ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

UG Curriculum and Syllabus

(1 to 8 Semesters)

B.E – ELECTRONICS AND INSTRUMENTATION ENGINEERING

Choice Based Credit System (CBCS)

REGULATION 2019

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B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

Choice Based Credit System (CBCS)

(For the students admitted during the Academic year 2020-21 and Onwards)

REGULATION 2019

ERODE SENGUNTHAR ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 057

VISION AND MISSION OF THE INSTITUTE

VISION OF THE INSTITUTE

Vision of Erode Sengunthar Engineering College is to become a World Class Technical Institution and Scientific Research Centre for the Benefit of the Society

MISSION OF THE INSTITUTE

- Create Positive difference to Society through Innovative Teaching – Learning Process.
- Impart Value Based Technical Education to the Students from across various Socio Economic backgrounds.
- Build State of art infrastructure for high quality Research and Development capabilities on par with the finest in the Globe and widen student's horizons beyond Class Room.
- Bring out Competent, Ethically Strong and Quality Professionals.

DEPARTMENT OF ELCTRONICS AND INSTRUMENTATION ENGINEERING

VISION AND MISSION OF THE DEPARTMENT

VISION OF THE DEPARTMENT

The department is committed to solve real time problems in the field of Process and Automation for the benefit of industry and humanity with ethical values in global level.

MISSION OF THE DEPARTMENT

- To make effective Electronics and Instrumentation Professionals for facing current scenarios in society
- To formulate and shape the talent for autonomous and lifelong learning in the technological changes
- To uphold energetic associations with industries and research institutes for widen student's horizons
- To enhance the managerial and technical skills of student and faculty through continuous learning

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

I. Excel in Electronics and Instrumentation profession and higher education through innovative teaching learning process.

II. To promote involvement in Automation software used for design and analysis.

III. Graduates will be able to examine, design, develop and maintain the Automation systems of an industry and propose solutions through research.

IV. Exhibit Skilled and Moral code of behavior, communication talent, team work and all-time learning to resolve societal problems.

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PROGRAM OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

PSO1: Real World Knowledge: An ability to design, analysis and control of physical, chemical processes with the knowledge of its associated hazards/disasters and preparedness.

PSO2: Expertise in Instrumentation Software: An ability to develop and debug program in the instrumentation oriented software.

PSO3: Potential in Automation: Apply instrumentation system and superior controller for automation

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ERODE SENGUNTHAR ENGINEERING COLLEGE (AUTONOMOUS), ERODE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

I TO VIII SEMESTERS CURRICULAM

Induction Program (Mandatory)	3 weeks duration
Induction program for students to be offered right at the start of the first year	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lecture by Eminent People • Visits to local Areas • Familiarization to Dept. / Branch &Innovations

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING
Minimum credits to be earned: 164

SEMESTER I

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19BS101	Calculus and its Applications	I, II	1,2,3,4,12	1	3	1	0	4	40	60	100	BS
19BS102	Engineering Physics	I, II	1,2,4,5,6, 8,9	1,2	2	0	2	3	40	60	100	BS
19BS103	Engineering Chemistry	I, II	1,2,3,4,5, 7,12	-	3	0	0	3	40	60	100	BS
19HS101	Communicative English	IV	2,3,6,9,10 ,12	-	3	0	0	3	40	60	100	HS
19ES101	Python Programming	I, II, III	1,2,3,4,12	2	3	0	0	3	40	60	100	ES
19TPS01	Soft Skills - I	IV	8,9,10,12	-	1	0	1	1.5	40	60	100	EEC
PRACTICAL												
19ES104	Python Programming Laboratory	I, II, III	1,2,3,4,5, 12	2	0	0	2	1	60	40	100	ES
19BS105	Chemistry Laboratory	I ,II	1,2,3,4,5, 12	-	0	0	4	2	60	40	100	BS
19ES107	Workshop Practices	II	1,3,9, 12	-	0	0	2	1	60	40	100	ES
				TOTAL	15	1	11	21.5	420	480	900	-

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SEMESTER II												
THEORY												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Cate gory**
		PEOs	**POs**	**PSOs**					**CA**	**ES**	**Total**	
19BS201	Vector Calculus and Complex Variables	I ,II	1,2,3,4,12	1	3	1	0	4	40	60	100	BS
19BS205	Physics for Electronics Engineering	I ,II	1,2,3,4,5, 7	-	3	0	0	3	40	60	100	BS
19MC201	Environmental Science and Engineering	I ,II	1,2,3,4,5, 6,7,8,12	-	3	0	0	0	40	60	100	MC
19ES206	Semiconductor Devices and Circuits	I,II	1,2,3,4,12	-	3	0	0	3	40	60	100	ES
19ES210	Principles of Civil and Mechanical Engineering	II	1,6	-	3	0	0	3	40	60	100	ES
	Language Elective	IV	2,3,6,9,10 12	-	3	0	0	3	40	60	100	HS
19TPS02	Soft Skills - II	IV	8, 9,10,12	-	1	0	1	1.5	40	60	100	EEC
PRACTICAL												
19ES223	Electronics Devices and Circuits Laboratory	I,II, III	1, 9	-	0	0	4	2	60	40	100	ES
19ES221	Engineering Drawing	I	1,2,3,5,10 12	-	0	0	4	2	60	40	100	ES
				TOTAL	19	1	9	21.5	400	500	900	-

SEMESTER III												
THEORY												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Cate gory**
		PEOs	**POs**	**PSOs**					**CA**	**ES**	**Total**	
19BS304	Transform Techniques and their Applications	I, II	1, 2,3,4	-	3	1	0	4	40	60	100	BS
19EI301	Sensors and Transducers	I, II	1, 2, 3	-	3	0	0	3	40	60	100	PC
19EI302	Circuit Theory	I, II, III	1,2, 5	-	2	2	0	4	40	60	100	PC
19EI303	Electrical Measurements	I,II, III	1, 2, 3, 4	-	3	0	0	3	40	60	100	PC
19ES304	Electrical Machines	I,II	1,2	-	3	0	0	3	40	60	100	ES
19EC303	Signals and Systems	II,III	1,2,3,4,5, 6,11,12	-	3	1	0	4	40	60	100	ES
19TPS03	Quantitative Aptitude, and Logical Reasoning - I	IV	1,2,9,10,1 2	-	2	0	0	0	40	60	100	EEC
19MC301	Indian Constitution	IV	6,8,10,11, 12	-	2	0	0	0	40	60	100	MC
PRACTICAL												
19ES307	Electrical Machines and Electric Circuits Laboratory	I,II,III	1,2,3,4,5, 9	-	0	0	4	2	60	40	100	ES
19EI304	Sensors and Measurements Laboratory	I, II	1,2,3,9	-	0	0	4	2	60	40	100	PC
				TOTAL	21	4	8	25	440	560	1000	-

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SEMESTER IV												
THEORY												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
		PEOs	**POs**	**PSOs**					**CA**	**ES**	**Total**	
19BS402	Numerical Methods	I, II	1, 2,3	-	3	1	0	4	40	60	100	BS
19ES403	Object Oriented Programming	II, III	1,2,3,4,12	-	3	0	0	3	40	60	100	ES
19EI401	Linear Integrated Circuits and Applications	II	1, 2,	-	3	0	0	3	40	60	100	PC
19EI402	Digital Principles and System Design	I,II	1,2,3,4,12	-	2	1	0	3	40	60	100	PC
19EI403	Industrial Internet of Things	I,II	1,2,3,4,12	-	2	0	2	3	40	60	100	PC
19ES405	Thermodynamics and Fluid Mechanics	II,III	2,3,4,12	-	3	0	0	3	40	60	100	ES
19TPS04	Quantitative Aptitude, and Logical Reasoning - II	IV	1,2,9,10, 12	-	2	0	0	0	40	60	100	EEC
PRACTICAL												
19ES404	Object Oriented Programming Laboratory	II,III	1,2,5,9	-	0	0	4	2	60	40	100	ES
19EI404	Linear and Digital Integrated Circuits Laboratory	I,II	1,2,3,4,9	-	0	0	4	2	60	40	100	PC
19HS401	Language Skills	IV	5, 9,10,12	-	0	0	2	0	100	0	100	EEC
				TOTAL	18	2	12	23	500	500	1000	-

SEMESTER V												
THEORY												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
		PEOs	**Pos**	**PSOs**					**CA**	**ES**	**Total**	
19EI501	Automatic Control Systems	II,III	1,2,3,4,5, 6,11,12	1, 3	3	1	0	4	40	60	100	PC
19EI502	Industrial Instrumentation-I	II,III	2,3,4	3	3	0	0	3	40	60	100	PC
19EI503	Industrial Instrumentation–II	II,III	3,4,5,6,7	3	3	0	0	3	40	60	100	PC
19EI504	Microprocessors and Microcontrollers	II, III	5,7,9,12	-	3	0	0	3	40	60	100	PC
19HS505	Universal Human Values 2 : Understanding Harmony	I,II,III,IV	1,6,7,10, 12	3	2	1	0	3	40	60	100	HS
19TPS05	Quantitative Aptitude, and Logical Reasoning - III	IV	9,10,11, 12	-	2	0	0	0	40	60	100	EEC
PRACTICAL												
19EI506	Industrial Instrumentation Laboratory	II,III	3,4,5,6,9, 10	3	0	0	4	2	60	40	100	PC
19EI507	Microprocessors and Microcontrollers Laboratory	II, III	2,3,4,9,10	-	0	0	4	2	60	40	100	PC
19EI508	Internship/ Industrial Training	I,IV	1,2,3,4,5, 6,7,8,9,10 11,12	1,2	0	0	2	1	100	0	100	EEC
				TOTAL	16	2	10	21	460	440	900	-

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SEMESTER VI

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	Pos	PSOs					CA	ES	Total	
19EI601	Industrial Automation	II,III, IV	1,3,5	1, 2, 3	3	0	0	3	40	60	100	PC
19EI602	Process Control	II,III	1,2,3,4,5, 6	1, 3	2	2	0	4	40	60	100	PC
19EI603	Analytical Instruments	II,III	2, 3, 4, 12	1, 3	3	0	0	3	40	60	100	PC
	Professional Elective – 1	--	-	-	3	0	0	3	40	60	100	PE
	Open Elective – 1	-	-	-	3	0	0	3	40	60	100	OE
19TPS06	Quantitative Aptitude, and Logical Reasoning – IV	IV	1,2,9, 10,12	-	2	0	0	0	40	60	100	EEC
PRACTICAL												
19EI604	Process Control Laboratory	II,III	2,3,4,5,6, 9,10	1, 3	0	0	4	2	60	40	100	PC
19EI605	Industrial Automation Laboratory	II,III,IV	1,2,3,5,9	1, 2, 3	0	0	4	2	60	40	100	PC
19HS601	Career Skills	IV	1,5,7,8,9, 12	-	0	0	2	0	100	0	100	EEC
				TOTAL	16	2	10	20	460	440	900	-

SEMESTER VII

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	Pos	PSOs					CA	ES	Total	
19EI701	Computer Control of Process	II, III	1,2,3,4,5	1, 2, 3	3	0	0	3	40	60	100	PC
19EI702	Industrial Data Networks	II, III	1,2,3,4,7,12	1, 2, 3	3	0	0	3	40	60	100	PC
19EI707	Robotics and Automation	II,III	1,2,3,5	3	3	0	0	3	40	60	100	PC
	ProfessionalElective – 2	-	-	-	3	0	0	3	40	60	100	PE
	Open Elective – 2	-	-	-	3	0	0	3	40	60	100	OE
PRACTICAL												
19EI703	Computer Control of Process Laboratory	II,III	1,2,3,4,5, 9	1, 2, 3	0	0	4	2	60	40	100	PC
19EI704	InstrumentationSystem Design Laboratory	II,III,IV	3,4,5,9,10	1, 3	0	0	4	2	60	40	100	PC
19EI705	Mini Project	II,III, IV	1,2,3,4,5,6, 7,8,9,10,11, 12	1, 3	0	0	2	1	100	0	100	EEC
19EI706	ComprehensiveReview	I, IV	1,2,3,4,5,6, 7,8,9,10,11, 12	-	0	0	2	0	100	0	100	EEC
				TOTAL	15	0	12	20	520	380	900	-

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SEMESTER VIII												
THEORY												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
		PEOs	**Pos**	**PSOs**					**CA**	**ES**	**Total**	
-	Professional Elective – 3	-	-	-	3	0	0	3	40	60	100	PE
-	Professional Elective – 4	-	-	-	3	0	0	3	40	60	100	PE
PRACTICAL												
19EI801	Project Work	II,III, IV	1,2,3,4,5,6, 7,8,9,10,11, 12	1, 3	0	0	12	6	60	40	100	EEC
				TOTAL	6	0	12	12	140	160	300	-

ELECTIVES

LANGUAGE ELECTIVES								
Code No.	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**
		PEOs	**Pos**	**PSOs**				
19HX201	English for Engineers	IV	2,3,6,9,10, 12	-	3	0	0	3
19HX202	Hindi	IV	2,3,6,9,10, 12	-	3	0	0	3
19HX203	Japanese	IV	2,3,6,9,10, 12	-	3	0	0	3
19HX204	French	IV	2,3,6,9,10, 12	-	3	0	0	3

PROFESSIONAL ELECTIVES								
Code No.	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**
		PEOs	**Pos**	**PSOs**				
PROFESSIONAL ELECTIVE – I								
19EIX01	Digital Signal Processing	II,III	1,2,3,5	-	3	0	0	3
19EIX02	Digital Control System	II,III	1,3,4,12	1	3	0	0	3
19EIX03	Field Instruments and Process Automation	II,III	1,2,3,4,5,6,7,8, 9,10,11	1, 3	3	0	0	3
19EIX04	Applied Soft Computing	II,III	1,2,5,11,12	1, 3	3	0	0	3
19EIX05	Smart and Wireless Instrumentation	II, III	1,2,3,4,5,6,9,12	3	3	0	0	3
PROFESSIONAL ELECTIVE – II								
19EIX06	Thermal Power Plant Instrumentation	II,III	1,2,3,5	1, 3	3	0	0	3
19EIX07	Instrumentation in Petrochemical Industries	II,III	1,3,5	1, 3	3	0	0	3
19EIX08	Instrumentation and Control in Iron and Steel Industries	II,III	2,3,4,5,7,8,10,1 1	1, 3	3	0	0	3
19EIX09	Instrumentation and Control in Paper Industries	II,III	1,2,3,4,5	1, 3	3	0	0	3
19EIX10	Instrumentation in Agriculture	II,III	1, 2, 3, 4, 5,6, 7, 12	1, 3	3	0	0	3
PROFESSIONAL ELECTIVE – III								
19EIX11	Embedded System	II,III	1, 2, 3, 4, 5,6	-	3	0	0	3
19EIX12	System Identification	II,III	1,3,4,5,7	-	3	0	0	3
19EIX13	Adaptive Control	II,III	1,3,4,5,8	-	3	0	0	3
19EIX14	Optimal Control	II,III	1,3,5,8	-	3	0	0	3
19EIX15	Optimal State Estimation	II,III	1, 2, 3, 4, 5,9, 11	-	3	0	0	3
PROFESSIONAL ELECTIVE – IV								
19EIX16	Introduction to Process Data Analytics	II,III	1,3,5	3	3	0	0	3
19EIX17	Virtual Instrumentation	II, III	1,2,3,4,5	1, 2, 3	3	0	0	3
19EIX18	Advanced Process Control	II,III	1, 2, 3, 4, 5,8	3	3	0	0	3
19EIX19	Fibre optics and Laser Instrumentation	II,III	1, 2, 3, 4, 5,6	-	3	0	0	3
19EIX20	Instrumentation in Food Processing Industries	II,III	1, 2	1, 3	3	0	0	3

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OPEN ELECTIVES								
Code No.	Course	Objective & Outcomes			L	T	P	C
		PEOs	POs	PSOs				
19EIY01	Radar and Navigation Aids	II, III	2,3,4,12	-	3	0	0	3
19EIY02	Electronic Instrumentation	II, III	2,3,4	-	3	0	0	3
19EIY03	Sensor Technology	II, III	2,3	-	3	0	0	3
19EIY04	Instrumentation in Aerospace and Navigation	II, III	2,3,4,12	-	3	0	0	3
19EIY05	Industrial Process Automation	II, III	2,3,4,12	-	3	0	0	3
19EIY06	Programmable Logic Controller	II, III	2,3,4,5,11,12	-	3	0	0	3

ADDITIONAL ONE CREDIT COURSES								
CodeNo.	Course	Objective & Outcomes			L	T	P	C
		PEOs	POs	PSOs				
19EIZ01	Entrepreneurship Development	IV	10, 11	-	1	0	0	1
19EIZ02	Industrial Safety Standards for Instrumentation Products	III	1, 2, 3, 6, 7,8	3	1	0	0	1
19EIZ03	Detailed Instrumentation Engineering	II,III	1, 2, 3, 5, 6	3	1	0	0	1
19EIZ04	Calibration Techniques	II, III	1, 2, 3, 7	3	1	0	0	1
19EIZ05	IoT using Raspberry Pi	II,III	1, 2, 3	2, 3	1	0	0	1
19EIZ06	Modeling and Analysis of Instrumentation	II,III, IV	1, 2, 3, 5, 7	1, 2, 3	1	0	0	1
19EIZ07	High Temperature Instrumentation	II,III, IV	1, 2, 3, 7	3	1	0	0	1
19EIZ08	Design Of Low Cost Automation for Industries	II,III	1, 2, 3, 5, 6,7	3	1	0	0	1
19EIZ09	Energy Management Systems In Industries	II,III	1, 2, 3, 5, 6,8	-	1	0	0	1
19EIZ10	Smart Plant Instrumentation	II,III	1, 2, 3, 5, 6	3	1	0	0	1

S.No.	Category	Credits Per Semester								Total Credit	Credits in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	12	7	4	4					27	16	15	20
2	HS	3	3			3				09	5	5	20
3	ES	5	10	9	8					32	20	15	20
4	PC			12	11	17	14	13		67	41	35	45
5	PE						3	3	6	12	7	5	10
6	OE						3	3		6	4	4	10
7	EEC	1.5	1.5			1		1	6	11	7	5	10
	Total	21.5	21.5	25	23	21	20	20	12	164	100		

BS-BasicScience
HS-Humanities andSocialScience
OE-Open Elective
MC –Mandatorycourse
ES- EndSemesterExamination

ES-Engineering Science
PE- Professional Elective
PC- Professional Core
CA – ContinuousAssessment
EEC-Employability EnhancementCourse

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	BS
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS101	CALCULUS AND ITS APPLICATIONS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Interpret the introductory concepts of Limit and continuity
- Interpret the introductory concepts of calculus, this will enable them to model and analyze physical phenomena involving continuous change of variables
- Find eigen values and eigen vectors which is one of the powerful tools to handle practical problems arising in the field of engineering.
- Summarize and apply the methodologies involved in solving problems related to functions of several variables.
- Develop enough confidence to identify surface and area there by solving using integration

Course Outcomes: At the end of this course, learners will be able to:

- Apply differentiation to solve maxima and minima problems use both the limit definition and rules of differentiation to differentiatefunctions
- Identify and model the real time problems using first order linear differential equations. Recognize and solve the higher order ordinary differentialequations.
- Analyze the characteristics of a linear system with Eigen values and Eigenvectors.
- Characterize the functions of several variables and get the solutions of thesame.
- Integrate the functions for evaluating the surface area andvolume.

