automation	Mitra and Sengupta
9. Supervisory Control and Data Acquisition	Boyar, S. A.
10. Practical SCADA for industry	Bailey David, Wright Edwin

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ANALYTICAL AND ENVIRONMENTAL INSTRUMENTS LAB

Course Code	IE 40091
Course Title	ANALYTICAL AND ENVIRONMENTAL INSTRUMENTS LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

In process industries analysis has become an integral part. The amount of pollution in air and water also needs measurement. A whole range of instruments is available for these measurements. An instrumentation engineer should have some practical experience of using a few of them. This course puts him in a position to analyze and control the required parameters.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Identify and use different pH electrodes for pH measurement.
2. Analyze gas samples in different ways.
3. Analyze quality of water for dissolved contents.
4. Use various commonly used analyzers and optical devices in industry.

CONTENTS

1. Measurement of pH for given liquid
2. To analyze gas sample by thermal conductivity method.
3. To measure Co2 in a given sample by Co2 analyzer
4. To measure conductivity of a given solution by conductivity meter.
5. To measure total dissolved O2 in water
6. To study spectrophotometer
7. Analysis of gas-by-gas chromatograph
8. Demonstration of infrared Analyzer
9. Demonstration of Mass spectrograph
10. Measurement of radiation by infrared meter.

REFERENCE BOOKS

1. Mechanical & Industrial Measurements	R.K. Jain
2. Principles of Industrial Instrumentation	D. Patranabis
3. Handbook of Analytical Instrument	R.S. Khandpur
4. Optical Production Theory	Horn
5. Opto Electronics an Introduction	Wilson, Hawkes

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OPTICAL INSTRUMENTS AND DEVICES LAB

Course Code	IE 40092
Course Title	OPTICAL INSTRUMENTS AND DEVICES LAB
Number of Credits	1 (L:0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

Optical sensors are used everywhere in process industries. An instrumentation person should be well aware of the characteristics and behavior of these devices. This course offers some hands-on knowledge about sensors and other optical devices.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Learn about various industrial optical transducers and draw their characteristics.
2. Learn details of construction, working and maintenance of different optical devices.

CONTENTS

1. To draw input current versus output intensity curve of LED
2. To draw the input / output characteristics of PV cell
3. To draw the input / output characteristics of Photo Diode
4. To draw the input / output characteristics of Photo Transistor
5. To draw the input / output characteristics of Photo Conductive cell (LDR)
6. Measurement of light intensity by lux meter
7. Measurement of absorption coefficient of a liquid
8. Study of optical fiber
9. Study of beam splitters
10. Study of polarimeter

REFERENCE BOOKS

1. Optical Fiber Communication	John M Senior
2. Optical Fiber Communication	J. Gower
3. Optical Fiber Communication	Gerd Keiser
4. Optical Communications – Components and Systems	JH Franz and VK Jain
5. Optical Fiber Communication Systems	GP Agrawal
6. Optical Fiber Communication and Its Applications	S C Gupta

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

V SEMESTER

(SESSION 2021-2022 & ONWARDS)

CONTROL THEORY

Course Code	IE 5001
Course Title	CONTROL THEORY
Number of Credits	3 (L: 2, T: 1, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Control theory is the heart of all instrumentation systems. It plays a very important role in the process and production industry. The concepts are important in order to prepare mathematical model and analysis of control systems. Stability analysis of control loops is also covered in this subject.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:
1. Understand the concept of mathematical modelling of physical systems.
2. Identify and optimally choose the suitable process control loops for processes.
3. Perform time domain and frequency domain analysis of control systems using various graphical plots.
4. Understand the basic principle, construction and working of various advanced control techniques

CONTENTS

1. Introduction to Process Control:
1.1 Transfer Function
1.2 Signal flow graph
1.3 Mason's gain formula
1.4 Block diagram representation

2. Time Domain Analysis:
2.1 Test signals
2.2 Response of first order system
2.3 Response of second order systems
2.4 Routh's stability analysis
2.5 Steady state error analysis

3. Frequency Domain Analysis:
3.1 Bode plots
3.2 Polar plots
3.3 Definition of Gain margin and Phase margin

4. Introduction of Advance Control Techniques:
4.1 PLC
4.2 DCS
4.3Data loggers
4.4 SCADA

REFERENCE BOOKS

1. Control Engineering — Katsuhiko Ogata
2. Control System Engineering — Nagrath and Gopal
3. Automatic Control Systems — Benjamin C. Kuo

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POWER AND INDUSTRIAL ELECTRONICS

Course Code	IE 5002
Course Title	POWER AND INDUSTRIAL ELECTRONICS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Electronic methods of power control in electrical load are used in industrial processes for the purpose of control of plant process parameters. An engineer is required to work and handle these control equipments and most modern techniques for satisfactory and efficient operation of the plant. This subject is introduced to cover some basic aspects of electronic control technique of power in electrical load.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1.Understand the basic principle, construction and working of various electronic switching devices like SCR, TRIAC, DIAC, UJTetc.
2. Identify and optimally choose the most modern switching device suitable for plant process parameter control.
3. Identify and use various power control techniques suitable for various plant processes.
4. Understand the basic principle, construction and working of circuits for control of electrical machines.