Unit I	LIMITS AND CONTINUITY	12

Representation of a function-Limit of a function-Continuity-Derivatives-Differentiation rules-Maxima and Minima of one variable

Unit II	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchy's linear differential equation - Method of variation of parameters for second order differential equations-Vibrating string-Electrical circuits

Unit III	MULTIVARIABLE CALCULUS	12

Functions of Two Variables and their solutions- Total Differential - Derivative of implicit functions-Jacobian's, Unconstrained maxima and minima.

Unit IV	MULTIPLE INTEGRALS	12

Double integration with constant and variable Limits-Region of integration -Change the order of integration -Area as double integral in Cartesian coordinates. Triple integral in Cartesian coordinates.

Unit V	EIGEN VALUES AND EIGEN VECTORS	12

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values-Cayley - Hamilton Theorem Orthogonal matrix- Diagonalization-Quadratic form: Reduction of a quadratic form to a canonical form.

REFERENCE(S):

1. Thomas Calculus, 14th Edition byPearson
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, NewDelhi 2015.
3. Peter V. O Neil, Advanced Engineering Mathematics, Seventh Edition, Cengage Learning India Private Limited,2018
4. C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd,2003.
5. Glyn James, Advanced Engineering Mathematics, Third Edition, Wiley India,2014.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS102	ENGINEERING PHYSICS (Laboratory Embedded)	2	0	2	3	60	100	

Course Objective (s): The purpose of learning this course are

- To enhance the fundamental knowledge in different materials.
- To intensify the information regarding the ultrasonic sound and its applications.
- To reveal the needs of fiber optics and laser application in the modern technology.
- To upgrade the knowledge in quantum mechanics.
- To analysis the role of thermal properties in the materials and applications.

Course Outcomes: At the end of this course, learners will be able:

- To gain knowledge on the basics of properties of matter and its applications
- To acquire knowledge on the concepts of Ultrasonic and their applications
- To have adequate knowledge on the concepts of fiber & Laser and their applications
- To get knowledge on advanced Physics concepts of quantum theory and its applications in tunneling microscopes
- To understand knowledge on the concepts of thermal properties of materials and their applications in expansion of joints and heat exchangers

Unit I	PROPERTIES OF MATTER	6

Elasticity – Stress-strain diagram and its uses - torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders.

Unit II	ULTRASONICS	6

Introduction–Classification of Sound- Ultrasonic Production - Magnetostriction generator - Piezo electric generator-cavitation's-ultrasonic cleaning-Non Destructive Testing- Pulse echo system through transmission and reflection modes- A, B and C – scan displays- Engineering Applications-Cutting, welding and drilling.

Unit III	LASER AND FIBRE OPTICS	6

Lasers: population of energy levels, Einstein 's A and B coefficients derivation – Semiconductor lasers: homojunction and heterojunction – Industrial applications of laser. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

Unit IV	QUANTUM PHYSICS	6

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.

Unit V	THERMAL PHYSICS	6

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: heat exchangers, ovens and solar water heaters.

TEXT BOOK(S):

1. Bhattacharya, D.K. & Poonam, T. —Engineering Physicsǁ. Oxford University Press, 2015
2. Gaur, R.K. & Gupta, S.L. —Engineering Physicsǁ. Dhanpat Rai Publishers, 2012
3. Pandey, B.K. & Chaturvedi, S. —Engineering Physicsǁ. Cengage Learning India, 2012

REFERENCE(S):

1. Halliday, D., Resnick, R. & Walker, J. —Principles of Physicsǁ. Wiley, 2015
2. Serway, R.A. & Jewett, J.W. —Physics for Scientists and Engineersǁ. Cengage Learning, 2010
3. Tipler, P.A. &Mosca, G. - Physics for Scientists and Engineers with Modern Physics'.W.H.Freeman, 2007

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Exp No.	Name of Experiments (Any Five)
1	Determination of Rigidity Modulus – Torsion Pendulum
2	Determination of Young's Modulus by Non-Uniform Bending Method
3	Determination of Young's Modulus by Uniform Bending Method
4	Determination of Wavelength, and Particle Size using Laser
5	Determination of Acceptance Angle in an Optical Fiber.
6	Determination of Thermal Conductivity of a Bad Conductor – Lee's Disc Method.
7	Determination of Velocity of Sound and Compressibility of Liquid – Ultrasonic Interferometer
8	Determination of Wavelength of Mercury Spectrum – Spectrometer Grating
9	Determination of Band gap of a Semiconductor
10	Determination of Thickness of a thin wire – Air Wedge Method

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	BS
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS103	ENGINEERING CHEMISTRY	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic concepts of water characterization and treatment methods.
- Know the fundamental concepts of electrochemistry and corrosion.
- Understand the principles and generation of energy in batteries and nuclear reactors.
- Gain knowledge on polymers.
- Know the types of fuels and the manufacture of solid, liquid and gaseous fuels.

Course Outcomes: At the end of this course, learners will be able to:

- Make the students conversant with water treatment techniques
- Know the reaction involved in corrosion and corrosion protection methods
- Impart knowledge on renewable energy sources like nuclear and to impart knowledge on energy storage devices
- Aware the synthesis & industrial application of polymers
- Impart knowledge on different types of fuels (solid liquid, gas, primary, secondary and synthetic) and combustion process.

Unit I	WATER CHEMISTRY	9

Hardness of water – types – Estimation of hardness of water by EDTA method– – Domestic water treatment-boiler troubles (scales,sludge,priming,foaming,causticembrittlememt) – Internal conditioning (carbonate, phosphate, sodium aluminate and calgon) .External treatment – Demineralization process – Reverse Osmosis

Unit II	ELECTROCHEMISTRY AND CORROSION	9

Electrochemical cell - redox reaction, electrode potential- Nernst equation (derivation and problems). Electro Chemical Series-Standard Hydrogen Electrode-Calomel Electrode. Corrosion: chemical & electrochemical corrosion (galvanic, differential aeration) - types-factors influencing corrosion rate corrosion control - sacrificial anode and impressed current cathodic protection method.

Unit III	ENERGY SOURCES	9

Introduction- nuclear energy- nuclear fission- nuclear fusion- nuclear chain reactions- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium ion battery. Fuel cell :H2 -O2 fuel cell.

Unit IV	POLYMER CHEMISTRY	9

Monomers - polymers - polymerization - functionality - degree of polymerization - classification of polymers based on source and applications. Types of polymerization: addition, condensation and copolymerization. Preparation, properties and applications of thermosetting (epoxy resin and Bakelite) and thermoplastics (poly vinyl chloride, poly tetrafluoroethylene and PMMA). Rubber: SBR. Compounding of plastics (blow moulding, injection, extrusion) .

Unit V	FUELS AND COMBUSTION	9

Fuel: Introduction- classification of fuels- solid fuels-coal- proximate and ultimate analysis- manufacture of metallurgical coke (Otto Hoffmann method) – Liquid fuels: Refining of petroleum- synthetic petrol Fischer-Trophs and Bergius processes- knocking- octane number- cetane number – Gaseous fuels: liquefied petroleum gases(LPG)- water gas- bio diesel. Combustion- flue gas analysis (ORSAT Method).

TEXT BOOK(S):

1. Jain P.C.and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2019.
2. Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2019

REFERENCE(S):

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2016
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2017.
3. GowarikerV.R,Viswanatha.N.V,Jayadev Sreedhar-"Polymer Science",Publishing company New Age International Publishers,New Delhi,2015.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2017.
5. Ashima Srivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2015.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING				R 2019	Semester I	HS
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS101	COMMUNICATIVE ENGLISH	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Acquire basic English grammar.
- Develop listening skills to listen lectures and basic videos.
- Enhance the reading skill to comprehend technical writings.
- Improve writing skills to express thoughts freely.
- Develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:

- Improve language usage in LSRW skills.
- Develop listening skills to comprehend general / technical talks.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas of the learners.
- Communicate fluently in real time context.

Unit I	LANGUAGE FOCUS	9

Parts of speech - Word formation - Sentence types (declarative, imperative, exclamatory & interrogative) - Tense forms - Subject - Verb agreement

Unit II	LISTENING	9

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Telephone etiquette - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress

Unit III	READING	9

Completing the sentences - Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure - Close reading

Unit IV	WRITING	9

Paragraph writing (descriptive, narrative, expository & persuasive) - Letter (formal and informal) - Dialogue writing- E-mail – Instructions

Unit V	SPEAKING	9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes

TEXT BOOK(S):

1. Communicative English by KN Shoba, Lourdes Joavani Rayen Publised by Cambridge university 2017.

REFERENCE(S):

1. Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For
2. Intermediate learners of English. Ived. United Kingdom: Cambridge University Press. 2012.
3. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
4. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.
5. Wren and Martin, High school English Grammar and Composition, Publisher: S.Chand. 2019.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	ES
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES101	PYTHON PROGRAMMING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Understand problem solving concepts.
- Understand why Python is a useful scripting language for developers and to read and write simple Python programs.
- Develop Python programs with conditionals and loops
- Use Python data structures –- lists, tuples, dictionaries.
- Do input/output with files in Python

Course Outcomes:

At the end of this course, learners will be able to

- Apply problems solving techniques to real world problems.
- Recognize and construct common programming idioms: variables, loop, branch, and input/output.
- Design, code, and test Python programs using List, Tuples and Strings
- Write code using dictionaries and functions
- Read and write data from/to files in Python Programs.

Unit I	COMPUTATIONAL THINKING	9

Introduction to Computational Thinking –From abacus to machine – The first Software –First Modern Computer- Information and data - Converting information into data -Data Capacity Problem Solving Techniques: General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart Problem Solving with Sequential Logic Structure- Problem Solving with Decisions - Problem Solving with Loops Case Study: Raptor and Scratch Tools.

Unit II	INTRODUCTION TO PYTHON	9

History- Features - Setting up path - Working with Python - Basic Syntax - Variable and Data Types - Operator- Conditional Statements – Looping – Control Statements

Unit III	STRING MANIPULATION, LIST AND TUPLES	9

Creating String - Accessing Strings - Basic Operations - String slices - Function and Methods – Creating List - Accessing list - Operations on List - Working with lists - Function and Methods – Creating tuple - Tuple Operations– Functions and Methods

Unit IV	DICTIONARIES AND FUNCTIONS	9

Creating Dictionaries - Accessing values in dictionaries - Working with dictionaries - Properties – Functions - Defining a function - Calling a function - Types of functions - Function Arguments - Anonymous functions - Global and local variables

Unit V	MODULES, FILES AND EXCEPTION HANDLING	9

Modules - Importing module - Math module - Random module - Packages - Composition Files - Opening and closing file- File Opening Modes - Reading and writing files – Functions Exception Handling - Exception - Exception Handling - Except clause - Try , finally clause User Defined Exceptions

TEXT BOOK(S)

1. David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2. M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.

REFERENCE(S)

1. Brian Heinold, "Introduction to Programming Using Python",Mount St. Mary's University, 2013.
2. Michael Dawson ,"Python Programming for the Absolute Beginner" , 3rd Edition, 2010.
3. Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4. Cunningham, sams teach yourself python in 24 hours, Second edition Pearson, 2014.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS01	SOFT SKILLS- I	1	0	1	1.5	30	100	

Course Objective (s): The purpose of learning this course is to

- Develop basic grammar knowledge in English.
- Enhance Speaking Skills in English
- Improve Verbal and Non-verbal Communication Skills
- Develop Confidence and Emotional Intelligence
- Develop Inter Personal Skills.

Course Outcomes: At the end of this course, learners will be able to:

- Have competent knowledge of grammar
- Speak fluent English by enriching Vocabulary Knowledge.
- Have good Presentation Skills through verbal and non-verbal communication.
- Handle any Situation with confidence by being emotionally stable.
- Work in a team by having team coherence and dealing with people.

UNIT 1	Effective English – Written English	6

Basic rules of Grammar - Parts of Speech – Tenses – Verbs.Sentence Construction.Dialogues and Conversations – Writing. Exercises to practice and improve these skills.

UNIT 2	Effective English – Spoken English	6

Vocabulary – Idioms & Phrases – Synonyms – Antonyms.Dialogues and Conversations –Writing. Exercises to practice and improve these skills.

UNIT 3	Art of Communication & The Hidden Data Involved	6

Verbal Communication - Effective Communication - Active listening –Paraphrasing – Feedback.
Non Verbal Communication - Body Language of self and others. Importance of feelings in communication - dealing with feelings in communication.

UNIT 4	World of Teams – Part -01	6

Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence.

UNIT 5	World of Teams – Part -02	6

Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved Working with Groups – Dealing with People- Group Decision Making

REFERENCES:

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – OgMandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	ES
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES104	PYTHON PROGRAMMING LABORATORY	0	0	2	1	30	100	

Course Objective (s):

The purpose of learning this course is to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Course Outcomes:

At the end of this course, learners will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

List of Experiments

1. Find the Greatest among three numbers without using third variable
2. Sum of the Digits of a Number
3. Generation of Prime Numbers
4. Implement a sequential search
5. Create a calculator program
6. Explore string functions
7. Implement Selection Sort and Stack
8. Read and write into a file
9. Demonstrate usage of basic regular expression
10. Demonstrate use of advanced regular expressions for data validation.
11. Demonstrate use of List and Dictionaries
12. Demonstrate use of Create Comma Separate Files (CSV), Load CSV files into internal Data Structure

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TEXT BOOK(S)

1. David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2. M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.

REFERENCE(S)

1. Brian Heinold," Introduction to Programming Using Python",Mount St. Mary's University, 2013.
2. Michael Dawson, "Python Programming for the Absolute Beginner", 3rd Edition, 2010.
3. Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4. Cunningham, sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS105	CHEMISTRY LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Determination of total, temporary & permanent hardness of water by EDTA method.
- Determination of chloride content of water sample by Argentometric method.
- Estimation of iron content of the given solution using potentiometer.
- Determination of strength of given hydrochloric acid using pH meter
- Conductometric titration of strong acid vs strong base.

Course Outcomes: At the end of this course, learners will be able to

- Make the student to acquire practical skills in the determination of water quality parameters through volumetric analysis.
- Acquire the knowledge about chloride content in water sample.
- Make the student to acquire practical skills about strength of iron using potentiometric titrations.
- Understand the how to estimate hydrochloric acid in water sample using pH meter.
- Gain the knowledge about conductance of ions.

List of Experiments

CHEMISTRY (ANY TEN)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of Dissolved oxygen content in water sample using Winklers Method
4. Determination of Alkalinity in Water Sample
5. Determination of strength of given hydrochloric acid using pH meter.
6. Determination of strength of acids in a mixture of acids using conductivity meter.
7. Conductometric titration of strong acid vs strong base
8. Estimation of iron content of the given solution using potentiometer.
9. Conductometric titration of strong acid vs strong base
10. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer
11. Estimation of iron content of the water sample using spectrophotometer
12. Estimation of Copper in Brass

LIST OF EQUIPMENT (CHEMISTRY)

S. No	Description of Equipment	Quantity required
1	Potentiometer	10 Nos.
2	pH meter	10 Nos.
3	Conductivity meter	10 Nos.
4	Spectrophotometer	2 Nos.
5	Oswald viscometer	30 Nos.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester I	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
19ES107	WORKSHOP PRACTICES	L	T	P	C			
		0	0	2	1	30	100	

Course Objectives: The purpose of learning this course is to

- Provide hands-on training in fabrication of components using carpentry, sheet metal and welding equipment / tools.
- Acquire the skill for making fitting joints and household pipe line connections using suitable tools.
- Develop the skill for preparing the green sand mould.
- Provide hands-on training in assembling and dismantling of petrol engines, gear boxes and pumps.
- Develop the skill for making wood/sheet metal models using suitable tools.

Course Outcomes: At the end of this course, learners will be able to:

- Fabricate simple components using carpentry, sheet metal and welding equipment/tools.
- Make fitting joints and household pipe line connections using suitable tools.
- Prepare green sand mould.
- Assemble and dismantle petrol engines, gear boxes and pumps.
- Make simple models using wood and sheet metal.

Exp. No.	Name of Experiments
1	Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box)
2	Fabrication of a simple component using thin and thick plates. (Example: Book rack)
3	Making a simple component using carpentry power tools. (Example: Pen stand/Tool box/ Letter box)
4	Prepare a "V", Half-round or Square joint from the given mild steel flat plate.
5	Construct a household pipe line connections using pipes, Tee-joint, Four-way joint, elbow, union, bend, gateway and taps (or) Construct a pipe connection for domestic application (centrifugal pump) using pipes, bend, gate valve, flanges and foot valve.
6	Prepare a green sand mould using solid pattern/split pattern.
7	Dismantling and assembly of Centrifugal Gear Pump / Gear box.
8	Dismantling and assembly of two-stroke and four-stroke petrol engine.
9	a) Preparation of butt joints, lap joints and T- joints by Electric Arc Welding. b) Gas Welding practice.
10	Mini-Project (Fabrication of small components).

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
S.No.	NAME OF THE EQUIPMENT	QUANTITY
1.	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings	15 sets
2.	Carpentry Vice (fitted to work bench)	15 Nos.
3.	Standard woodworking tools	15 Sets.
4.	Models of industrial trusses, door joints, furniture joints	5 each
5.	Power Tools: (a) Rotary Hammer	2 Nos.
	(b) Demolition Hammer	2 Nos.
	(c) Circular Saw	2 Nos.
	(d) Planer	2 Nos.
	(e) Hand Drilling Machine	2 Nos.
	(f) Jigsaw	2 Nos.
6.	Arc welding transformer with cables and holders	5 Nos.
7.	Welding booth with exhaust facility	2 Nos.
8.	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
9.	Oxygen and acetylene gas cylinders, blow pipe and other welding outfits	2 Nos.
10.	Centre lathe	2 Nos.
11.	Hearth furnace, anvil and smithy tools	2 Sets.
12.	Moulding table, foundry tools	2 Sets.
13.	Power Tool: Angle Grinder	2 Nos.
14.	Study-purpose items: Centrifugal pump, Air-conditioner	One each.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	BS
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS201	VECTOR CALCULUS AND COMPLEX VARIABLES	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Summarize problems related to fundamental principles of Vector Calculus
- Apply the methodologies involved in solving problems related to fundamental principles Vector Differentiation and Vector Integration.
- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- Defining a complex function and solving through complex integration

Course Outcomes: At the end of this course, learners will be able to:

- Characterize the calculus of vectors.
- Apply the theoretical aspects of vector integral calculus in their core areas.
- Recognize the differentiation properties of complex functions.
- Identify the complex functions and their mapping in certain complex planes.
- Use the concepts of integration to complex functions in certain regions.

Unit I	DIFFERENTIATION OF VECTORS	12

Vector point function- Directional derivative - Gradient -Divergence -Curl - Solenoidal – Irrotational vector fields – Scalar potential

Unit II	INTEGRATION OF VECTORS	12

Work done - Line Integral - Surface integral- Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

Unit III	ANALYTIC FUNCTIONS	12

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.

Unit IV	MAPPING OF COMPLEX FUNCTIONS	12

Conformal mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

Unit V	COMPLEXINTEGRATION	12

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series-Classification of Singularities - Cauchy's Residue Theorem

REFERENCE(S):

1. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015
2. C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd, 2003
3. J. A. Brown and R. V. Churchill, Complex Variables and Applications, Sixth Edition, McGraw Hill,New Delhi, 1996
4. Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition, Cengage Learning India Private Limited, 2012
5. Glyn James, Advanced Engineering Mathematics, Third Edition,WileyIndia,2007

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS205	PHYSICS FOR ELECTRONICS ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course are

- To understand the essential principles of electrical properties of materials.
- To understand the properties of magnetic materials and its applications.
- To become skillful in semiconductors.
- To become proficient in dielectric materials.
- To strengthen the basic knowledge on the nanomaterials and quantum concepts.

Course Outcomes: At the end of this course, learners will be able:

- To gain knowledge on electrical properties of materials,
- To acquire knowledge on basics of magnetic materials and its applications in various devices
- To get knowledge on semiconducting materials and its properties,
- To have the necessary understanding on dielectric materials and its applications
- To understand the basics of nanomaterials and their applications

Unit I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures — Fermi- Dirac statistics – Density of energy states – metals, semiconductors and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

Unit II	MAGNETIC PROPERTIES	9

Origin of Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory, Hysteresis theory, soft and hard magnetic materials. Applications of Magnetic materials.

Unit III	SEMICONDUCTOR PHYSICS	9

Introduction- types of semiconductors - Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Hall effect theory (n-type and p-type semiconductors) and its experiment- Applications.

Unit IV	DIELECTRIC PROPERTIES OF MATERIALS	9

Dielectric materials: various types of Polarization mechanisms – Electronic, Ionic, Orientation and space charge polarization- Frequency and temperature dependence of polarization-dielectric loss – internal field – Clausius - Mosotti relation- various dielectric breakdown mechanisms- Applications of dielectric materials-Ferro electric Materials-Properties and applications.

Unit V	NANOELECTRONIC DEVICES	9

Nanomaterials Introduction – synthesis-top down and bottom up approach- -physical vapour deposition-quantum dots - size dependence of Fermi energy– quantum confinement – applications- transistor-MOSFET-LED-Carbon nanotubes: preparation- chemical vapour deposition-properties and Applications-Energy storage devices.

TEXT BOOK(S):

1. Kasap, S.O. —Principles of Electronic Materials and Devicesll, McGraw-Hill Education, 2007.
2. Umesh K Mishra &Jasprit Singh, —Semiconductor Device Physics and Design, springer,2008.
3. Wahab, M.A. —Solid State Physics: Structure and Properties of Materials, NarosaPublishingHouse, 2009.

REFERENCE(S):

1. Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.
2. Hanson, G.W. —Fundamentals of Nanoelectronics. Pearson Education, 2009
3. Rogers, B., Adams, J. &Pennathur, S. —Nanotechnology: Understanding Small Systems. CRC Press, 2014

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	MC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19MC201	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	0	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the nature and facts about environment.
- Finding and implementing scientific, technological and economic solutions to environmental problems.
- Know the types of natural resources and the individual role in conserving the resources.
- Apply the knowledge to various social issues by understanding the environmental legislation laws.
- Study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Outcomes: At the end of this course, learners will be able to:

- Extend their knowledge in maintaining ecological balance and make use of their knowledge in the preservation of biodiversity.
- Outline the role of human being in maintaining a clean environment and useful environment for the future generations.
- Explain the constituents of environment, precious resources in the environment and conservation of natural resources.
- Find the role of government and Non-Government organization and explain the various rain water harvesting techniques.
- Develop their awareness about population growth, Family planning programme and HIV/AIDS and extend their knowledge in role of information technology in environment & human health.

Unit I	ECOSYSTEMS AND BIODIVERSITY	10

Environment: Scope – importance - need for public awareness -Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social - ethical - aesthetic values - Hotspots of biodiversity - Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts. Conservation of biodiversity - In-situ and Ex-situ conservation.

Unit II	ENVIRONMENTAL POLLUTION	8

Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.

Unit III	NATURAL RESOURCES	9

Forest resource - Use-over exploitation -deforestation - Water resource - use-over utilization of surface and ground water - conflicts over water - Mineral resource - use-exploitation-environmental effects of extracting and using mineral resource - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resource - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.

Unit IV	SOCIAL ISSUES AND THE ENVIRONMENT	9

Sustainable & Unsustainable development-Water conservation - rain water harvesting (roof top method)-climate change-global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – 12 Principles of Green chemistry – Application of Green chemistry

Unit V	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth - variation among nations - Population explosion & its consequences – Family, child, women welfare programmes - Human rights - HIV/AIDS – Human health and environment - Role of information technology in environment and human health

TEXT BOOK(S):

1. Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015)
2. Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th Edition (2016)

REFERENCE(S):

1. Masters, Gilbert M, —Introduction to Environmental Engineering and Sciencell, Second Edition, Pearson Education, New Delhi (2012).
2. Santosh Kumar Garg, Rajeshwari garg, smfRanjni Garg —Ecological and Environmental Studiesll Khanna Publishers, NaiSarak, Delhi (2014).

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3. .K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard", Vol. I and II, Enviro Media.
4. Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi, 2007. 4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005
5. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2015.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES206	SEMICONDUCTOR DEVICES AND CIRCUITS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the structure and working operation of basic electronic devices.
- identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

Unit I	PN JUNCTION DEVICES	9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

Unit II	TRANSISTORS AND THYRISTORS	9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics

Unit III	AMPLIFIERS	9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

Unit IV	MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER	9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages –Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers – Types (Qualitative analysis).

Unit V	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TEXT BOOK(S):

1. David A. Bell," Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

REFERENCE(S):

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES210	PRINCIPLES OF CIVIL AND MECHANICAL ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Impart basic knowledge on Civil and Mechanical Engineering.
- Familiarize the materials and measurements used in Civil Engineering.
- Provide the exposure on the fundamental elements of civil engineering structures.
- Enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

Course Outcomes: At the end of this course, learners will be able to:

- Appreciate the Civil and Mechanical Engineering components of Projects.
- Explain the usage of construction material and proper selection of construction materials.
- Measure distances and area by surveying
- Identify the components used in power plant cycle.
- Demonstrate working principles of petrol and diesel engine.
- Elaborate the components of refrigeration and Air conditioning cycle.

A – OVER VIEW

Unit I	SCOPE OF CIVIL AND MECHANICAL ENGINEERING	9

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering

Overview of Mechanical Engineering - Mechanical Engineering contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering - Production, Automobile, Energy Engineering - Interdisciplinary concepts in Civil and Mechanical Engineering.

B – CIVIL ENGINEERING

Unit II	SURVEYING AND CIVIL ENGINEERING MATERIALS	9

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber – modern materials

Unit III	BUILDING COMPONENTS AND STRUCTURES	9

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.

Civil Engineering Structures: Brick masonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rain water harvesting - introduction to high way and railway.

Unit IV	INTERNAL COMBUSTION ENGINES AND POWER PLANTS	9

Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants –- working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps

Unit V	REFRIGERATION AND AIR CONDITIONING SYSTEM	9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.

TEXT BOOK(S):

1. Shanmugam Gand Palanichamy MS," Basic Civil and Mechanical Engineering", Tata McGraw Hill PublishingCo.,NewDelhi,1996.

REFERENCE(S):

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications,2010.
2. Ramamrutham S.,"Basic Civil Engineering", DhanpatRaiPublishing Co.(P)Ltd.1999.
3. Seetharaman S.,"BasicCivilEngineering",AnuradhaAgencies,2005.
4. ShanthaKumarSRJ.,"Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai,2000.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING				R 2019	Semester II	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS02	SOFT SKILL - II	1	0	1	1.5	30	100

Course Objective (s): The purpose of learning this course is to

- Train the Students on Group Discussion Do's and Don'ts.
- Coach the students on Interview Skills.
- Develop Presentation Skills.
- Develop Business Etiquette.
- Teach importance of Ethics and Values.

Course Outcomes: At the end of this course, learners will be able to:

- Participate Group Discussion with Confidence by knowing the tips and Tricks.
- Attend the interview with positive attitude by having Mock Interviews.
- Present them very well by enhancing their Presentation Skills.
- Behave very well in official gathering and Meeting by knowing Etiquette.
- Have good ethics and values in their Personal and Professional Life.

UNIT 1	**GROUP DISCUSSION**	**6**

GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback

UNIT 2	**INTERVIEW SKILLS**	**6**

Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback

UNIT 3	**PRESENTATION SKILLS**	**6**

Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback

UNIT 4	**Business Etiquette**	**6**

Grooming etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress.

UNIT 5	**Ethics**	**6**

Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines

REFERENCE BOOKS

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – OgMandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	ES
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES223	ELECTRONICS DEVICES AND CIRCUITS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Illustrate the VI characteristics semi conductor devices.
- Determine the various parameters of solid state devices by experimentally.
- Design an oscillator circuit using R, L, C components.
- Design an amplifier circuit using Transistors
- Analyze the application of solid state devices.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the applications of semiconductor devices.
- Analyze the parameters of BJT and FET.
- Apply the concept of UJT and SCR for simple applications
- Design an oscillator circuit using R,L,C components.
- Design an amplifier circuit using Transistors

LIST OF EXPERIMENTS

1. Characteristics of Semi conductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter, common collector and common base configurations
3. Characteristics of JFET (Draw the equivalent circuit)
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
7. Design and testing of RC phase shift, LC oscillators
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Differential amplifiers using FET
10. Study of CRO for frequency and phase measurements
11. Astable and Monostable multivibrators
12. Realization of passive filters

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Experimental setup for

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC8
4. Function Generators10
5. Regulated 3 output Power Supply 5, ± 15V10
6. CRO10
7. Storage Oscilloscope1
8. Bread boards10
9. At least one demo module each for the listed equipment.
10. Component data sheets to be provided

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
19ES221	ENGINEERING DRAWING	L	T	P	C			
		0	0	4	2	60	100	

Course Objectives: The purpose of learning this course is to

- Learn conventions and use of drawing tools in making engineering drawings.
- Draw orthographic projection of points and lines.
- Draw the projection of planes and simple solids.
- Draw the section of solids and obtain the development of surfaces of given solids.
- Draw the isometric projection of the given solids.

Course Outcomes: At the end of this course, learners will be able to:

- Recognize the conventions and apply dimensioning concepts while drafting simple objects.
- Draw the orthographic projection of points and lines.
- Draw the projection of planes and simple solids.
- Draw the section of solid drawings and development of surfaces of given solids.
- Draw the isometric projection of the given objects.

CONCEPTS AND CONVENTIONS (Not for Examination)	1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	
UNIT I **PLANE CURVES**	**12**
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of triangle, square and circle – Drawing of tangents and normal to the above curves.	
UNIT II **PROJECTION OF POINTS AND LINES**	**11**
Orthographic projection- Principles-Principal Planes-First angle projection-projection of points. rejection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.	
UNIT III **PROJECTION OF PLANES & SOLIDS**	**12**
Projection of planes (polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.	
UNIT IV **PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**	**12**
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.	
UNIT V **ISOMETRIC PROJECTIONS**	**12**
Principles of isometric projection – isometric scale –Isometric projections of simple solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.	

TEXT BOOK(S):

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2012.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited,2008.

REFERENCE(S):

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition,2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2007.
4. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi,2015.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING				R 2019	Semester III	BS
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS304	TRANSFORM TECHNIQUES AND THEIR APPLICATIONS	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- Find the difference between the discrete and continuous signals and formulae using Z-Transform.
- Find Laplace transform of a continuous function in time space and solve second order differential equations
- Understand the concepts of Fourier series, Transforms and Boundary Conditions, which will enable them to model and analyze the physical phenomena
- Implement the Fourier Transform an elegant method in the study of signals
- Summarize and apply the mathematical aspects that contribute to the solution of one dimensional wave equation

Course Outcomes: At the end of this course, learners will be able to:

- Use the Z-transform to convert a discrete-time signal, which is a sequence of real or complex numbers, into a complex frequency domain representation
- Formulate a function in frequency domain whenever the function is defined in time domain
- Recognize the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series.
- Apply the Fourier transform, which converts the time function into a sum of sine waves of different frequencies, each of which represents a frequency component.
- Apply and solve the engineering problems in the area of heat, wave equations.