CONTENTS

1. Introduction:
1.1 Principle, Construction and characteristics of SCR, TRIAC, DIAC, UJT.
1.2 Ratings of SCR
1.3 “Turn on” and “Turn off” mechanism of SCR
1.4 Series and parallel connections of SCR
1.5 Snubber circuits

2. Power Control and Rectifiers:
2.1 Phase control circuit of SCR
- 2.1.1 Simple R-C circuit
- 2.1.2 Transformer circuit
- 2.1.3 UJT circuit

2.2 SCR Half Wave rectifier (single phase)
- 2.2.1 SCR with resistive load
- 2.2.2 SCR with inductive load (with and without freewheeling diode)

2.3 Three phase HW and FW rectifier using PN junction diode
- 2.3.1 Calculation of RMS value
- 2.3.2 Average value
- 2.3.3 Ripple factor
- 2.3.4 PIV
- 2.3.5 TUF

3. Inverters, Choppers and Cyclo-converters
3.1 Basic principle of inverters
3.2 Series and parallel inverter circuits using SCR (Single phase)
3.3 Basic idea of PWM inverter
3.4 Choppers
3.5 Cyclo-converters

4. AC Stabilizer and Power Supply
4.1 Resonant stabilizer

4.2 Electro mechanical stabilizer (using relay and servo motor)
4.3 Electronic stabilizer
4.4 Block diagram of UPS (OFF line and ON line)

5. A.C., D.C. Motors & control
5.1 Concept of motor speed control (for D.C. motor only)
5.2 Armature voltage control using SCR (for D.C. motor only)
5.3 Brief idea of speed control of stepper motor

REFERENCE BOOKS

1. An Introduction to Thyristors and their applications	Ramamoorty M.
2. Thyristors: Theory and Applications	Sugandhi RK, Sugandhi KK
3. Industrial Electronics	G.K. Mithal
3. Industrial Electronics	O. Cage
4. Thyristor Engineering	M.S. Berde
5. Electronics in Industry	Chute & Chute
6. Power Electronics	P.C. Sen
10. Power Electronics	P.S. Bhimbhara
11. Industrial electronics & control	Biswanath Paul

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ECONOMIC POLICIES IN INDIA

Course Code	IE 51001 (Same in All Branches of Engg.)
Course Title	Economic Policies in India
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES:

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

CO1	Understand Indian economics policy, planning strategies
CO2	It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
CO3	Development Economics as a discipline encompasses different approach es to the problems of unemployment, poverty, income generation, industrialization from different perspectives
CO4	Able to identify the problems and capable to decide the application for future development
CO5	Analyze economic issues and find solutions to complex economic problems and take correct economic judgment

COURSE CONTENTS:

1. BASIC FEATURES AND PROBLEMS OF INDIAN ECONOMY:

1.1. Economic History of India;
1.2. Nature of Indian Economy
1.3. Demographic features and Human Development Index,
1.4. Problems of Poverty, Unemploy-ment, Inflation, income inequality, Blackmoney in India.

2. SECTORAL COMPOSITION OF INDIAN ECONOMY:

2.1. Issues in Agriculture sector in India,
2.2. land reforms
2.3. Green Revolution
2.4. agriculture policies of India,

3. INDUSTRIAL DEVELOPMENT,

3.1. Small scale and cottage industries,
3.2. Industrial Policy,
3.3. Public sector in India,
3.4. Service sector in India.

4. ECONOMIC POLICIES:

4.1. Economic Planning in India,
4.2. Planning commission v/s NITI Aayog,
4.3. Five Year Plans,
4.4. Monetary policy in India,
4.5. Fiscal Policy in India,
4.6. Centre state Finance Relations,
4.7. Finance commission in India
4.8. LPG policy in India

5. EXTERNAL SECTOR IN INDIA

5.1. India's foreign trade value composition and direction,
5.2. India Balance of payment since 1991,

5.3. FDI in India,
5.4. Impact of Globalization on Indian Economy,
5.5. WTO and India.

REFERENCE BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy .S Chand & Co.Ltd. New Delhi.
2. Mishra S. K & V. K Puri (2017). Indian Economy and Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, NewDelhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India ,Oxford University Press.

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ENGINEERING ECONOMICS & ACCOUNTANCY

Course Code	IE 51002 (Same in All Branches of Engg.)
Course Title	Engineering Economics & Accountancy
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
Course Category	OE

COURSE OBJECTIVES

•To acquire knowledge of basic economics to facilitate the process of economic decision making.
•To acquire knowledge on basic financial management aspects.
•To develop the basic skills to analyze financial statements.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand cost elements of the product and its effect on decision making
CO3	Prepare accounting records and summarize and interpret the accounting datafor managerial decisions
CO4	Understand accounting systems and analyze financial statements using ratio analysis
CO5	Understand the concepts of financial management and investment

COURSE CONTENTS

1. INTRODUCTION:

1.1. Managerial Economics;
1.2. Relationship with other disciplines;
1.3. Firms: Types, objectives and goals;
1.4. Managerial decisions;
1.5. Decision analysis.

2. DEMAND & SUPPLY ANALYSIS:

2.1. Demand;
2.1.1. Types of demand;
2.1.2. Determinants of demand;
2.1.3. Demand function;
2.1.4. Demand elasticity;
2.1.5. Demand forecasting;
2.2. Supply;
2.2.1. Determinants of supply;
2.2.2. Supply function;
2.2.3. Supply elasticity.

3. PRODUCTION AND COST ANALYSIS:

3.1. Production function;
3.2. Returns to scale;
3.3. Production optimization;
3.4. Least cost input; Iso quants;
3.5. Managerial uses of production function;
3.6. Cost Concepts;
3.6.1. Cost function;
3.6.2. Types of Cost;

3.6.3. Determinants of cost;
3.6.4. Short run and Long run cost curves;
3.6.5. Cost Output Decision;
3.6.6. Estimation of Cost.

4. PRICING:

4.1. Determinants of Price;
4.2. Pricing under different objectives and different market structures;
4.3. Price discrimination;
4.4. Pricing methods in practice;
4.5. Role of Government in pricing control.

5. FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):

5.1. Balance sheet and related concepts;
5.2. Profit & Loss Statement and related concepts;
5.3. Financial Ratio Analysis;
5.4. Cash flow analysis;
5.5. Funds flow analysis;
5.6. Comparative financial statements;
5.7. Analysis & Interpretation of financial statements;
5.8. Investments;
5.9. Risks and return evaluation of investment decision;
5.10. Average rate of return;
5.11. Payback Period;
5.12. Net Present Value;
5.13. Internal rate of return,

REFERENCE BOOKS:

1.Mc Guigan, Moyer and Harris,' Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
2.Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition,2005.
3.Samuelson. Paul A and Nordhaus W. D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
4.Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, NewDelhi, 2007.
5.Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson SouthWestern, 4th Edition, 2001.

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MICROCONTROLLER AND APPLICATIONS

Course Code	IE50031
Course Title	MICROCONTROLLER AND APPLICATIONS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

The evolution of microcontrollers has dramatically changed the concept of automation in recent years. Study of microcontrollers is necessary to design a cost effective and reliable control system.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1.Understand the organizational architecture of 8051 microcontroller.
2. Know about instruction set of 8051 microcontroller.
3. Write and execute basic programs using 8051 microcontroller.
4. Know about ARM processor fundamentals.

CONTENTS

1. Introduction
1.1 Introduction to Microcontrollers
1.2 Intel MCS-51 family features
1.3 8051 -organization and architecture

2. Programming with 8051
2.1. 8051 instruction set
2.2. Addressing modes
2.3. Conditional instructions
2.4. I/O Programming
2.5. Arithmetic logic instructions
2.6 Single bit instructions
2.7 Interrupt handling
2.8 Programming counters, timers and Stack

3. MCS-51 and external Interfaces
3.1 8 - User interface - keyboard, LCD, LED
3.2 Real world interface - ADC, DAC, SENSORS Communication interface.

4. Programming with 8051
4.1 8 - I/O Programming
4.2 Timers/counters
4.3 Serial Communication
4.4 Interrupt
4.5 User Interfaces - LCD, Keypad, LED and communication interfaces [RS232].

REFERENCE BOOKS

1. The 8051 Micro Controller and Embedded Systems — Mazidi and Mazidi
2. Microprocessor and Microcontrollers — Krishna Kant
3. Microcontrollers — Shah,Oxford Publication
4. Principles of Microcomputers and Microcontroller — Cady,Oxford Publication

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BIO MEDICAL INSTRUMENTATION

Course Code	IE 50032
Course Title	BIO MEDICAL INSTRUMENTATION
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

There is a growing need of medical electronic technician to operate, maintain and service the electronic equipment used in health science. Medical science is fully dependent on Electronics Engineering. Almost all medical equipment are nowadays electronics based. Therefore, the knowledge of this subject will be useful for an instrumentation engineer.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the physiology of human body.
2. Know about different types of electrodes used in bio medical engineering.
3. Know about construction and working of electronic systems used in medical and health engineering.

CONTENTS

1. Introduction to Physiology
1.1 Physiological systems of the human body
1.2 Mechanism of respiration
1.3 Generation, propagation and distribution of action potentials

2. Medical Electrodes
2.1 Introduction
2.2 Bio-electrode theory
2.3 Types of electrodes and implantation
- 2.3.1 Microelectrode
- 2.3.2 Body surface electrode
- 2.3.3 Needle electrode

3. Electro Cardiograph (E.C.G.)
3.1 Electrical activity of heart and its construction
3.2 Block diagram of E.C.G. machine
3.3 ECG electrodes
3.4 Lead configuration
3.5 Heart rate measurement
3.6Basic idea of EEG and EMG

4. Pace Makers
4.1 Introduction
4.2 Block diagram of Demand pacemaker
4.3 Basic circuit of fixed rate and synchronous pacemaker

5. Blood Pressure Monitoring
5.1 Blood circulation system
5.2 Blood pressure waveform
5.3 Blood pressure measurement techniques

6. Defibrillator
6.1 Introduction
6.2 Types of defibrillator
6.3 Basic defibrillator circuits
6.4 Lawn waveform

7. Biomedical Instruments

7.1 Blood flow meter
7.2 X- Ray machine
7.3 Concept of Sonography
7.4 Concept of CT scan
7.5 Concept of Magnetic Resonance Indication (MRI)
7.6 Concept of Laparoscopic surgery

REFERENCE BOOKS

1. Bio Medical Instrumentation	K.R. Nahar
2. Bio Medical Instrumentation	Crombell
3. Servicing Medical &Bioelectronics Equipment	Carl J.J.
4. Bio Medical Electronics	Khandpur

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EMBEDDED SYSTEMS

Course Code	IE 50041
Course Title	EMBEDDED SYSTEMS
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

An embedded system is a microcontroller based computer hardware with proper software codes to perform a dedicated function. This subject is introduced to make students familiar with the process of development of embedded systems for real time operations.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Use Arduino IDE for development of small embedded systems.
2. Write C programs for embedded systems.

CONTENTS

1. Embedded C basics operators for Arduino
1.1 Familiarizing with the Arduino IDE.
1.2 Sketch designing for Arduino
1.3 Communication interface using serial port
1.4 Basic understanding of the code with Boolean operations, pointer access operations, bitwise operations, compounded operations.

2. Embedded C control structure blocks
2.1 Looping mechanism – for, do and while.
2.2 The branching operations based on conditions expression

3. Introduction to Arduino Mega
3.1 Arduino Mega specifications including power ratings, digital and analog peripherals.
3.2 Difference between the C language and Embedded C language
3.3 Arduino Mega Ports, Pins, Digital and Analog Peripherals

4. Communication with Arduino
4.1 Different communication modules available with their real-life application
4.2 Communication interface

REFERENCE BOOKS

1. Arduino Projects for Dummies Kennedy George, Davis Bernard, PrasannaSRM

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SIGNAL CONDITIONING

Course Code	IE 50042
Course Title	SIGNAL CONDITIONING
Number of Credits	3 (L:3, T: 0, P: 0)
Course Category	PE
Prerequisites	NONE

RATIONALE

Various measuring devices are used for measuring different parameters. These devices give signals in various forms. To use them for proper measurement and control we have to condition the signal for appropriate use.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the concept of AC and DC signal conditioning.
2. Understand analog signal conditioning concepts and working of circuits used.
3. Understand the working of different digital circuits used in signal conditioning.