Unit I	Z -TRANSFORM	12

Z-Transform - Elementary Properties - Inverse Z-Transform - Convolution Method- Partial fraction method - Solution of Difference Equations using Z-Transform.

Unit II	LAPLACE TRANSFORM	12

Laplace Transform- Existence Condition -Transforms of Standard Functions - Unit step function, Unit impulse function- Properties- Transforms of Derivatives and Integrals - Initial and Final Value Theorems - Laplace transform of Periodic Functions - Inverse Laplace transforms - Applications of Differential Equations

Unit III	FOURIER SERIES	12

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range cosine and sine series - Root mean square value

Unit IV	FOURIER TRANSFORM	12

Fourier Integral Theorem- Fourier Transform and Inverse Fourier Transform- Sine and Cosine Transforms - Properties - Transforms of Simple Functions - Convolution Theorem - Parseval's Identity

Unit V	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	12

Classification of Second Order Quasi Linear Partial Differential Equations - Fourier Series Solutions of One Dimensional Wave Equation - One Dimensional Heat Equation - Steady State Solution of Two-Dimensional Heat Equation - Fourier Series Solutions in Cartesian Coordinates.

REFERENCE(S):

1. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, Inc, Singapore, 2008. 2.Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition, Cenage Learning India Private Ltd, 2012.
2. C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd, 2003.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester III	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI301	SENSORS AND TRANSDUCERS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Know the methods of measurement, classification of transducers and to analyze error.
- Understand the behavior of transducers under static and dynamic conditions and hence to model the transducer.
- Get exposed to different types of resistive transducers and their application areas.
- Acquire knowledge on capacitive and inductive transducers.
- Gain knowledge on variety of transducers and get introduced to MEMS and Smart transducers.

Course Outcomes: At the end of this course, learners will be able to:

- Apply the mathematical knowledge and science & engineering fundamentals gained to solve problems pertaining to measurement applications.
- Analyze the problems related to sensors &transducers.
- Select the right sensor/transducer for a given application.
- Determine the static and dynamic characteristics of transducers using software packages.
- Understand fiber optic sensor, smart traducer and its standard.

Unit I	SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS	9

Units and standards – Static calibration – Classification of errors, Limiting error and probable error – Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

Unit II	CHARACTERISTICS OF TRANSDUCERS	9

Static characteristics: - Accuracy, precision, resolution, sensitivity, linearity, span and range. Dynamic characteristics: Mathematical model of transducer, Zero, I and II order transducers, Response to impulse, step, ramp and sinusoidal inputs.

Unit III	VARIABLE RESISTANCE TRANSDUCERS	9

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezo-resistive sensor and humidity sensor.

Unit IV	VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS	9

Inductive transducers: – Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer – Variable reluctance transducers – Synchros – Microsyn – Principle of operation, construction details, characteristics of capacitive transducers – Different types & Signal Conditioning – Applications:- Capacitor microphone, Capacitive pressure sensor, Proximity sensor.

Unit V	OTHER TRANSDUCERS	9

Piezoelectric transducer – Hall Effect transducer – Magneto elastic sensor – Digital transducers – Fiber optic sensors – Thick & Thin Film sensors (Bio sensor & Chemical Sensor) – Environmental Monitoring sensors (Water Quality & Air pollution) – Introduction to MEMS – Introduction to Smart transducers and its interface standard (IEEE 1451).

TEXT BOOK(S):

1. Doebelin E.O. and Manik D.N., "Measurement Systems", 6th Edition, McGraw-Hill Education Pvt. Ltd.,2011
2. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge, 2003

REFERENCE(S):

1. Bela G.Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4th Edition, Vol. 1, ISA/CRC Press, 2003.
2. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.
3. John P. Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2000.
4. W.Bolton, Engineering Science, Elsevier Newnes, Fifth edition, 2006.
5. Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
6. Ian Sinclair, Sensors and Transducers, 3rd Edition, Elsevier, 2012.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester III	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI302	CIRCUIT THEORY	2	2	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Introduce electric circuits and its analysis
- Impart knowledge on solving circuit equations using network theorems
- Introduce the phenomenon of resonance in coupled circuits.
- Educate on obtaining the transient response of circuits.
- Introduce Phasor diagrams and analysis of three phase circuits

Course Outcomes: At the end of this course, learners will be able to:

- Analyze the electric circuits.
- Apply the network theorems to compute various parameters of electric network.
- Design of tank circuit for given frequency and analyze the coupled circuits in series and parallel.
- Analyze the transient response of RL, RC and RLC circuits with DC and AC input.
- Analyze the three phase circuit with different types of loads.

Unit I	BASIC CIRCUIT ANALYSIS	12

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy

Unit II	NETWORK THEOREMS FOR DC AND AC CIRCUITS	12

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton& Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

Unit III	RESONANCE AND COUPLED CIRCUITS	12

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance– Coefficient of coupling – Tuned circuits – Single tuned circuits.

Unit IV	TRANSIENT RESPONSE	12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

Unit V	THREE PHASE CIRCUITS	12

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TEXT BOOK(S):

1. William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, Engineering Circuit Analysis, Eighth Edition, Tata McGraw Hill, 2013
2. Joseph Edminister and Mahmood Nahvi, —Electric Circuitsll, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCE(S):

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Sudhakar AandShyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI303	ELECTRICAL MEASUREMENTS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the meters used to measure current & voltage.
- Have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
- Elaborate discussion about potentiometer & instrument transformers.
- Detailed study of resistance measuring methods.
- Detailed study of inductance and capacitance measurement.

Course Outcomes: At the end of this course, learners will be able to:

- Measure current and voltage,
- Understand AC and DC measurements.
- Measure power and calibration of energy meters.
- Measure current and voltage using potentiometric method.
- Understand the resistance measurement and using bridge circuit to measure resistance, inductance and capacitance.

Unit I	MEASUREMENT OF VOLTAGE AND CURRENT	9

Galvanometers: – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation- A.C. galvanometer– Vibration galvanometer.

Unit II	MEASUREMENT OF POWER AND ENERGY	9

Electrodynamometer type wattmeter: – Theory & its errors – Methods of correction – LPF wattmeter–Phantom loading – Induction type kWh meter – Induction type energy meter – Calibration of wattmeter and Energy meter.

Unit III	POTENTIOMETERS & INSTRUMENT TRANSFORMERS	9

DC potentiometer:– Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer:-Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Instrument Transformer:-C.T and P.T construction, theory, operation and characteristics.

Unit IV	RESISTANCE MEASUREMENT	9

Measurement of low, medium & high resistance: – Ammeter, voltmeter method – Wheatstone bridge–Kelvin double bridge – Series and shunt type ohmmeter – High resistance measurement :-Loss of charge method, Megohm bridge method – Megger – Direct deflection methods – Price's guard-wiremethod – Earth resistance measurement.

Unit V	A.C BRIDGES	9

A.C bridges:– Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge– Schering bridge – Anderson bridge –Hay's bridge- Campbell bridge to measure mutual inductance –Errors in A.C. bridge methods and their compensation – Detectors – Excited field.

TEXT BOOK(S):

1. E.W. Golding &F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler& Co,2001
2. H.S. Kalsi, Electronic Instrumentation, McGraw-Hill Education, New Delhi,2010

REFERENCE(S):

1. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi,2010.
2. S.K.Singh, 'Industrial Instrumentation and control', Tata McGraw Hill, 2nd edn.,2002.
3. J.B.Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation',S.K.Kataria& Sons, Delhi, 2003.
4. Martin U. Reissland, 'Electrical Measurement – Fundamental Concepts and Applications', New Age International (P) Ltd.,2001.
5. R.B. Northrop, Introduction to Instrumentation and Measurements, Taylor & Francis, New Delhi,2008.
6. M.M.S. Anand, "Electronics Instruments and Instrumentation Technology", Prentice Hall India,NewDelhi,2009.
7. J.J. Carr, "Elements of Electronic Instrumentation and Measurement", Pearson Education India, New Delhi,2011.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterIII	ES
Course Code	Course Name	Hours/Week			Credit	TotalHours	Maximum Marks	
		L	T	P	C			
19ES304	ELECTRICAL MACHINES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the principles of operations of DC machines as motor and generator
- Introduce the principles of operations of Transformers
- Introduce the principles of operations of Induction machines
- Introduce the principles of operations of Synchronous machines
- Introduce other special machines

Course Outcomes: At the end of this course, learners will be able to:

- Design combinational and sequential Circuits.
- Acquire knowledge to solve problems associated with DC and AC Machines.
- Test and control different machines based on the familiarity of basic concepts and working principle.
- Choose appropriate machines for a given application while carrying out projects.
- Apply the knowledge gained to choose appropriate machines for specific application useful for the society.
- Know about the latest developments related to machines and to learn their concepts even after the completion of the course.

Unit I	D.C. MACHINES	9

D.C. Machines: – Principle of operation and construction of motor and generator – torque equation – Various excitation schemes – Characteristics of Motor and Generator – Starting, Speed control of D.C. Motor.

Unit II	TRANSFORMERS	9

Principle, Construction and Types of Transformer - EMF equation - Phasor diagrams - Regulation and efficiency of a transformer-Introduction to three phase transformer Connection. Applications of Current and Potential Transformer.

Unit III	SYNCHRONOUS MACHINES	9

Principle of Operation, type - EMF Equation and Phasor diagrams - Synchronous motor- Rotating Magnetic field Starting Methods , Torque V- Curves, inverted – V curves.

Unit IV	THREE PHASE INDUCTION MOTORS	9

Induction motor-principle of operation, Types - Torque-slip characteristics - Starting methods and Speed control of induction motors.

Unit V	SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	9

Types of single phase induction motors –Double field revolving theory- Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Switched reluctance motor – Brushless D.C motor.-Stepper motor.

TEXT BOOK(S):

1. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill,2002.
2. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi,2007.

REFERENCE(S):

1. Abhijit Chakrabarti and Sudipta Debnath, "Electrical Machines", McGraw- Hill Education,2015.
2. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi,2011
3. B.S.Guru and H.R.Hiziroglu, "Electric Machinery and Transformer', Oxford university Press2007
4. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi,1995.
5. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, McGraw Hill Education,2010.
6. C.A.Gross, "Electric Machines", CRC Press2010.
7. NPTEL Video Lecture series on "Electrical Machines I" and "Electrical Machines II" by Dr. Krishna Vasudevan, IIT Madras.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterIII	ES
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC303	SIGNALS AND SYSTEMS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic properties of signal &systems
- Understand the continuous tine signals
- Know the methods of characterization of LTI systems in time domain
- Analyze continuous time signals and system in the Fourier and Laplace domain
- Analyze discrete time signals and system in the Fourier and Z transform domain.

Course Outcomes: At the end of this course, learners will be able to:

- Be able to determine if a given system is linear/causal/stable
- Explain about the continuous tine signals
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- Be able to compute the output of an LTI system in the time and frequency domains

Unit I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy& Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

Unit II	ANALYSIS OF CONTINUOUS TIME SIGNALS	9

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

Unit III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	9

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

Unit IV	ANALYSIS OF DISCRETE TIME SIGNALS	9

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

Unit V	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	9

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TEXT BOOK(S):

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, —Signals and Systemsǁ, Pearson, 2015.(Unit 1-V)

REFERENCE(S):

1. B. P. Lathi, —Principles of Linear Systems and Signalsǁ, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, —Signals & Systems - Continuous and Discreteǁ, Pearson, 2007.
3. John Alan Stuller, —An Introduction to Signals and Systemsǁ, Thomson,2007.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R2019	Semester III	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS03	QUANTITATIVE APTITUDE AND LOGICAL REASONING - I	2	0	0	0	30	100	

Course Objective (s): The objective of this course is to

- Crack aptitude assessment by using speed math concepts.
- Solve problems using fast track method by learning simplification and numbers.
- Learn the basic of ratio and proportion and mixture concepts.
- Calculate different ways of solving problems on average and ages.
- Learn the logical skills by analyzing the objects.

Course Outcomes: At the end of this course, learners will be able to:

- Solve the question with speed and accuracy.
- Crack the quantitative aptitude questions by using simplification and numbers system.
- Solve most of the aptitude topics by knowing ratio and proportion topics with allegation.
- Solve the problems on average and ages by using logical way of approach.
- Develop their logical thinking.

UNIT 1	SPEED MATHS AND NUMBER SYSTEMS	6

SPEED MATHS: Square and square roots – Square for numbers from 31 to 50. Finding squares of numbers between 81 to 100. Cubes and cubes roots.
NUMBER SYSTEMS: Numbers and types of Numbers – Properties of Numbers –Face value and place value - Divisibility rules – Concept on unit digit and remainder theorem.

UNIT 2	SIMPLIFICATIONS & PROBLEMS ON NUMBERS	6

SIMPLIFICATIONS: BODMAS rule – Application of algebraic formulae –Simplification of decimal fraction & mixed fraction – Continued fraction and its simplification – Recurring decimals.
PROBLEMS ON NUMBERS: Set of numbers – Assume the unknown numbers and form equations

UNIT 3	RATIO &PROPORTION ,ALLIGATIONS& MIXTURE	6

.**RATIO AND PROPORTION:** Ratio between two or more persons – Miscellaneous problems.
ALLIGATIONS ANS MIXTURES: Definition – Allegation rule – Mean value (or cost price) of the mixture – Six golden rules to solve problems on mixture – Removal among the quantities more than two.

UNIT 4	AVERAGES &PROBLEM ON AGES	6

AVERAGES: Average from total –Total from the average – Miscellaneous problems.
PROBLEMS ON AGES: Ages - Persons in Past - Present - Future. Miscellaneous problem.

UNIT 5	ANALOGY & MIRROR & WATER IMAGES	6

ANALOGY: Study and topic relationship – Worker and tool relationship – Tool and action relationship – Work and working place – Worker and product – Product and raw materials – Instrument and measurement – Quantity and unit – Animals and young ones – Male and female.
MIRROR IMAGES AND WATER IMAGES: Letter inverted – Object inverted.

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING				R 2019	Semester III	MC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19MC301	INDIAN CONSTITUTION	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: At the end of this course, learners will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Unit I	**History of making of Indian Constitution**	**5**
History of Indian Constitution - Drafting Committee, (Composition & Working)		
Unit II	**Philosophy of the Indian Constitution**	**5**
Preamble - Salient Features		
Unit III	**CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES**	**5**
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.		
Unit IV	**ORGANS OF GOVERNANCE**	**5**
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.		
Unit V	**LOCAL ADMINISTRATION**	**5**
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy.		
Unit VI	**ELECTION COMMISSION**	**5**
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

TEXT BOOK(S):

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. Dr. S. N. Busi, "Dr. B. R. Ambedkar Framing of Indian Constitution", 1st Edition, 2016. Ava Publishers
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.

REFERENCE (s)

1. D.D. Basu , Introduction to the Constitution of India, Lexis Nexis, 2015.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterIII	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES307	ELECTRICAL MACHINES AND ELECTRIC CIRCUITS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Obtain the no load and load characteristics of D.C machines.
- Obtain the speed characteristics of D.C motor.
- Find out regulation characteristics of Transformer.
- Simulate various electric circuits using Pspice/ Matlab/e-Sim / Scilab
- Gain practical experience on electric circuits and verification of theorems.

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge on the proper usage of various electronic equipment and simulation tools for design and analysis of electronic circuits.
- Get hands-on experience in studying the characteristics of semiconductor devices.
- Analyze various electronic circuits such as voltage regulators, transistor amplifiers and oscillators.
- Make use of basic concepts to obtain the no load and load characteristics of D.C machines.
- Analyze and draw conclusion from the characteristics obtained by conducting experiments on machines.

LIST OF EXPERIMENTS

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. series motor.
4. Load test and speed control of D.C. shunt motor.
5. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).
6. Load test on single phase induction motor.
7. Simulation and experimental solving of electrical circuit problems using Kirchhoff's voltage and current laws.
8. Simulation and experimental solving of electrical circuit problems using Thevenin's theorem and Norton's theorem
9. Simulation and experimental solving of electrical circuit problems using Superposition theorem and Maximum Power transfer Theorem.
10. Simulation and Experimental validation of R-C electric circuit transience.
11. Measurement of three phase power supply using two watt meter method.
12. Design and Simulation of parallel and series resonant circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

FOR CIRCUITS LAB:

2. Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
3. Function Generator (1 MHz) - 10 Nos.
4. Single Phase Energy Meter - 1 No.
5. Oscilloscope (20 MHz) - 10 Nos.
6. Digital Storage Oscilloscope (20 MHz) – 1 No.
7. 10 Nos of PC with Circuit Simulation Software (min 10 Users) (e-Sim / Scilab/ Pspice /
8. Matlab /other Equivalent software Package) and Printer (1 No.)
9. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.) 8
10. Single Phase Wattmeter – 3 Nos.
11. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each – 6 Nos.
12. Circuit Connection Boards - 10 Nos.

FOR MACHINES LAB:

1. DC Shunt Motor with Loading Arrangement-2 Nos
2. Single Phase Transformer-3 Nos
3. Single Phase Induction Motor with Loading Arrangement-1 Nos
4. Single Phase Auto Transformer-3 Nos
5. Single Phase Resistive Loading Bank-2 Nos
6. Sufficient number of Ammeters, Voltmeters, (or multimeters), switches, tachometers, Wattmeters-2 Nos

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI304	SENSORS AND MEASUREMENTSLABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Make the students aware of basic concepts of measurement and operation of different types of transducers.
- Make the students conscious about static and dynamic characteristics of different types of transducer.
- Make the students to analyze step response of RTD
- The student to measure resistance using bridge circuits
- Make the students to calibrate the electricalinstruments

Course Outcomes: At the end of this course, learners will be able to:

- Understand the concepts of measurement, error and uncertainty.
- Understand the static and dynamic characteristics of measuring instruments.
- Gain knowledge about the principle of operation and characteristics of different types of resistance, capacitance and inductance transducers.
- Acquire knowledge of analyzing different stages of signal conditioning units.
- Interpret the results and draw meaningful conclusions.

LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a potentiometrictransducer.
2. Characteristics of Strain gauge and Loadcell.
3. Characteristics of LVDT, Hall Effect transducer and Photoelectric tachometer.
4. Characteristics of LDR, thermistor and thermocouple (J, K, E types).
5. Step response characteristic of RTD and thermocouple.
6. Temperature measurements using RTD with three and four leads.
7. Wheatstone and Kelvin's bridge for measurement of resistance.
8. Schering Bridge for capacitance measurement and Anderson Bridge for inductance measurement.
9. Measurement of Angular displacement using resistive and Capacitive transducer.
10. Calibration of Single-phase Energy meter and wattmeter.
11. Calibration of Ammeter using Shunt type potentiometer.
12. Calibration of Voltmeter using Shunt type potentiometer.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Experimental setup for

1. Measurement of Linear displacement using Potentiometer
2. Strain gauge and Load cell characterization and application
3. LVDT characterization and application
4. Hall Effect characterization and application
5. Measurement of Angular displacement
6. Muffle furnace
7. Thermistor characterization and application
8. Various types of Thermocouple and RTD characterization and application
9. Measurement of power and energy
10. Sufficient number of power supply, Galvanometer, Bread board, Multimeter, resistors, Decade Capacitance box, Decade resistance box, Decade Inductance box, CRO.

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	BS
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS402	NUMERICAL METHODS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Acquire the knowledge of finding approximate solutions of algebraic, linear and non linear equations, differentiation and integration by numerical methods and interpolating the values of a function.
- Able to interpolate and predict a data
- Able to analyse differentiation and integration numerically
- Ability to find solution of initial and boundary value problems using single and multi-step approximations.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Course Outcomes: At the end of this course, learners will be able to:

- Classify the equations into Algebraic, Transcendental or simultaneous and apply the techniques to solve them numerically.
- Demonstrate and implement an appropriate numerical method for interpolation.
- Apply numerical computational techniques to obtain the differentiation and Integration of functions.
- Obtain the solutions of first order ordinary differential equations, numerically.
- Classify the partial differential equations and able to get the solutions of those equations using numerical methods.

Unit I	SOLUTIONOF SYSTEM OF EQUATIONS	12

Newton Raphson method- Method of False Position – Graffes root square method – Crout's Method - Gauss Jordan, Gauss Seidal method.

Unit II	INTERPOLATION	12

Interpolation: Newton's forward and backward difference formulae, Lagrange's and Newton's divided difference interpolation formulae

Unit III	NUMERICALDIFFERENTIATIONANDINTEGRATION	12

Numerical differentiation: Newton's forward and backward difference formulae, Numerical Integration: Trapezoidal, Simpson's 1/3 rule – Two point Gaussian quadrature formula – Three point Gaussian quadrature formula

Unit IV	NUMERICAL SOLUTION OF ORDINARYDIFFERENTIALEQUATION	12

Initial value Problem: Single step methods: Taylor's series method ,Euler's method and Fourth order Runge - Kutta method for solving first order equations - Multi step methods: Milne's - Adams – Bashforth predictor and corrector methods for solving first order equations.

Unit V	NUMERICAL TECHNIQUES FOR THE SOLUTION OF PARTIAL DIFFERENTIALEQUATIONS	12

Finite difference solution of parabolic equation by Crank-Nicholson method-Solution of elliptic equations of simple harmonic motions and its solutions numerically.

REFERENCE(S):

1. Steven Chapra , Numerical Methods for Engineers , Tata McGraw Hill seventh Edition, 2015.
2. Burden R. L and Douglas Faires J, Numerical Analysis Theory and Applications, Cengage Learning, Ninth Edition, 2005.
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Seventh Edition, Pearson Education, New Delhi, 2006.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	ES
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES403	OBJECT ORIENTED PROGRAMMING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling &Multi threading
- Know how to handle events

Course Outcomes: At the end of this course, learners will be able to:

- Write Java application programs using OOP principles and proper program structuring
- Demonstrate the concepts of Packages and inheritance
- Write Java programs to implement error handling techniques using exception handling
- Develop application using multi threading
- Write a event based java program

Unit I	INTRODUCTION TO JAVA	9

Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java

Unit II	OBJECT AND CLASSES	9

Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

Unit III	INHERITANCE AND PACKAGES	9

Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, Util package

Unit IV	THREADS AND EXCEPTION HANDLING	9

Thread - Thread life cycle and methods, Runnable interface, Multi-threading - Thread synchronization, Exception handling with try-catch-finally – Nested try-catch – User defined Exception

Unit V	EVENT AND GUI PROGRAMMING	9

Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

TEXT BOOK(S):

1. The Complete Reference, Java 2 (10th Edition , Herbert Schildt, TMH, 2017
2. Core Java Volume-I Fundamentals, 10thEdition, Horstmann& Cornell, Pearson Education, 2016.

REFERENCE(S):

1. E. Balagurusamy, Java Programming with Java, sixth edition, Tata Mcgraw Hill, 2019.
2. Ken Arnold, Java Programming Language, Addison Wesely, 1996
3. John R Hubbard, Programming with Java, Second Edition, Tata Mcgraw Hill, 2020

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI401	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn the IC fabrication procedure.
- Signal analysis using Op-amp based circuits.
- Apply Op-amp for industrial purpose.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- Know about the linear integrated circuits fabrication and their Application.

Course Outcomes: At the end of this course, learners will be able to:

- Acquire knowledge in IC fabrication procedure
- Analyze the characteristics of Op-Amp
- Understand the importance of Signal analysis using Op-amp based circuits.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- Understand and acquire knowledge on the Applications of Op-amp

Unit I	IC FABRICATION	9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

Unit II	CHARACTERISTICS OF OPAMP	9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-V/I & I/V converters.

Unit III	APPLICATIONS OF OPAMP	9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using op amps.

Unit IV	SPECIAL ICs	9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC;565-phase locked loop IC, AD633 Analog multiplier ICs

Unit V	APPLICATION ICs	9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators – LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variable voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TEXT BOOK(S):

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCE(S):

1. Fiore,"Opamps& Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition,2012.
5. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning,2011.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	PC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI402	DIGITAL PRINCIPLES AND SYSTEM DESIGN	2	1	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study various number systems and simplify the logical expressions using Boolean functions
- Study combinational circuits
- Design various synchronous and asynchronous circuits.
- Introduce asynchronous sequential circuits and PLDs
- Introduce digital simulation for development of application oriented logiccircuits.

Course Outcomes: At the end of this course, learners will be able to:

- Design combinational, sequential Circuits and simulate using software package.
- Study various number systems and simplify the logical expressions using Boolean functions
- Design various synchronous and asynchronous circuits.
- Introduce asynchronous sequential circuits and PLDs
- Introduce digital simulation for development of application oriented logiccircuits.

Unit I	NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES	9

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

Unit II	COMBINATIONAL CIRCUITS	9

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

Unit III	SYNCHRONOUS SEQUENTIAL CIRCUITS	9

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

Unit IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES	9

Asynchronous sequential logic circuits-Transition stability, flow stability-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

Unit V	VHDL	9

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

TEXT BOOK(S):

1. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCE(S):

1. Mandal,"DigitalElectronicsPrinciples&Application,McGrawHillEdu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson,2013.
3. ThomasL.Floyd,'DigitalFundamentals',11thedition,PearsonEducation,2015.
4. CharlesH.Roth,Jr,LizyLizyKurianJohn,'DigitalSystemDesignusingVHDL,Cengage,2013.
5. D.P.Kothari,J.S.Dhillon, 'Digital circuits and Design',PearsonEducation,2016.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI403	INDUSTRIAL INTERNET OF THINGS	2	0	2	3	60	100	

Course Objective (s): The purpose of learning this course is to

- Impart knowledge in Internet of Things(IoT)
- Understand the concept of interfacing smart sensors/actuators with internet connectivity
- Illustrate the various protocol standards deployed in Internet of Things (IoT) domain
- Aware of security concerns and challenges in IoT.
- Know about DIY kits and other apps.

Course Outcomes: At the end of this course, learners will be able to:

- Compare the IoT with M2M by analyzing the characteristics, functional blocks and architectural models of IoT
- Examine the various design levels, physical devices and technologies used for IoT
- Analyze the design principles of various connected devices used in IoT
- Analyze the various communication protocols & standards used for IoT design
- Apply IoT design principles in various domain and infer the challenges in real time implementation

UNIT I	INTRODUCTION AND ELEMENTS OF IoT	12

Definition of IoT - Evolution of IoT - IoT and related terms - Business Scope- Introduction to Elements of IoT - Basic Architecture of an IoT Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA

UNIT II	COMMUNICATION AND CONNECTIVITY TECHNOLOGIES	12

Cloud Computing in IoT - Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning. IoT Communication Model – Cloud Connectivity

UNIT III	DATA ANALYTICS AND IoT PLATFORMS	12

Big Data Analytics - Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating- The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage – A General Overview of High-Performance Architecture - Data Visualization - IoT Platforms

UNIT IV	CONCERNS AND FUTURE TRENDS	12

Different Players of IoT - Security Concerns and Challenges - Future Trends – Standards

UNIT V	HANDS-ON PROJECTS	12

DIY Kits - IFTTT and other apps

TEXT BOOK(S):

1. Samuel Greengard, The Internet of Things (Essential Knowledge), MIT Press, 2015
2. Adrian McEwen and HakimCassimally, Designing the Internet of Things, 2015

REFERENCE(S):

1. ArshdeepBagha& Vijay Madisetti, Internet of Things Ã¢?? A Hands-On Approach,VPT, 2014
2. R G. Moreira, T.P Coultate Automatic Control for Food Processing System. 2001
3. Willard, H.H., L. L. Merrit, J. A. Dean and F. L. Seattle, Instrumental Methods of Analysis, CBS Publishing Co, New York,2010

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19ES405	THERMODYNAMICS ANDFLUID MECHANICS	L	T	P	C			
		3	0	0	3	45	100	

Course Objective(s): The purpose of learning this course is to

- Study the fundamental laws of thermodynamics
- Study the various cycles used in thermodynamic analysis
- Learn about the applications of thermodynamics in Mechanical systems
- Study the principles of Fluid mechanics in fluid flow
- Learn the applications of fluid flow in hydraulic systems

Course Outcome(s): At the end of this course, learners will be able to:

- Solve problems on Flow and non-flow systems,
- Derive the expression and determine the thermal efficiency of various thermodynamic cycles
- Apply the thermodynamic concepts to find the solutions for IC Engines and get to know the working principles of Compressors, Boilers and Turbines
- Evaluate the pressure of the fluids, losses in pipes and determine the discharge through orifice, venturi etc.
- Determine the design parameters of pumps and turbines.

Unit I	THERMODYNAMICS LAWS	9

Introduction – system and its types, properties, thermodynamic equilibrium, state, process – quasi-static, reversible and irreversible, zeroth law, work and heat transfer, first law applicable to open and closed system, SFEE. Second law – heat engines, heat pump and refrigerator, Kelvin – Planck and Clausius statements, corollaries of Second law, Entropy, Change in entropy , Principles of Increase in Entropy.

Unit II	THERMODYNAMIC CYCLES	9

Carnot cycle, Otto, Diesel, Dual cycles –Efficiency and Mean Effective Pressure, Simple and Improved Brayton cycle, Rankine Cycle with reheat and regeneration.

Unit III	APPLICATIONS OF THERMODYNAMICS	9

Internal Combustion Engines – Two and Four strokes – Performance Calculation, Steam Power Plant – Layout and Working of Components, Boilers and Turbines (Qualitative treatment only), Gas turbine power plant – Open and Closed cycle - Layout and Working. Reciprocating and Rotary Compressors (Qualitative treatment only).

Unit IV	FUNDAMENTALS OF FLUID MECHANICS	9

Fluids and their types, properties of fluids, Newton's law of viscosity, Measurement of pressure-U-tube and differential manometer, Conservation of mass, momentum and energy. Types of fluid flow – laminar, turbulent, vortex. Significance of Reynolds number. Flow through pipes, losses in pipes, Flow through Orifice meter,Venturimeter, Notches.

Unit V	HYDRAULIC PUMPS AND TURBINES	9

Pumps – classification and their working principle. Specific speed, Unit quantities, Design parameters. Hydraulic turbines – impulse and reaction, working of Pelton, Francis and Kaplan turbines, Design parameters – Layout and Working of Hydel Power Plant.

TEXT BOOK(S):

1. P.K. Nag, 'Engineering Thermodynamics', Tata McGraw Hill, New Delhi, 2007
2. R.K.Bansal, A Textbook of Fluid Mechanics and Machinery, Laxmi Publications (P) Ltd., New Delhi, Revised Ninth edition, 2014.
3. R.K. Rajput, Engineering Thermodynamics, Laxmi Publications Pvt.Ltd., NewDelhi,2011.

REFERENCE(S):

1. Y. Cengel and Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi,2003.
2. J.P.Holman, Thermodynamics, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi,2002.
3. R.S.Khurmi, Steam table with Psychometric chart, S.Chand Publications, New Delhi,2009.
4. YunusCengel and John Cimbala, Fluid Mechanics Fundamentals and Application, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi 2009
5. Robert and W Fox, Introduction to Fluid Machines, John Wiley Eastern Pvt. Ltd., New Delhi, 6th edition,2006.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	EEC
Course Code	Course Name	Hours/Week			Credit	TotalHours	Maximum Marks	
		L	T	P	C			
19TPS04	QUANTITATIVE APTITUDE AND LOGICAL REASONING - II	2	0	0	0	30	100	

Course Objective (s): The objective of this course is to

- Learn the basic of partnership and chain rule in simplified way.
- Solve problems using fast track method by learning profit and loss with percentage.
- Teach the angle of elevation and depression.
- Know the relationship, direction concepts in easy way.
- Know about coding and decoding through logical way.

Course Outcomes: At the end of this course, learners will be able to:

- Solve problems by using shortcut in partnership and chain rule.
- Know the tips and tricks of profit and loss with percentage through fast track methods.
- Understand the concepts of angles.
- Evaluate critically the real life situations by resorting and analyzing analytical reasoning of keyissues and factors.
- Enhance the logical way of thinking by solving problems codes and rankings concepts.

UNIT 1	PARTNERSHIP & CHAIN RULE	6

PARTNERSHIP: Ratio of division of gains: Simple Partnership – Compound Partnership - Working and sleeping partners.
CHAIN RULE: Definition – Direct proportion and Indirect proportion.

UNIT 2	PROFIT &LOSS, PERCENTAGE	6

PROFIT AND LOSS: Basic definition and types of profit and loss – Concept of discount and marked price – Concept of true v/s false value – Application in data interpretation problems.
PERCENTAGE: Percentage – Percentage using shortcuts.

UNIT 3	HEIGHT AND DISTANCE	6

HEIGHT AND DISTANCES: Line of sight – Angle of elevation – Angle of depression.

UNIT 4	BLOOD RELATIONSHIP & DIRECTION SENSE TEST	6

BLOOD RELATIONSHIP: Analysis the gender relationship –Relationship diagram - Family tree.
DIRECTION SENSE TEST: Distance between the starting and ending points - Sense the direction correctly.

UNIT 5	LOGICAL SEQUENCE OF WORD, CODING AND DECODING, NUMBER RANKING & TIME SEQUENCE TEST	6

LOGICAL SEQUENCE OF WORDS: Sequence of occurrence of events – Sequence of objects in a class or group – Sequence of increasing/decreasing size, value, intensity, etc.
CODING AND DECODING: Introduction – Description of coding method, Coding patterns – Concepts of coding & decoding – Problems involving coding & decoding method.
NUMBER RANKINGS & TIME SEQUENCE TEST: Number test – Ranking test – Time sequence test.