CONTENTS

1. Introduction

1.1 Meaning and necessity of signal conditioning
1.2 AC and DC signal conditioning

2. Analog Signal Conditioning:

2.1 Principles of Analog Signal Conditioning
- 2.1.1 Signal level changes
- 2.1.2 Signal conversion
- 2.1.3 Filtering and Impedance matching

2.2 R.C. Filters
2.3 Instrumentation amplifiers
2.4Operational Amplifier circuits
2.5Charge amplifier
2.6Isolation amplifier

3. Digital Signal Conditioning

3.1 A/D Conversion
3.2 D/A Conversion
3.3 Multiplexer / Demultiplexer
3.4 Encoder / Decoder
3.5 Sample and hold
3.6 Data acquisition system

REFERENCE BOOKS

1. Instrumentation Devices & Systems	Rangan, Sharma & Mani
2. Process Control Instrumentation Technology	Curtis Johnson
3. Electrical, Electronic Measurement& Instrumentation	A.K. Sawhney
4. Industrial Electronics & Control	Biswanath Paul

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APPLIED INSTRUMENTATION

Course Code	IE 5005
Course Title	APPLIED INSTRUMENTATION
Number of Credits	3 (L: 2, T: 1, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Applied instrumentation subject covers the entire process industry. In order to understand various instrumentation and control scheme, thorough knowledge of various systems is required.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the basic principle, construction and working of various control schemes in different process industries.
2. Identify and optimally choose instrumentation and control schemes suitable for process plant.
3. Know the working of various process industries and power plants in details with all control schemes.

CONTENTS

1. Processes and Control Schemes of the following in Industry

- 1.1 Iron and Steel Industry
- 1.2Glass Industry
- 1.3 Power Industry
  - 1.3.1 Thermal
  - 1.3.2 Nuclear
- 1.4 Cement Industry
- 1.5 Fertilizer Industry
- 1.6 Paper Industry
- 1.7 Sugar Industry

2. Instrumentation and Control Scheme in Chemical Reactors

- 2.1Temperature Control
- 2.2Pressure Control

3. Instrumentation and Control Scheme in Dryers

- 3.1 Batch Dryers
- 3.2 Continuous Dryers

4. Instrumentation and Control Scheme of Heat Exchangers

- 4.1 Steam Heaters
- 4.2 Condensers
- 4.3 Vaporizers

5. Instrumentation and Control Scheme in Evaporators

- 5.1 Measurement and control of Pressure
- 5.2 Measurement and control of Density

REFERENCE BOOKS

1. Instrumentation in the Processing Industries — Bela G. Liptak
2. Hand Book of Applied Instrumentation — D. M. Considine

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POWER AND INDUSTRIAL ELECTRONICS LAB

Course Code	IE 5006
Course Title	POWER AND INDUSTRIAL ELECTRONICS LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PC
Prerequisites	NONE

RATIONALE

Electronic methods of power control in electrical load are used in industrial processes for the purpose of control of plant process parameters. This subject is introduced to cover some basic practical aspects of electronic control technique of power in electrical load.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1.Observe and understand the basic principle, construction and working of electronic switching devices like SCR, TRIAC, DIAC, UJTetc.
2. Observe, identify and optimally choose the most modern switching device suitable for plant process parameter control.
3. Observe, identify and use various power control techniques suitable for various plant processes.
4. Observe, understand the basic principle, construction and working of circuits for control of electrical machines.

CONTENTS

1. To plot V-I characteristics of SCR
2. To plot V-I characteristics of TRIAC
3. To plot V-I characteristics of UJT
4. To plot V-I characteristics of DIAC
5. Observe the various waveforms of UJT relaxation oscillator
6. Study of half wave rectifier using SCR with resistive load and inductive load.
7. Application of TRIAC as light dimmer/fan regulator
8. Study of phase inverter circuit using transistor
9. Study of inverter circuit using SCR
10. Study of electronic-mechanical/electronic A.C. stabilizer
11. Study of UPS
12. Study of speed control of D.C. motor

REFERENCE BOOKS

1. An Introduction to Thyristors and their applications	Ramamoorty M.
2. Thyristors: Theory and Applications	Sugandhi RK, Sugandhi KK
3. Industrial Electronics	G.K. Mithal
3. Industrial Electronics	O. Cage
4. Thyristor Engineering	M.S. Berde
5. Electronics in Industry	Chute & Chute
6. Power Electronics	P.C. Sen
10. Power Electronics	P.S. Bhimbhara
11. Industrial electronics & control	Biswanath Paul

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MICROCONTROLLER AND APPLICATIONS LAB

Course Code	IE 50071
Course Title	MICROCONTROLLER AND APPLICATIONS LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

The evolution of microcontrollers has dramatically changed the concept of automation in recent years. Study of microcontrollers is necessary to design a cost effective and reliable control system. Some practical aspects of microcontroller programming are introduced through this course,

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1.Write and execute programs with basic instructions of 8051 microcontroller.
2. Write and execute programs to use ports and peripheral devices of 8051 microcontroller.
3. Understand GPIO programming.