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester IV	ES
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES404	OBJECT ORIENTED PROGRAMMING LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling &Multi threading
- Know how to handle events

Course Outcomes: At the end of this course, learners will be able to:

- Write program using object classes
- Apply inheritance and Interface to write program
- Able to handle I/O with exception handling
- Develop multi threaded program
- Develop GUI with event handling

List of Experiments

1. Programs using class and methods
2. Inheritance implementation
3. Inheritance via Interface and Abstract class
4. Programs on Package implementations
5. Applications using Generic collections
6. Program using IO Streaming
7. Create user defined exception
8. Develop application to demonstrate multi threading
9. Program using Applet with event handling
10. Program to demonstrate event handing using AWT/ Swing
11. Program to demonstrate Layout Managers
12. Program to demonstrate file handling

TEXT BOOK(S)

1. The Complete Reference, Java 2 (10th Edition , Herbert Schildt, TMH, 2017
2. Core Java Volume-I Fundamentals, 10th Edition, Horstmann& Cornell, Pearson Education, 2016

REFERENCE(S)

1. Bert Bates, Kathy Sierra, Head First Java, 2nd Edition, OReilly Media, 2005.
2. Kathy Sierra, Bert Bates, OCA/OCP Java SE 7 Programmer I and II Study Guide, First edition, McGraw Hill Education, 2014.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterIV	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI404	LINEAR AND DIGITAL INTEGRATEDCIRCUITS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Learn design, testing and characterizing of circuit behavior with analog ICs.
- Learn digital electronics circuits adder / subtractor
- Know about counters and shift register functions
- Acquire knowledge in counters and multiplexer
- Learn about Different Application of Op-Amp

Course Outcomes: At the end of this course, learners will be able to:

- Design and implement counters using specific counter IC.
- Understand about the code converter
- Understand the concepts of counters and shift register functions
- Design the counters, adder / subtractor and multiplexer
- Acquire knowledge on Application of Op-Amp.

LIST OF EXPERIMENTS

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Counters: Design and implementation of 4-bit modulo counters
5. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes
6. Timer IC application: Study of NE/SE 555 timer in Astable and Monostable operation.
7. Application of Op-Amp: inverting, non-inverting amplifier and comparator
8. Application of Op-Amp Adder, Integrator and Differentiator
9. Voltage to frequency characteristics of NE/ SE 566 IC.
10. Variability Voltage Regulator using IC LM317.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variability Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	
7	Computer (PSPICE installed)	1	
	Consumabilitys (sufficient quantity)		
1	IC 741/ IC NE555/566/565		
2	Digital IC types		
3	LED		
4	LM317		
5	LM723		
6	ICSG3524 / SG3525		
7	Transistor – 2N3391		
8	Diodes, IN4001,BY126		
9	Zener diodes		
10	Potentiometer , Capacitor, Resistors 1/4 Watt Assorted		
11	Step-down transformer 230V/12-0-12V, Single Strand Wire		

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterIV	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HS401	LANGUAGE SKILLS	0	0	2	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Involve the students in effective listening activities.
- Improve the oral communication skills in proper manner.
- Focus the effective reading of general and technical text.
- Enhance and comprehend the written text.
- Integrate LSRW skills.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the technical talks.
- Communicate to his peer group properly.
- Comprehend the general and technical text.
- Write the reports and job application in clear manner.
- Integrate LSRW skills.

Unit I	LISTENING	6

Listening as a key skill- its importance - Listen to a process information- give information, as part of a simple explanation - Being an active listener: giving verbal and non-verbal feedback - taking lecture notes - preparing to listen to a lecture

Unit II	SPEAKING	6

Give personal information - ask for personal information - express ability - enquire about ability - ask for clarification - Improving pronunciation - pronunciation basics - conversation starters: small talk – stressingsyllables and speaking clearly - summarizing academic readings and lectures

Unit III	READING	6

Strategies for effective reading- Read and recognize different text types - Predicting content using photos and title- Read for details-Use of graphic organizers to review and aid comprehension - Understanding pronoun reference and use of connectors in a passage- speed reading techniques-

Unit IV	WRITING	6

Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence -Write a descriptive paragraph - Write a paragraph with reasons and examples - Write an opinion paragraph – E-mail writing - Types of essays - descriptive-narrative- issue-based-argumentative-analytical.

Unit V	INTEGRATION OF LSRW	6

Task based Instruction :Listing Task- Sorting and ordering-comparing - Problem solving-sharing Personal Experience - Content based instruction : Texts, Articles, Advertisements ,Videos)

TEXT BOOK(S):

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford:2011
3. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCE(S):

1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan:
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press1992.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester V	PC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI501	AUTOMATIC CONTROL SYSTEM	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the use of transfer function models for analysis physical systems and introduce the control system components.
- Provide adequate knowledge in the time response of systems and steady state error analysis.
- Accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- Introduce stability analysis and design of compensators
- Introduce state variable representation of physical systems

Course Outcomes: At the end of this course, learners will be able to:

- Develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.
- Do time domain and frequency domain analysis of various models of linear system and understand the use of PID controller in closed loop system
- Interpret characteristics of the system to develop mathematical model.
- Design appropriate compensator for the given specifications.
- Come out with solution for complex control problem.

Unit I	SYSTEMS AND THEIR REPRESENTATION	9

Basic elements in control systems: – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

Unit II	TIME RESPONSE	9

Time response: – Time domain specifications – Types of test input – I and II order system response –Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

Unit III	FREQUENCY RESPONSE	9

Frequency response: – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications

Unit IV	STABILITY AND COMPENSATOR DESIGN	9

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria –Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, lead and lag-lead compensator using bode plots.

Unit V	STATE VARIABLE ANALYSIS	9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

TEXT BOOK(S):

1. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.

REFERENCE(S):

1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
2. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
3. John J.D., Azzo Constantine, H. and HoupisSttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
4. RamesC.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.
5. M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
6. NPTEL Video Lecture Notes on "Control Engineering "by Prof. S. D. Agashe, IIT Bombay

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester V	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI502	INDUSTRIAL INSTRUMENTATION – I	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the measurement techniques of force, torque and speed.
- Introduce the measurement techniques of acceleration, Vibration and density
- Introduce the measurement Viscosity, Humidity and moisture.
- Introduce the temperature measurement techniques
- Introduce the pressure measurement techniques

Course Outcomes: At the end of this course, learners will be able to:

- Understand the construction and working of instruments used for measurement of force, torque, speed, acceleration, vibration, density, viscosity, humidity, moisture, temperature.
- Select instruments according to the application.
- Understand the concept of calibration of instruments and gain knowledge about temperature measurement devices.
- Design signal conditioning circuits and compensation schemes for temperature measuring instruments.
- Understand the working of instruments used for measurement of pressure.

Unit I	MEASUREMENT OF FORCE, TORQUE AND SPEED	8

Different types of load cells: Hydraulic, Pneumatic, Strain gauge, Magneto-elastic and Piezoelectric load cells - Different methods of torque measurement: Strain gauge, Relative angular twist. Speed measurement: Capacitive tacho, Drag cup type tacho, D.C and A.C tacho generators - Stroboscope.

Unit II	MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY	8

Accelerometers: LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer – Vibration sensor - Calibration of vibration pickups - Units of density and specific gravity – Baume scale and API scale – Densitometers: Pressure type densitometers, Float type densitometers, Ultrasonic densitometer and gas densitometer.

Unit III	MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE	8

Viscosity: Saybolt viscometer - Rotameter type and Torque type viscometers – Consistency Meters – Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter. Moisture: Different methods of moisture measurements –Thermal, Conductivity and Capacitive sensors, Microwave, IR and NMR sensors, Application of moisture measurement - Moisture measurement in solids.

Unit IV	TEMPERATURE MEASUREMENT	12

Definitions and standards – Primary and secondary fixed points – Different types of filled in system thermometers – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – IC sensors – Thermocouples: Laws of thermocouple, Fabrication of industrial thermocouples, Reference junctions compensation, Signal conditioning for thermocouple, Commercial circuits for cold junction compensation, Response of thermocouple, Special techniques for measuring high temperature using thermocouple – Radiation fundamentals - Radiation methods of temperature measurement – Total radiation pyrometers – Optical pyrometers – Two color radiation pyrometers – Fiber optic sensor for temperature measurement – Thermograph, Temperature switches and thermostats – Temperature sensor selection, Installation and Calibration.

Unit V	PRESSURE MEASUREMENT	9

Units of pressure – Manometers: Different types, Elastic type pressure gauges: Bourdon tube, Bellows, Diaphragms and Capsules - Electrical methods: Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum: McLeod gauge, Thermal conductivity gauge, lionization gauges, Cold cathode type and hot cathode type – Pressure gauge selection, installation and calibration using dead weight tester.

TEXT BOOK(S):

1. Doebelin, E.O. and Manik, D.N., "Measurement systems Application and Design", 6th McGraw-Hill Education Pvt. Ltd, 2011.
2. Jones, B.E., "Instrument Technology", Vol.2, Butterworth-Heinemann, International Edition,2003.

REFERENCE(S):

1. Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)", CRC Press, 2005. Patranabis, D., "Principles of Industrial Instrumentation", 3rd Edition, McGraw-Hill Education, 2017.
2. Eckman D.P., "Industrial Instrumentation", Wiley Eastern Limited, 1990.
3. Singh,S.K., "Industrial Instrumentation and Control", Tata Mc-Graw-Hill Education Pvt. Ltd., New Delhi, 2009.

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4. Alok Barua, "Lecture Notes on Industrial Instrumentation", NPTEL, E-Learning Course, IIT Kharagpur.
5. Jayashankar, V., "Lecture Notes on Industrial Instrumentation", NPTEL, E-Learning Course, IIT Madras.
6. A.K. Sawhney, "A Course in Electronic Measurements and Instrumentation ", Dhanpat Rai & Co. (P) Limited, 2015

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester V	PC
Course Code	Course Name	Hour/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI503	INDUSTRIAL INSTRUMENTATION – II	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce variable head type flow meters
- Introduce quantity meters, air flow meters and mass flow meters
- Educate on electrical type flow meters
- Educate on the level measurement techniques
- Educate on Viscosity, Humidity and Moisture content.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the construction, installation and working of different variable head type flow meters.
- Understand the construction, working and calibration of different quantity flow meters, variable area flow meters, mass flow meters,
- Understand the construction, working of different electrical type, open channel and solid flow meters.
- Gain knowledge about the construction, working and calibration of different type of transmitters.
- Choose appropriate flow meters or level sensor for an application.

Unit I	VARIABLE HEAD TYPE FLOWMETERS	9

Expression for flow rate through restriction(compressible and incompressible flow) -Orifice plate: different types of orifice plates – Cd variation – pressure tappings – Venturi tube – Flow nozzle – Dall tube – Pitot tube: combined pitot tube, averaging pitot tube – Installation and applications of head flow meters

Unit II	QUANTITYMETERS,AREAFLOWMETERSANDMASSFLOW METERS	9

Positive displacement flow meters: Nutating disc, Reciprocating piston and Oval gear flow meters – Inferential meter – Turbine flow meter – Variable Area flow meter: Rotameter –theory, characteristics, installation and applications – Mass flow meter :– Angular momentum – Thermal, Coriolis type mass flow meters – Calibration of flow meters: – Dynamic weighing method.

Unit III	ELECTRICALTYPEFLOW METERS	9

Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.

Unit IV	LEVELMEASUREMENT	9

Level measurement: Float gauges - Displacer type – D/P methods -Bubbler system-Load cell – Electrical types – Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge – Boiler drum level measurement :– Differential pressure method and Hydrastep method -Solid level measurement -Radar and ultrasonic level measurements.

Unit V	TRANSMITTERS	9

Pneumatic transmitter: Operation - Electronic transmitter: Study of 2 wire and 4 wire transmitters – Operation of Electronics and Smart transmitters – Principle of operation of flow, level, temperature and pressure transmitters – Installation and Calibration of smart and conventional transmitters-Prover Method.

TEXT BOOK(S):

1. Doebellin, E.O. and Manik D.N., "Measurement systems Application and Design", 5th Edition, Tata McGraw-Hill Education Pvt. Ltd., 2007.
2. Patranabis, D., "Principles of Industrial Instrumentation", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

REFERENCE(S):

1. Liptak, B.G., Instrumentation Engineers Handbook (Measurement), CRC Press, 2005.
2. Singh,S.K., Industrial Instrumentation and Control, Tata McGrawHill Education Pvt. Ltd., New Delhi, 2009.
3. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
4. Jayashankar, V., "Lecture Notes on Industrial Instrumentation", NPTEL, E-Learning Course, IIT Madras.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI504	MICROPROCESSORS AND MICROCONTROLLERS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Architecture of μP8085 & μC 8051
- Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Know about the peripheral interfacing with 8085 & 8051
- Simple applications development with programming 8085 & 8051

Course Outcomes: At the end of this course, learners will be able to:

- Acquire knowledge in Addressing modes & instruction set of 8085 & 8051.
- Need & use of Interrupt structure 8085 & 8051.
- Understand the importance of Interfacing
- Explain the architecture of Microprocessor and Microcontroller.
- Develop the Microprocessor and Microcontroller based applications

Unit I	8085 PROCESSOR	9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

Unit II	PROGRAMMING OF 8085 PROCESSOR	9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up tability - Subroutine instructions - stack.

Unit III	8051 MICROCONTROLLER	9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.

Unit IV	PERIPHERAL INTERFACING	9

Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, - A/D and D/A converters &Interfacing with 8085& 8051.

Unit V	MICROCONTROLLER PROGRAMMING & APPLICATIONS	9

Simple programming exercises - key board and display interface – Closed loop control of servo motor-stepper motor control –Washing Machine Control.

TEXT BOOK(S):

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi& Janice GilliMazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE(S):

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM," Computer Fundamentals Architecture and Organization" New age International Private Limited, Fifth edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.
4. Ajay V.Deshmukh, 'Microcontroller Theory &Applications', McGraw Hill Edu,2016
5. Douglas V.Hall, 'Microprocessor and Interfacing', McGraw Hill Edu,2016.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester V	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19HS505	UNIVERSAL HUMAN VALUES 2 :UNDERSTANDING HARMONY	L	T	P	C	60	100	
		2	1	0	3			

Course Objective (s): The purpose of learning this course is to

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' toensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality andthe rest of existence. Such a holistic perspective forms the basis of Universal Human Values andmovement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical humanconduct, trustful and mutually fulfilling human behavior and mutually enriching interaction withNature

Salient Features of the Course: The salient features this course is to

- It presents a universal approach to value education by developing the right understanding of reality(i.e. a worldview of the reality "as it is") through the process of self-exploration.
- The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of the reality are presented and the students are encouraged to self-explore the proposals by verifying them on the basis of their natural acceptance within oneself and validate experientially inliving.
- The prime focus throughout the course is toward affecting a qualitative transformation in the life ofthe student rather than just a transfer of information.
- While introducing the holistic worldview and its implications, a critical appraisal of the prevailingnotions is also made to enable the students discern the difference on their own right.

Course Methodology: The methodology of this course is :

- To explorational and thus universally adaptable. It involves asystematic and rational study of the human being vis-à-vis the rest of existence.
- The course is in the form of 28 lectures (discussions) and 14 practice sessions.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
- This process of self-exploration takes the form of a dialogue between the teacher and the students tobegin with, and then to continue within the student in every activity, leading to continuous self evolution.

This self-exploration also enables them to critically evaluate their pre-conditionings and presentbeliefs.

Module 1 – Introduction to Value Education **6+3**

Lectures - Understanding Value Education - Self-exploration as the Process for Value Education- Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations

Tutorials *[Practice Session] - Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance*

Module 2– Harmony in the Human Being **6+3**

Lectures- Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials *[Practice Session] - Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body*

Module 3 – Harmony in the Family and Society **6+3**

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials *[Practice Session] - Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal*

Module 4 – Harmony in the Nature/Existence **4+2**

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders ofNature –Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Tutorials *[Practice Session] - Exploring the Four Orders of Nature - Exploring Co-existence in Existence*

Chairman - BoS
Dept. of EIE - ESEC

Module 5 – Implications of the Holistic Understanding 6+3

Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal HumanOrder - Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical CaseStudies - Strategies for Transition towards Value-based Life and Profession

Tutorials *[Practice Session] - Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order*

Course Outcomes: At the end of this course, learners will be able to:

- Students are expected to become more aware of themselves, and their surroundings(family, society, nature)
- Students would become more responsible in life, and in handling problems with sustainable solutions.
- Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction .

Students would have better critical ability .

TEXT BOOK(S):

1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCE(S):

1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3.	The Story of Stuff (Book)
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher
6.	Slow is Beautiful - Cecile Andrews
7.	Economy of Permanence - J C Kumarappa
8.	Bharat Mein Angreji Raj –PanditSunderlal
9.	Rediscovering India - by Dharampal
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

SUGGESTED ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student,so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by faculty mentor: 10 marks

Self-assessment: 10 marks &*Assessment by peers*: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R2019	SemesterV	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS05	QUANTITATIVE APTITUDE AND LOGICAL REASONING - III	2	0	0	0	30	100	

Course Objective (s): The objective of this course is to

- Design to help people make sense of numerical data.
- Calculate the calendars and series in simplified way.
- Understand the concept of the interest amount in SI and CI.
- Know the procedure to deal with a situation and sufficient to determine the answer.
- Teach seating arrangements in rows or in small groups.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstrate various principles involved in solving mathematical problems and thereby reducingthe time taken to solve Aptitude Questions.
- Solve the question based on calendar, odd man out and series by using shortcut methods.
- Calculate the interest by using shortcut methods instead of traditional methods.
- Induce their critical thinking by solving the syllogism and course of action.
- Analyze the conditions and do interpretation.