CONTENTS

1. Programming with Arithmetic logic instructions
2. Program using constructs (Sorting an array)
3. Programming using Ports
4. Delay generation using Timer
5. Programming Interrupts
6. Interfacing LCD Display
7. Interfacing with Keypad
8. Programming ADC/DAC
9. Interfacing with stepper motor

REFERENCE BOOKS

1. The 8051 Micro Controller and Embedded Systems Mazidi and Mazidi
2. Microprocessor and Microcontrollers Krishna Kant
3. Microcontrollers Shah,Oxford Publication
4. Principles of Microcomputers and Microcontroller Cady,Oxford Publication

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BIO MEDICAL INSTRUMENTATION LAB

Course Code	IE 50072
Course Title	BIO MEDICAL INSTRUMENTATION LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

There is a growing need of medical electronic technician to operate, maintain and service the electronic equipment used in health science. Practical encounter with bio medical instruments will be of immense use for students of this course. Also a few visits to facilities using these devices can be knowledge boosters.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Identify different bio medical electrodes.
2. Use and troubleshoot equipment like recorders, ECG machine and pacemakers.
3. Know about installation and use of larger systems like X-Ray machine, MRI & CT scan machines and monitoring systems in ICUs.

CONTENTS

1. Study of different types of electrodes
2. Study of ECG machine
3. Measurement of blood pressure using indirect method.
4. Study of blood pressure amplifier
5. Study of pacemakers
6. Visit to clinical laboratory or hospital
7. Visit to a hospital for X-ray machine / Sonography / CT scan.

REFERENCE BOOKS

1. Bio Medical Instrumentation	K.R. Nahar
2. Bio Medical Instrumentation	Chrompbell
3. Servicing Medical &Bioelectronics Equipment	Carl J.J.
4. Bio Medical Electronics	Khandpur

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EMBEDDED SYSTEMS LAB

Course Code	IE 50081
Course Title	EMBEDDED SYSTEMS LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

An embedded system is a microcontroller based computer hardware with proper software codes to perform a dedicated function. This subject is introduced to make students familiar with practical aspects of development of embedded systems for real time operations.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Use Arduino IDE for development of small embedded systems.
2. Write, test and execute C programs for embedded systems.

CONTENTS

1. Built-in LED state control by push button sketch implementation
2. Built-in LED blinking sketch implementation
3. Built-in LED blinking by toggling states based on binary operation
4. Built-in LED state control by user interface through serial port
5. User interface for Boolean operation and bit wise operation through serial port
6. User interface for compounded operation through serial port
7. Looping mechanism to check the state of pin and if change print its status on serial port
8. Controlling multiple LEDs with a loop and an array
9. Use a potentiometer to control the blinking of an LED
10. Uses an analog output (PWM pin) to fade an LED.
11. Servo Motor Control using PWM
12. Temperature sensor interfacing and sending its reading over serial port
13. I2C light sensor interfacing and sending its reading over serial port

REFERENCE BOOKS

1. Arduino Projects For Dummies Kennedy George, Davis Bernard, PrasannaSRM
2. Make: Getting Started With Arduino - The Open SourceElectronics PrototypingPlatform
Massimo Banziand Michael ShilohShroff
3. https://www.arduino.cc/reference/en/
4. https://learn.adafruit.com/category/learn-arduino

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SIGNAL CONDITIONING LAB

Course Code	IE 50082
Course Title	SIGNAL CONDITIONING LAB
Number of Credits	1 (L: 0, T: 0, P: 2)
Course Category	PE
Prerequisites	NONE

RATIONALE

Different measuring devices give signals in various forms. To use them for proper measurement and control we have to condition the signal for appropriate use. Practically using some prototype signal conditioning circuits is expected in this course.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Use and implement basic signal conversion circuits.
2. Use analog to digital and digital to analog conversion circuits.
3. Analyze performance of filter circuits.

CONTENTS

1. To convert current to voltage using operational amplifier.
2. To convert voltage to current using operational amplifier.
3. To use a logarithmic amplifier and draw characteristics.
4. To draw the characteristic of a RC low pass filter.
5. To draw the characteristic of a RC high pass filter.
6. To use a voltage to frequency converter.
7. To use a frequency to voltage converter.
8. To convert an analog signal into digital signal using ADC.
9. To convert digital signal into analog using DAC.
10. To use a sample and hold circuit.

REFERENCE BOOKS

1. Instrumentation Devices & Systems — Rangan, Sharma & Mani
2. Process Control Instrumentation Technology — Curtis Johnson
3. Electrical, Electronic Measurement& Instrumentation — A.K. Sawhney
4. Industrial Electronics & Control — Biswanath Paul

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GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

VI SEMESTER

(SESSION 2021-2022 & ONWARDS)

ENTREPRENEURSHIP AND START-UPS

Course Code	IE 6111 (Same in All Branches of Engg.)
Course Title	Entrepreneurship and Start-ups
Number of Credits	4 (L-3 ,T-1, P-0)
Prerequisites (Course code)	None
Course Category	HS

COURSE LEARNING OBJECTIVES:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with varioususes ofhuman resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship-its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

LEARNING OUTCOME:

Upon completion of the course, these student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. StrategicMarketing Planning
6. New Productor Service Development
7. Business Plan Creation

COURSE CONTENTS:

1. INTRODUCTION TO ENTREPRENEURSHIP AND START–UPS

- 1.1. Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- 1.2. Types of Business Structures,
- 1.3. Similarities / differences between entrepreneurs and managers.