UNIT 1	DATA INTERPRETATION & CLOCKS	6

DATA INTERPRETATION: Tabulation – Bar graphs – Pie charts – Line graphs.
CLOCKS: Definition – important points – Angular difference between two hands at different timings- Incorrect clock.

UNIT 2	CALENDARS, ODDMAN OUT & SERIES	6

CALENDARS: Odd days – Leap year – Ordinary year – Counting of odd days – Day of the week.
ODDMAN OUT & SERIES: Odd man out – Power series – Number series-Sequence of real numbers.

UNIT 3	SIMPLE & COMPOUND INTEREST	6

SIMPLE INTEREST: Principal – Rate of interest – Number of years – Using formulae and shortcuts methods.
COMPOUND INTEREST: Compounded Annually – Compounded Half-Yearly – Compounded Quarterly – Compounded annually – Rates are different for different years.

UNIT 4	STATEMENT & COURSE OF ACTION, SYLLOGISM	6

STATEMENT AND COURSE OF ACTION: Courses of action - Decision taken - Improvement, Follow-up or further action in regard to the given statement.
SYLLOGISM/ LOGICAL VENN DIAGRAMS: Relationship between the two things or not - Classification of propositions – Immediate deductive inference – Immediate deductive inference.

UNIT 5	SEATING ARRANGEMENTS & DATA SUFFICIENCY	6

SEATING ARRANGEMENTS: Persons seating in the circular – Rectangular – Square.
DATA SUFFICIENCY: Reasoning ability using a set of directions.

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI506	INDUSTRIAL INSTRUMENTATION LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Impart an adequate knowledge and expertise to handle equipment generally available in an industry
- Make the students aware about calibration of meters, sensors and transmitters.
- Make the students conscious about the working and operation of different types of analytical Instruments.
- Identify, formulate, and analyze problems regarding sensors and transmitter
- Known about the physiological parameters such as BP, ECG and pulse rate.

Course Outcomes: At the end of this course, learners will be able to:

- Experimentally measure industrial process parameters such as flow and level.
- Experimentally measure industrial process parameters such as temperature, pressure and viscosity.
- Measure and analyze pH, conductivity.
- Measure and analyze UV absorbance and transmittance.
- Measure and analyze physiological parameters such as BP, ECG and pulse rate.

LIST OF EXPERIMENTS

1. Measurement of speed, torque and vibration
2. Calibration of ammeter, voltmeter and wattmeter using multifunction calibrator
3. Calibration of pressure gauge using dead weight tester
4. Measurement of level using d/p transmitter and fibre optics system.
5. Measurement of flow using
6. Discharge coefficient of orifice plate
7. Calibration of Rotameter.
8. Design and Testing of Electromagnetic Flow meters.
9. Measurement of temperature using IR thermometer and IC sensor
10. Measurement of Absorbance and Transmittance of Test solutions using UV-Spectrometer.
11. Measurement of Conductivity, Moisture and Viscosity of test solutions.
12. Standardization and measurement of pH values of different solutions
13. Measurement and analysis of ECG and pulse rate.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	Orifice plate	1
2.	Dead weight tester with pressure gauge	1
3.	Torque trainer	1
4.	Saybolt Viscometer	1
5.	Vacuum gauge	1
6.	DP transmitter	1
7.	UV – Visible spectrophotometer	1
8.	pH meter	1
9.	Conductivity meter	1
10.	ECG trainer	1
11.	Pulse rate trainer	1
12.	Tacho meter	1

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI507	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Provide training on programming of microprocessors and understand the interface requirements.
- Provide training on programming of microcontrollers and understand the interface requirements.
- Simulate various microprocessors and microcontrollers using KEIL or Equivalent simulator.
- Learn about the basics of serial communication
- Know about the basics of software simulators.

Course Outcomes: At the end of this course, learners will be able to:

- Understand and apply computing platform and software for engineering problems.
- Programming logics for code conversion.
- Acquire knowledge on A/D and D/A.
- Understand basics of serial communication.
- Understand and impart knowledge in DC and AC motor interfacing.

LIST OF EXPERIMENTS

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   a) Ascending / Descending order, Maximum / Minimum of numbers.
   b) Programs using Rotate instructions.
   c) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085 A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
   i. Conditional jumps & looping
   ii. Calling subroutines.
9. Programming I/O Port and timer of 8051
   a) study on interface with A/D & D/A
   b) Study on interface with DC & AC motors
10. Application hardware development using embedded processors.
11. The speed control of DC motor 8051

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface boards	5
4.	8251 Interface boards	5
5.	8259 Interface boards	5
6.	8279 Keyboard / Display Interface boards	5
7.	8254 timer/ counters	5
8.	ADC and DAC cards	5
9.	AC & DC motor with Controller s	5
10.	Traffic Light Control Systems	5

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING				R 2019	SemesterV	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	MaximumMarks
		L	T	P	C		
19EI508	INTERNSHIP / INDUSTRIAL TRAINING	0	0	2	1	30	100

Course Objective (s): The purpose of learning this course is to

- Understand one or more practical application of the core courses learned
- Get an inside view of an industry and organization/company
- Gain valuable skills and knowledge
- Make professional connections and enhance networking
- Get experience in a field to allow the student to make a careertransition

Course Outcomes: At the end of this course, learners will be able to provide short-term work experience in an Industry/ Company/ Organization

Guidelines

1. It is mandatory for every student to undergo this course.
2. Every student is expected to spend a minimum of 15-days in an Industry/ Company/ Organization, during the vacation.
3. The student must submit the "Training Completion Certificate" issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department.
4. The committee assesses the student performance, based on the report submitted and the presentation made.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI601	INDUSTRIAL AUTOMATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Give anoverviewofthe automation technologies such as PLCs, SCADA used in industries.
- Provide a fundamental understanding of the different languages used for PLC Programming
- Learn about the PLC program in different languages for industrial sequential applications.
- Know about automation technologies such as DCS used in industries.
- Provide insight into some of the advancedprinciples those are evolvingforpresent and future automation

Course Outcomes: At the end of this course, learners will be able to:

- Understand all the important components such as PLC, SCADA, DCS,
- Understand the concepts of I/O modules and field devices of an industrial automation system.
- Develop PLC program in different languages for industrial sequential applications.
- Select and use most appropriate automation technologies for a given application.
- Gain knowledge on the recent developments in industrial automation.

Unit I	**INRODUCTION TO PLC&SCADA**	**9**

PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures.

Unit II	**BASICS OFPLC PROGRAMMING(LADDER)**	**9**

Basics of PLC programming – Ladder Logic – Relay type instructions – Timer/Counter instructions – Program control instructions – Data manipulation and math instructions – Programming Examples.

Unit III	**PLC PROGRAMMING(OTHER LANGUAGES)**	**9**

Functional block programming - Sequential function chart – Instruction list – Structured text programming – PLC controlled sequential Process Examples.

Unit IV	**DISTRIBUTED CONTROL SYSTEM**	**9**

DCS: Evolution & types – Hardware architecture – Field control station – Interfacing of conventional and smart field devices (HART and FF enabled) with DCS Controller – Communication modules – Operator and Engineering Human interface stations – Study of any one DCS available in market.

Unit V	**ADVANCEDTOPICS INAUTOMATION**	**9**

Introduction to Networked Control systems – Plant wide control – Cloud based Automation – OLE for Process Control – Safety PLC – Case studies: PLC - SCADA - DCS.

TEXT BOOK(S):

1. F.D.Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2. Michael P.Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986
3. D. Popovic andV.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker,Inc., Newyork,1990.

REFERENCE(S):

1. Clarke,G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
2. Hughes, T.A., "Programmable Logic Controllers: Resources for Measurements and Control Series", 3rd Edition, ISA Press, 2004.
3. McMillan, G.K., "Process/Industrial Instrument and Controls Handbook", 5thEdition, McGraw- Hill handbook, New York, 1999.
4. NPTEL Notes on, "ProgrammableLogicControlSystem"byDepartmentofElectricalEngg.,IIT Kharagpur.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PC
Course Code	Course Name	Hours Week		Credit		Total Hours	Maximum Marks	
		L	T	P	C			
19EI602	PROCESS CONTROL	2	2	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Introducetechnical termsand nomenclature associated with Process control domain.
- Familiarize the students with characteristics, selection, sizing of control valves.
- Provide an overview of the features associated with Industrial type PID controller.
- Make the students understand the various PID tuning methods.
- Elaborate different types of control schemes such as cascade control, feed- forward control and Model based control schemes.

Course Outcomes: At the end of this course, learners will be able to:

- Understand technical terms and nomenclature associated with Process control domain.
- Build models using first principles approach as well as analyze models.
- Design, tune and implement PID Controllers to achieve desired performance for various processes
- Analyze Systems and design & implement control Schemes for various Processes.
- Identify, formulate and solve problems in the Process Control Domain.

Unit I	PROCESS MODELLING AND DYNAMICS	6+6

Need for process control – Mathematical Modeling of Processes: Level, Flow, Pressure and Thermal processes – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

Unit II	FINAL CONTROL ELEMENTS	6+6

Actuators: Pneumatic and electric actuators – Control Valve Terminology - Characteristic of Control Valves: Inherent and Installed characteristics - Valve Positioner – Modeling of a Pneumatically Actuated Control Valve – Control Valve Sizing: ISA S 75.01 standard flow equations for sizing Control Valves – Cavitation and flashing – Control Valve selection

Unit III	CONTROL ACTIONS	6+6

Characteristic of ON-OFF, Proportional, Single speed floating, Integral and Derivative controllers – P+I, P+D and P+I+D control modes – Practical forms of PID Controller – PID Implementation Issues: Bumpless, Auto/manual Mode transfer, Anti-reset windup Techniques – Direct/reverse action.

Unit IV	PID CONTROLLER TUNING	6+6

PID Controller Design Specifications: Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning: Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning – Cascade control – Feed-forward control

Unit V	MODEL BASED CONTROL SCHEMES	6+6

Smith Predictor Control Scheme - Internal Model Controller – IMC PID controller – Three-element Boiler drum level control - Introduction to Multi-loop Control Schemes – Control Schemes for CSTR, and Heat Exchanger -P&ID diagram- Redundant controller.

TEXT BOOK(S):

1. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003.
2. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.
3. Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005.

REFERENCE(S):

1. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw - Hill International Edition,2004.
2. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson, 2006.
3. Considine, D.M., Process Instruments and Controls Handbook, Second Edition, McGraw, 1999.
4. Bela.G.Liptak., "Process Control and Optimization"., Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
5. Ramesh C. Panda., T.Thyagarajan., "An Introduction to Process Modelling Identification and Control for Engineers" Narosa Publishing house Pvt. Ltd, 2017.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterVI	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI603	ANALYTICAL INSTRUMENTS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the theory and operational principles of instrumental methods for identification and quantitative analysis of chemical substances by different types of spectroscopy.
- Impart fundamental knowledge on gas chromatography and liquid chromatography.
- Integrate a fundamental understanding of the underlining principles of physics as they relate to specific instrumentation used for gas analyzers and pollution monitoring instruments.
- Impart knowledge on the important measurement in many chemical processes and laboratories handling liquids or solutions.
- Understand the working principle, types and applications of NMR and Mass spectroscopy.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the fundamental principles of selective analytical instruments used in medical diagnosis, quality assurance & control and research studies.
- Assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.
- Artistically evaluate the strengths and limitations of the various instrumental methods.
- Develop critical thinking for interpreting analytical data.
- Understand the working principle, types and applications of NMR and Mass spectroscopy

Unit I	SPECTROPHOTOMETRY	9

Spectral methods of analysis – Beer-Lambert law – UV-Visible spectroscopy – IR Spectrophotometry - FTIR spectrophotometry – Atomic absorption spectrophotometry - Flame emission and atomic emission photometry – Construction, working principle, sources detectors and applications.

Unit II	CHROMATOGRAPHY	9

General principles – classification – chromatographic behavior of solutes – quantitative determination – Gas chromatography – Liquid chromatography – High-pressure liquid chromatography – Applications.

Unit III	INDUSTRIALGASANALYZERSANDPOLLUTION MONITORING INSTRUMENTS	9

Gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity detectors, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

Unit IV	pH METERS AND DISSOLVED COMPONENTANALYZERS	9

Selective ion electrodes - Principle of pH and conductivity measurements - dissolved oxygen analyzer – Sodium analyzer – Silica analyzer – Water quality Analyzer.

Unit V	NUCLEAR MAGNETIC RESONANCE AND MASS SPECTROMETRY	9

NMR – Basic principles – Continuous and Pulsed Fourier Transform NMR spectrometer – Mass Spectrometry – Sample system – Ionization methods – Mass analyzers – Types of mass spectrometry.

TEXT BOOK(S):

1. Willard, H.H., Merritt, L.L., Dean, J.A., Settle, F.A., "Instrumental methods of analysis", CBS publishing & distribution, 7th Edition, 2012.
2. Braun, R.D., "Introduction to Instrumental Analysis", Pharma Book Syndicate, Singapore, 2006.
3. Robert E. Sherman., "Analytical Instrumentation",InstrumentsSociety ofAmerica, 1996.

REFERENCE(S):

1. Khandpur, R.S., "Handbook of Analytical Instruments", Tata McGraw-Hill publishing Co. Ltd.,2nd Edition 2007.
2. Ewing, G.W., "Instrumental Methods of Chemical Analysis", McGraw-Hill, 5th Edition reprint 1985. (Digitized in 2007).
3. Liptak, B.G., "Process Measurement and Analysis", CRC Press, 5th Edition, 2015.
4. NPTEL lecture notes on, "Modern Instrumental methods of Analysis" by Dr.J.R. Mudakavi, IISC, Bangalore.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS06	QUANTITATIVE APTITUDE AND LOGICAL REASONING - IV	2	0	0	0	30	100	

Course Objective (s): The objective of this course is to

- To ascertains the occurrence of an event on the basis of already present information.
- To use area models to represent the distributive property in mathematical reasoning.
- To calculate the work capacity by chocolate based method.
- To work with time, speed and distance by relative speed concepts.
- To determine how various phenomena are related.

Course Outcomes: At the end of this course, learners will be able to

- Know the outcome of an event developed the concept of probability.
- Calculate the area and surface volume in real time application.
- Understand the concepts of Times and Work and Pipes and Cistern and Correlating the Concepts of both.
- Know the concepts of Time, Speed and Distance and concepts of Boats and Streams.
- Analyze the cause and effect of problems by using critical thinking.

UNIT 1	PROBABILITY , PERMUTATIONS & COMBINATIONS	6

PROBABILITY: Rolling an unbiased dice – Tossing a fair coin – Drawing a card from a pack of well shuffled cards – Picking up balls of certain color from a bag containing balls of different colors.
PERMUTATIONS: Numbers with digits - Words with letters - Arrangements of person in a row - Arrangements of books on a shelf.
COMBINATIONS: Formation of committee – Selection of questions from question papers.

UNIT 2	AREA & VOLUME	6

AREA: Area – Perimeter – Important points about triangle – Quadrilateral – Fast track techniques.
VOLUME: Cuboids – Cube – Cylinder – Cone – Frustum of a cone – Sphere – Hemisphere – Pyramid –their formulas.

UNIT 3	TIME & WORK, PIPE & CISTERNS	6

TIME AND WORK: Introduction – Basic concepts – Leaving and joining – Alternative days – In between days the works starting and ending.
PIPES AND CISTERNS: Introduction - Basic concepts – Capacity of the total liters –Water flow in the tank.

UNIT 4	TIME& DISTANCE, TRAINS, BOATS AND STREAMS	6

TIME AND DISTANCE: Definition – Average speed – Distance covered is same – Distance covered is different – Stoppage time per hour for a train – Time taken with two different modes of transport – Time and distance between two moving bodies.
PROBLEMS ON TRAINS: Basic concepts – Basic formulae – Different types of objects –Two trains crossing each other in both directions – Shortcuts.
BOATS AND STREAMS: Introduction – Speed of man (boat and streams) - Moving same and opposite directions – important formulae.

UNIT 5	STATEMENT - CONCLUSION , ARGUMENTS, CAUSE & EFFECT, ASSERTION & REASON	6

STATEMENT AND CONCLUSION: Statement to be true - Two conclusions together - Logically follows.
STATEMENT AND ARGUMENTS: Arguments strong with respect to the statement.
CAUSE AND EFFECT: Cause and effect relationship between the two statements.
ASSERTION AND REASON: Assertion(A) and Reason(R) – Both (A) and (R) are individually true and (R) - (A) is true but (R) is false – (A) is false but (R) is true.