2. BUSINESS IDEAS AND THEIR IMPLEMENTATION

- 2.1. Discovering ideas and visualizing the business
- 2.2. Activity map
- 2.3. Business Plan

3. IDEA TO START-UP

- 3.1. Market Analysis– Identifying the target market,
- 3.2. Competition evaluation and Strategy Development,
- 3.3. Marketing and accounting,
- 3.4. Risk analysis

4. MANAGEMENT

- 4.1. Company's Organization Structure,
- 4.2. Recruitment and management of talent.
- 4.3. Financial organization and management

5. FINANCING AND PROTECTION OF IDEAS

- 5.1. Financing methods available for start-ups in India
- 5.2. Communication of Ideas to potential investors– Investor Pitch
- 5.3. Patenting and Licenses

6. EXIT STRATEGIES FOR ENTREPRENEURS ,BANKRUPTCY, AND SUCCESSION AND HARVESTING STRATEGY

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN–978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN–978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN–978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Chris Tensen	Harvard business ISBN:978-142219602

SUGGESTEDSOFTWARE/LEARNINGWEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatehstructure/
c .https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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PROJECT MANAGEMENT

CourseCode	IE 62001(Same in All Branches of Engg.)
CourseTitle	Project Management
NumberofCredits	3(L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

•To develop an understanding of key project management skills and strategies.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the importance of projects and its phases.
CO2	Analyze projects from marketing, operational and financial perspectives.
CO3	Evaluate projects based on discount and non-discount methods.
CO4	Develop network diagrams for planning and execution of a given project.
CO5	Apply crashing procedures for time and cost optimization.

COURSE CONTENTS

1. **CONCEPT OF A PROJECT**:
   - 1.1. Classification of projects
   - 1.2. Importance of project management
   - 1.3. The project Life cycle
   - 1.4. Establishing project priorities (scope-cost-time)
   - 1.5. Project priority matrix
   - 1.6. Work break down structure.

2. **CAPITAL BUDGETING PROCESS:**
   - 2.1. Planning -Analysis-Selection-Financing-Implementation-Review.
   - 2.2. Generation and screening of project ideas
   - 2.3. Market and demand analysis
   - 2.4. Demand forecasting techniques.
   - 2.5. Market planning and marketing research process
   - 2.6. Technical analysis

3. **FINANCIAL ESTIMATES AND PROJECTIONS:**
   - 3.1. Cost of projects
   - 3.2. Means of financing
   - 3.3. Estimates of sales and production-cost of production
   - 3.4. Working capital requirement and its financing
   - 3.5. Profitability project , cash flow statement and balance sheet.
   - 3.6. Breakeven analysis.

4. **BASIC TECHNIQUES IN CAPITAL BUDGETING**:
   - 4.1. Non discounting and discounting methods
   - 4.2. pay-back period
   - 4.3. Accounting rate of return
   - 4.4. Net present value
   - 4.5. Benefit cost ratio
   - 4.6. Internal rate of return.
   - 4.7. Project risk.
   - 4.8. Social cost benefit analysis andeconomic rate of return.
   - 4.9. Non-financial justification of projects.

5. **PROJECT ADMINISTRATION**:
   - 5.1. Progress payments,

5.2. Expenditure planning,
5.3. Project scheduling and network planning,
5.4. Use of Critical Path Method(CPM),
5.5. Schedule of payments and physical progress,
5.6. time-cost trade off.
5.7. Concepts and uses of PERT
5.8. Cost as a function of time,
5.9. Project Evaluation and Review Techniques
5.10. Cost mechanisms.
5.11. Determination of least cost duration.
5.12. Post project evaluation.
5.13. Introduction to various Project management softwares.

REFERENCE BOOKS

1.Project planning, analysis, selection, implementation and review –Prasannachandra–Tata McGraw Hill
2.Project Management – the Managerial Process– Clifford F. Gray & Erik W. Larson-McGrawHill
3.Project management- David I Cleland- Mcgraw Hill International Edition, 1999
4.Project Management– Gopala krishnan– Mcmillan India Ltd.
5.Project Management- Harry – Maylor – Peason Publication

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RENEWABLE ENERGY TECHNOLOGIES

CourseCode	IE 62002 (Same in All Branches of Engg.)
CourseTitle	Renewable Energy Technologies
NumberofCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To understand present and future scenario of world energy use.
•To understand fundamentals of solar energy systems.
•To understand basics of wind energy.
•To understand bio energy and its usage in different ways.
•To identify different available non-conventional energy sources.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

COURSE CONTENTS

1. INTRODUCTION:

1.1. World Energy Use;
1.2. Reserves of Energy Resources;
1.3. Environmental Aspects OF Energy Utilisation;
1.4. Renewable Energy Scenario in India and around the World;
1.5. Potentials; Achievements/ Applications;
1.6. Economics of renewable energy systems.

2. SOLAR ENERGY:

2.1. Solar Radiation;
2.2. Measurements of Solar Radiation;
2.3. Flat Plate and Concentrating Collectors;
2.4. Solar direct Thermal Applications;
2.5. Solar thermal Power Generation
2.6. Fundamentals of Solar Photo Voltaic Conversion;
2.7. Solar Cells;
2.8. Solar PV Power Generation;
2.9. Solar PV Applications.

3. WIND ENERGY:

3.1. Wind Data and Energy Estimation;
3.2. Types of Wind Energy Systems;
3.3. Performance; Site Selection;
3.4. Details of Wind Turbine Generator;
3.5. Safety and Environmental Aspects.

4. BIO-ENERGY:

4.1. Bio mass direct combustion;
4.2. Bio mass gasifiers;
4.3. Bio gas plants;
4.4. Digesters;
4.5. Ethanol production;
4.6. Bio diesel;

4.7. Cogeneration;
4.8. Bio mass Applications.

5. OTHER RENEWABLE ENERGY SOURCES:

5.1. Tidal energy;
5.2. Wave Energy;
5.3. Open and Closed OTEC Cycles;
5.4. Small Hydro Geothermal Energy;
5.5. Hydrogen and Storage;
5.6. Fuel Cell Systems;
5.7. Hybrid Systems.

REFERENCE BOOKS

1. Non-Conventional Energy Sources, Rai. G. D., Khanna Publishers, New Delhi, 2011.
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN SponLtd.,UK,2 006.
3. Solar Energy, Sukhatme. S. P., Tata Mc Graw Hill Publishing CompanyLtd. ,New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, G N Tiwari and M K Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment A Policy Analysis for India ,NH Ravindranath, U K Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, R A Ristinen and J J Kraushaar, second edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, J W T widell and A D Weir, ELBS, 2006.

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PRODUCT DESIGN

CourseCode	IE 63001 (Same in All Branches of Engg.)
CourseTitle	Product Design
NumberofCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To acquire the basic concepts of product design and development process
•To understand the engineering and scientific process in executing a design from concept to finished product
•To study the key reasons for design or redesign.

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define thecustomer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

COURSE CONTENTS

1. DEFINITION OF A PRODUCT

1.1. Types of product;
1.2. Levels of product;
1.3. Product-market mix;
1.4. New prod-uct development (NPD) process;
1.5. Idea generation methods;
1.6. Creativity;
1.6.1. Creative attitude;
1.6.2. Creative design process;
1.7. Morpho logical analysis;
1.8. Analysis of inter-connected decision areas;
1.9. Brain storming.

2. PRODUCT LIFECYCLE;

2.1. The challenges of Product development;
2.2. Product analysis;
2.3. Product characteristics;
2.4. Economic considerations;
2.5. Production and Marketing aspects;
2.6. Characteristics of successful Product development;
2.7. Phases of a generic product development process;
2.8. Customer need identification;
2.9. Product development practices and industry-product strategies.

3. PRODUCT DESIGN

3.1. Design by evolution;
3.2. Design by innovation;
3.3. Design by imitation;
3.4. Factors affecting product design;
3.5. Standards of performance and environmental factors;
3.6. Decision making and iteration;
3.7. Morphology of design (different phases);
3.8. Role of aesthetics in design.

4. INTRODUCTION TO OPTIMIZATION IN DESIGN

4.1. Economic factors in design;

4.2. Design for safety and reliability;
4.3. Role of computers in design;
4.4. Modeling and Simulation;
4.5. The role of models in engineering design;
4.6. Mathematical modeling;
4.7. Similitude and scale models;
4.8. Concurrent design;
4.9. Six sigma and design for six sigma;
4.10. Introduction to optimization in design;
4.11. Economic factors and financial feasibility in design;
4.12. Design for manufacturing;
4.13. Rapid Proto typing (RP);
4.14. Application of RP in product design;
4.15. Product Development versus Design.

5. DESIGN OF SIMPLE PRODUCTS DEALING WITH VARIOUS ASPECTS OF PRODUCT DEVELOPMENT;

5.1. Design Starting from need till the manufacture of the product

REFERENCE BOOKS

1.Product Design and Development, Karl T.Ulrichand Steven D.Eppinger, TataMc Graw–Hill edition.
2.Engineering Design– George E. Dieter.
3.An Introduction to Engineering Design methods Vijay Gupta.
4.Merie Crawford: New Product management, McGraw-Hill Irwin.
5.Chitale A K and Gupta R C," Product Design and Manufacturing", Prentice Hall of India, 2005.
6.Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pears on education.

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DISASTER MANAGEMENT

Course Code	IE 63002 (Same in All Branches of Engg.)
Course Title	Disaster Management
Number of Credits	3 (L: 3, T: 0 ,P :0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

Following are the objectives of this course:

•To learn about various types of natural and man-made disasters.
•To know pre and post-disaster management for some of the disasters.
•To know about various information and organizations in disaster management in India.
•To get exposed to technological tools and their role in disaster management.

COURSE OUTCOMES:

1.1. After competing this course, student will be:
1.2. Acquainted with basic information on various types of disasters
1.3. Knowing the precautions and awareness regarding various disasters
1.4. Decide first action to be taken under various disasters
1.5. Familiarised with organization in India which are dealing with disasters
1.6. Able to select IT tools to help in disaster management

COURSE CONTENTS

1. UNDERSTANDING DISASTER

1.1. Understanding the Concepts and definitions of Disaster,
1.2. Hazard,
1.3. Vulnerability,
1.4. Risk,
1.5. Capacity–Disaster and Development,
1.6. Disaster management.

2. TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS

2.1. Geological Disasters (earth quakes, land slides,tsunami, mining);
2.2. Hydro-Meteorological Di-sasters (floods, cyclones, lightning, thunder-storms, hailstorms, avalanches, droughts, cold and heat waves)
2.3. Biological Disasters (epidemics, pestattacks, forestfire);
2.4. Technological Disasters (chemical, industrial, radiological, nuclear)
2.5. Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)
2.6. Global Disaster Trends
2.7. Emerging Risks of Disasters
2.8. Climate Change and Urban Disasters.

3. DISASTER MANAGEMENT CYCLE AND FRAME WORK

3.1. Disaster Management Cycle
3.2. Paradigm Shift in Disaster Management.
3.3. Pre-Disaster
3.4. Risk Assessment and Analysis,
3.5. Risk Mapping,
3.6. Zonation and Microzonation,
3.7. Prevention and Mitigation of Disasters,
3.8. Early Warning System
  3.8.1. Preparedness,
  3.8.2. Capacity Development;
  3.8.3. Awareness.
3.9. During Disaster
  3.9.1. Evacuation
  3.9.2. Disaster Communication
  3.9.3. Search and Rescue

3.9.4. Emergency Operation Centre
3.9.5. Incident Comm and System
3.9.6. Relief and Rehabilitation

3.10. Post-disaster
3.10.1. Damage and Needs Assessment,
3.10.2. Restoration of Critical Infra structure
3.10.3. Early Recovery Reconstruction and Redevelopment;
3.10.4. IDNDR, Yokohama Stretegy, Hyogo Frame-work of Action.

4. DISASTER MANAGEMENT IN INDIA

4.1. Disaster Profile of India
4.2. Mega Disasters of India and Lessons Learnt.
4.3. Disaster Management Act 2005
4.4. Institutional and Financial Mechanism,
4.5. National Policy on Disaster Management,
4.6. National Guidelines and Plans on Disaster Management;
4.7. Role of Government (local, state and national),
4.8. Non-Government and Inter Governmental Agencies

5. APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

5.1. Geo informatics in Disaster Management (RS, GIS, GPS and RS).
5.2. Disaster Communication System (Early Warning and Its Dissemination).
5.3. Land Use Planning and Development Regulations,
5.4. Disaster Safe Designs and Constructions,
5.5. Structural and Non Structural Mitigation of Disasters
5.6. S & T Institutions for Disaster Management in India

REFERENCES

1.Publications of National Disaster Management Authority (NDMA) on Various Templates and Guide lines for Disaster Management
2.Bhandani, R. K., An over view on natural & man-made disasters and their reduction, CSIR, New Delhi
3.Srivastava, H. N., and Gupta G. D. , Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4.Alexander, David, Natural Disasters, Kluwer Academic London
5.Ghosh, G .K. ,Disaster Management, APH Publishing Corporation
6.Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

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INDIAN CONSTITUTION

CourseCode	IE 6333 (Same in All Branches of Engg.)
CourseTitle	Indian Constitution
NumberofCredits	0 (L:2,T:0;P:0)
Prerequisites(Coursecode)	None
CourseCategory	AU

COURSE CONTENT

1. THE CONSTITUTION –

1.1. Introduction
1.2. The History of the Making of the Indian Constitution
1.3. Preamble and the Basic Structure, and its interpretation
1.4. Fundamental Rights and Duties and their interpretation
1.5. State Policy Principles

2. UNION GOVERNMENT

2.1. Structure of the Indian Union
2.2. President– Role and Power
2.3. Prime Minister and Council of Ministers
2.4. Lok Sabha and Rajya Sabha

3. STATE GOVERNMENT

3.1. Governor– Role and Power
3.2. Chief Minister and Council of Ministers
3.3. State Secretariat

4. LOCAL ADMINISTRATION

4.1. District Administration
4.2. Municipal Corporation
4.3. Zila Panchayat

5. ELECTION COMMISSION

5.1. Role and Functioning
5.2. Chief Election Commissioner
5.3. State Election Commission

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L.Fadia	Sahitya Bhawan; New edition(2017)
3.	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty-Third 2018 edition

SUGGESTED SOFTWARE / LEARNING WEBSITES:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

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PROCESS CONTROLLER

Course Code	IE 6001
Course Title	PROCESS CONTROLLER
Number of Credits	3 (L: 3, T: 0, P: 0)
Course Category	PC
Prerequisites	NONE

RATIONALE

Industrial processes need control devices. These devices are known as process controllers. There Are various types of controllers used in industry. This subject deals with some of them so that essential knowledge could be imparted to an instrumentation engineer.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Understand the basics of different control actions taken by process controllers.
2. Know about the construction and working of pneumatic, hydraulic and electronic controllers.
3. Understand the concepts of special control schemes employed in process industries.

CONTENTS

1. Introduction to Automatic Control

1.1 Concept of open loop and close loop system

1.2 Automatic control system with general block diagram and examples

2. Control Actions

2.1 On-Off control action
2.2 Proportional control action
2.3 Integral control action
2.4 Derivative control action
2.5 P+I, P+D, P+I+D actions

3. Pneumatic Controllers

3.1 Basic control mechanism of pneumatic controller with flapper nozzle as control element
3.2 Pneumatic Proportional controller
3.3 Pneumatic PI controller
3.4 Pneumatic PD controller
3.5 Pneumatic PID controller

4. Hydraulic Controllers

4.1 Principle of operation of pressure control pilot
4.2 Hydraulic proportional controller
4.3 Hydraulic PI controller
4.4 Hydraulic PD controller
4.5 Hydraulic PID controller

5. Electronic Controllers

5.1 Working of OP-AMP as
- 5.1.1Adder
- 5.1.2Differentiator
- 5.1.3 Integrator

5.2 Electronic Proportional Controller
5.3 Electronic PI controller
5.4 Electronic PD controller
5.5 Electronic PID controller

6. Special Control Schemes

6.1 Feed forward control
6.2 Cascade control
6.3 Ratio Control
6.4 Split range control
6.5 Selective control

REFERENCE BOOKS

1. Control Engineering	K. Ogata
2. Control System Engineering	Nagrath Gopal
3. Chemical Process Control	Stephanopoulos
4. Process Systems Analysis and Control	Coughanowr
5. Process Control	Peter Harriot

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PROCESS CONTROLLER LAB

Course Code	IE 6002
Course Title	PROCESS CONTROLLER LAB
Number of Credits	2 (L:0, T: 0, P: 4)
Course Category	PC
Prerequisites	NONE

RATIONALE

Process controller lab is introduced in the curriculum to give hands on knowledge about various types of controllers to the students. It is an important task to operate and calibrate different controllers.

SUBJECT LEARNING OUTCOMES (SLOS)

After studying the subject, the student will be able to:

1. Realize different prototype electronic controllers using elementary components.
2. Have in-depth knowledge of pneumatic and hydraulic controllers.
3. Understand the working of special control schemes.

CONTENTS

1. Realization of On – Off controller and to verify its output
2. Realization of Electronic P – Controller and to verify its output
3. Realization of Electronic PI – Controller and to verify its output
4. Realization of Electronic PD – Controller and to verify its output
5. Realization of Electronic PID – Controller and to verify its output
6. Study of Pneumatic PID Controller
7. Study of Hydraulic PID Controller
8. Study of Feed Forward Controller
9. Study of Cascade Controller
10. Study of Ratio Controller

REFERENCE BOOKS

1. Control Engineering	K. Ogata
2. Control System Engineering	Nagrath Gopal
3. Chemical Process Control	Stephanopoulos
4. Process Systems Analysis and Control	Coughanowr
5. Process Control	Peter Harriot

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