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterVI	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI604	PROCESS CONTROL LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Experimentally verify the process control concepts on the selected process control loops.
- Impart theoretical and practical skills in process identification and PID controller tuning.
- Make the students aware of basic and advanced control schemes.
- Know about the simulation tools such as MATLAB/LABVIEW/ASPEN.
- Learn about the simple adaptive and model based control schemes.

Course Outcomes: At the end of this course, learners will be able to:

- Understand and analyze process control engineering problems.
- Build dynamic models using input – output data of a process.
- Working with real time control loops(flow/level/temperature/pressure).
- Simulation tools such as MATLAB/LABVIEW/ASPEN.
- Implement simple adaptive and model based control schemes.

LIST OF EXPERIMENTS

Simulation Based Experiments

1. Simulation of lumped /distributed parameter system
2. Mathematical model of a typical industrial process using nonparametric identification methods
3. Tuning of PID Controller for mathematically described processes
4. PID Enhancements (Cascade and Feed-forward Control Schemes)
5. Design and Implementation of Multi-loop PID Controller on the simulated model of a typical industrial process.
6. Study of burner management system.

Hardware based experiments

1. Characteristics of Pneumatically Actuated Control Valve (with and without Positioner).
2. Study and control of flow process using Compact Flow Control Unit.
3. Control of Level and Pressure using Process Control Training Plant.
4. Design and implementation of ON/OFF Controller for the Temperature Process.
5. Design and implementation of Interacting and non-interacting system
6. Design and implementation of adaptive or model predictive control schemes

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Description of Equipment
1.	Flow process station with all accessories
2.	Analog / Digital PID controller
3.	Control valve setup (with position for varying ΔP across the valve)
4.	Flow meter
5.	Level process station with all accessories
6.	Temperature process station with all accessories
7.	Pressure process station with all accessories
8.	Personal computer-15 nos
9.	MATLAB software
10.	Two tank system with following accessories.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterVI	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI605	INDUSTRIAL AUTOMATION LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Programming of PLCand DCS.
- Sensor data acquisition, data processing and visualization
- Interfacing the various field devices with PLC
- Learn about designing and implementing control schemes in PLC & DCS
- Know about the Fieldbus /IOT/Wireless HART Enabled Transmitter

Course Outcomes: At the end of this course, learners will be able to:

- Ability to understand and Programming of PLC, SCADA and DCS
- Ability to working with industrial automation system
- Be able to design and implement control schemes in PLC & DCS
- Ability to interface field devices with PLC& DCS
- Understand the Fieldbus /IOT/Wireless HART Enabled Transmitter

LIST OF EXPERIMENTS

1. Study of PLC field device interface modules (AI,AO,DI,DO modules)
2. Programming Logic Gates Function in PLC
3. Implementing Mathematical Operations in PLC
4. Programming Jump-to-subroutine & return operations in PLC
5. PLC Exercises:- 1. Traffic Light Control and Filling/Draining Control Operation
6. PLC Exercise: 1. Reversal of DC Motor Direction 2. ON/OFF Controller for Thermal Process
7. PC based control of Level Process
8. On-line Monitoring and Control of a Pilot plant using DCS
9. PLC based Control of Flow Process
10. Study of Foundation Fieldbus /IOT/WirelessHART Enabled Transmitter

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity Required
1.	Programmable Logic controller	5 Nos.
2.	Programmable Logic controller Software	10 User License
3.	DAQ card	2 Nos.
4.	Filling /Draining System	1 No.
5.	Traffic Light Controller	2 Nos
6.	DC Motor	5 Nos
7.	Personal computer	10 Nos
8.	DCS along with Interface modules	1 set
9.	Thermal Process, Level Process & Flow Process stations	1 set each
10.	Smart Transmitter	1 No.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	SemesterVI	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI605	INDUSTRIAL AUTOMATION LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Programming of PLCand DCS.
- Sensor data acquisition, data processing and visualization
- Interfacing the various field devices with PLC
- Learn about designing and implementing control schemes in PLC & DCS
- Know about the Fieldbus /IOT/Wireless HART Enabled Transmitter

Course Outcomes: At the end of this course, learners will be able to:

- Ability to understand and Programming of PLC, SCADA and DCS
- Ability to working with industrial automation system
- Be able to design and implement control schemes in PLC & DCS
- Ability to interface field devices with PLC& DCS
- Understand the Fieldbus /IOT/Wireless HART Enabled Transmitter

LIST OF EXPERIMENTS

1. Study of PLC field device interface modules (AI,AO,DI,DO modules)
2. Programming Logic Gates Function in PLC
3. Implementing Mathematical Operations in PLC
4. Programming Jump-to-subroutine & return operations in PLC
5. PLC Exercises:- 1. Traffic Light Control and Filling/Draining Control Operation
6. PLC Exercise: 1. Reversal of DC Motor Direction 2. ON/OFF Controller for Thermal Process
7. PC based control of Level Process
8. On-line Monitoring and Control of a Pilot plant using DCS
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10. Study of Foundation Fieldbus /IOT/WirelessHART Enabled Transmitter

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity Required
1.	Programmable Logic controller	5 Nos.
2.	Programmable Logic controller Software	10 User License
3.	DAQ card	2 Nos.
4.	Filling /Draining System	1 No.
5.	Traffic Light Controller	2 Nos
6.	DC Motor	5 Nos
7.	Personal computer	10 Nos
8.	DCS along with Interface modules	1 set
9.	Thermal Process, Level Process & Flow Process stations	1 set each
10.	Smart Transmitter	1 No.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI701	COMPUTER CONTROL OF PROCESSES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Represent the linear time invariant System in discrete State Space form.
- Analyze the controllability, observability and stability of a Discrete time System.
- Estimate model parameters from input/output measurements
- Design Digital Controllers
- Design Multi-loop and Multivariable Controllers for multivariable system

Course Outcomes: At the end of this course, learners will be able to:

- Explain about the linear time invariant System in discrete State Space form.
- Analyze the discrete time systems
- Build models from input-output data
- Design a digital controller
- Design multi-loop controller and multivariable controller for multi-variable systems.

Unit I	DISCRETE STATE-VARIABLE TECHNIQUE	9

State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system–Stability tests of discrete-data system.

Unit II	SYSTEM IDENTIFICATION	9

Identification of Non Parametric Input-Output Models:-Transient analysis–Frequency analysis–Correlation analysis– Spectral analysis – Identification of Parametric Input-Output Models:- Least Squares Method – Recursive Least Square Method.

Unit III	DIGITAL CONTROLLER DESIGN	9

Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead-beat controller and Dahlin's controller – IMC - Smith Predictor.

Unit IV	MULTI-LOOP REGULATORY CONTROL	9

Multi-loop Control - Introduction – Process Interaction – Pairing of Inputs and Outputs -The Relative Gain Array (RGA) – Properties and Application of RGA - Multi-loop PID Controller – Biggest Log Modulus Tuning Method – De-coupler.

Unit V	MULTIVARIABLE REGULATORY CONTROL	9

Introduction to Multivariable control –Multivariable PID Controller–Multivariable Dynamic Matrix Controller–Fuzzy Logic Controller – Case Studies:- Distillation Column, CSTR and Four-tank system.

TEXT BOOK(S):

1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and Practice", Prentice Hall o India, 2005
2. SigurdSkogestad, Ian Postlethwaite, "Multivariable Feedback Control: Analysis and Design", John Wiley an Sons, 2005

REFERENCE(S):

1. Gopal, M., "Digital Control and State Variable Methods", Tata Mc Graw Hill, 2003
2. Dale E. Seborg, Duncan A. Mellichamp, Thomas F. Edgar, "Process Dynamics and Control", Wiley John an Sons, 3rd Edition, 2010
3. P. Albertos and A. Sala, "Multivariable Control Systems An Engineering Approach", Springer Verlag, 2006
4. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2008
5. Thomas E. Marlin, Process Control – Designing Processes and Control systems for Dynamic Performance Mc-Graw-Hill,2000

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI702	INDUSTRIAL DATA NETWORKS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Educate on the basic concepts of data networks
- Introduce the basics of internetworking and serial communications
- Provide details on HART and Field buses
- Educate on MODBUS, PROFIBUS and other communication protocol
- Introduce industrial Ethernet and wireless communication

- Ability to define basic concepts of data communication and its importance.
- Ability to explain the various internetworking devices involved in industrial networks and various serial communications used in process industries.
- Ability to illustrate, compare & explain the working of HART and Field bus used in process digital communication.
- Ability to summarize the operation of MODBUS, PROFIBUS protocol & its applications.
- Ability to explain and adopt the different Industrial Ethernet protocol and usage of wireless communication in process applications.

Unit I	DATA NETWORK FUNDAMENTALS	9

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing -CSMA/CD, TCP/IP

Unit II	INTERNET WORKING and RS 232, RS485	9

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Devicenet

Unit III	HART AND FIELD BUS	9

Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications - Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).

Unit IV	MODBUS AND PROFIBUS PA/DP/FMS AND FF	9

MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway

Unit V	NDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION	9

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.

TEXT BOOK(S):

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004
2. William Buchanan, Computer Buses, CRC Press, 2000.
3. BehrouzForouzan ,Data Communications & Networking ,3RD edition, Tata McGraw hill,2006.

REFERENCE(S):

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
2. Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2nd Edition, 2001.
3. William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI707	ROBOTICS AND AUTOMATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the various parts of robots, fields of robotics and various kinematics and inverse kinematics of robots.
- Study the Euler, Lagrangian formulation of Robot dynamics and the trajectory planning for robot.
- Study the control of robots for some specific applications.
- Educate on various path planning techniques
- Introduce the dynamics and control of manipulators

Course Outcomes: At the end of this course, learners will be able to:

- Understand the evolution of robot technology and mathematically represent different types of robot.
- Get exposed to the case studies and design of robot machine interface.
- Familiarize various control schemes of Robotics control.
- Understand the various path planning techniques.
- Gain knowledge about the dynamics and control of manipulators.

Unit I	BASIC CONCEPTS	9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots.

Unit II	POWER SOURCES, SENSORS AND ACTUATORS	9

Hydraulic, pneumatic and electric drives: Design and controlissues – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Unit III	MANIPULATORS AND GRIPPERS DIFFERENTIAL MOTION	9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Unit IV	KINEMATICS AND PATH PLANNING	9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist andarm singularity - Static analysis - Force and moment BalanceSolution kinematics problem – robot programming languages.

Unit V	DYNAMICS AND CONTROL AND APPLICATIONS	9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model –Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TEXT BOOK(S):

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 2015.
2. Saeed B Niku, Introduction to Robotics, Analysis, Systems, Applications Prentice Hall, 3 edition 2104.

REFERENCE(S):

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005
5. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education,2009.
6. Issac Asimov I Robot, Ballantine Books, New York, 1986..

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI703	COMPUTER CONTROL OF PROCESS LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Obtain adequateknowledgeindesignofDiscrete P+I+D controller for a first order and second order system using MATLAB.
- Gain knowledge about control of Bottle filling system using PLC.
- Impart design knowledge of PI,PIDcontrollers.
- Acquire the knowledge of various algorithms
- Learn about the Multivariable control system using MATLAB

Course Outcomes: At the end of this course, learners will be able to:

- Understand design of design ofDiscrete P+I+D controller for a first order and second order system using MATLAB.
- Explain about control of Bottle filling system using PLC.
- Design PI, PID controllers.
- Explain about various algorithms.
- Explain about the Multivariable control system using MATLAB.

LIST OF EXPERIMENTS

1. Simulation of first order system and second order with and without dead time using discretization method and Runge – Kutta method.
2. Design of Discrete P+I+D controller for a first order and second order system using MATLAB.
3. Control of Bottle filling system using PLC.
4. Simulation of feedback, feed forward, ratio and cascade complex control systems using matlab package.
5. Design of PI controller for computerized liquid level system.
6. Design of PID controller for computerized thermal system.
7. Design of dead beat / Dahlin/ Kalman's Algorithms.
8. Study of Human machine interface using SCADA package.
9. Design of Multivariable control system using MATLAB.
10. Design of pole placement controller for discrete system.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Expt.No.	List of equipments
1	Matlab Software Package

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI704	INSTRUMENTATION SYSTEM DESIGN LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Obtain adequate knowledge indesignofvarioussignalconditioningcircuits.
- Gain knowledge about instrumentation systems.
- Impart design knowledge of controller, control valve and transmitter.
- Acquire the knowledge of piping diagram of industrial standard
- Make the students aware of industry project, planning and scheduling.

Course Outcomes: At the end of this course, learners will be able to:

- Understand design of signal conditioning circuits.
- Explain about instrumentation systems.
- Design controller, control valve and transmitter.
- Design and draw the piping diagram for industrial application projects.
- Design the multi-channel data acquisition system and transmitter.

LIST OF EXPERIMENTS

1. DesignofInstrumentationamplifier.
2. Designofactivefilters–LPF,HPFandBPF.
3. Designofregulatedpower supplyanddesignofV/IandI/Vconverters.
4. Designoflinearizingcircuitsandcold–junctioncompensationcircuitfor thermocouples.
5. Designofsignal conditioningcircuitfor straingaugeand RTD.
6. Designoforificeplateandrotameter.
7. DesignofControl valve(sizingandflow-liftcharacteristics) and PIDcontroller (usingoperationalamplifier andmicroprocessor)
8. Designofamulti-channeldataacquisitionsystem andmultirangeDPtransmitter.
9. PipingandInstrumentationDiagram–casestudy.
10. Preparationofdocumentationofinstrumentationprojectandprojectschedulingfortheabove casestudy.(Processflowsheet,instrumentindexsheetandinstrumentspecificationssheet, jobscheduling,installationproceduresandsafetyregulations

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Expt.No.	List of equipments
1	Sufficient number of Monolithic Instrumentation amplifier , Operationalamplifiers,IC7805and resistors,diodes,capacitors
2	Linear control valve,ON/OFFcontrol valve,Air regulator, Rotameter,Pump 1No. each
3	Sufficient number of IC741,CRO,Breadboard,Signalgenerator (PID) Microprocessor kitwithADCand DACsection
4	AnyProcessstation(TemperatureorLevel) with Correspondingsensors,Dataacquisitioncard,and Storagedevice (microcontroller/microprocessor)
5.	Flowprocessstation withDPtransmitter
6	Loopanalyzer
7	Thermocouple&RTD
8	Bondedstraingauge, Loads
9	Orificeplate

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EI705	MINI PROJECT	0	0	2	1	60	100

Course Objective (s): The purpose of learning this course is to

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
- Prepare report and present oral demonstrations

Course Outcomes: At the end of this course, learners will be able to:

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
- Prepare report and present oral demonstrations

Guidelines

A multidisciplinary project to be taken up by a team of maximum of ten students. Development of prototype product, a 3D model, simulation, blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.

Learning Resources

IEEE Journal, Elsevier Journals, Springer Jour nals, and any open access journal, reference / user manuals, etc.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EI706	COMPREHENSIVE REVIEW	0	0	2	1	30	100

Course Objective (s): The purpose of learning this course is to

- encourage the students to comprehend the knowledge acquired from the first Semester to seventh semester of B.E degree course through periodic exercise.

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EI801	PROJECT WORK	0	0	16	8	300	100	

Course Objective (s): The purpose of learning this course is to

- develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

Course Outcomes:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

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LANGUAGE ELECTIVE

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HSX201	ENGLISH FOR ENGINEERS	3	0	0	3	45	100	

Course Objective (s):

- To acquire usage of grammar in Englishlanguage.
- To develop listening skills which will enable to listen lectures and comprehend different types oftexts.
- To enhance the reading skill to comprehend technicalwritings.
- To improve writing skills to express thoughtsfreely.
- To help learners develop their speaking skills and speak fluently in realcontexts.

Course Outcomes: At the end of this course, learners will be able to:

1. Improve their language usage in LSRWskills.
2. Develop listening skills to understand sentence stress andintonations.
3. Acquire the ability to understand different writtentexts.
4. Enhance the writing skills to express the ideas of thelearners.
5. Communicate fluently in pair /team.

Unit I	**LANGUAGE FOCUS**	**9**

Prepositions - Articles - Conjunctions - Voice(Active & Passive) - Reported speech - Conditionals – Collocations-Discourse markers - One word substitution - Phrasal verbs

Unit II	**LISTENING**	**9**

Listening to identify topic, content, function - Sentence stress - Rhythm – Intonation

Unit III	**READING**	**9**

Reading graphs and charts - Skimming and scanning texts - Read business articles for specific information - Understanding the structure of a text - Error identification

Unit IV	**WRITING**	**9**

Application for a job - Recommendations - Report writing (accident and survey) - Writing review (book and movie) - Transcoding

Unit V	**SPEAKING**	**9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging – LanguageFunctions: suggesting - comparing and contrasting – expressing - Finding out facts, attitudes and opinions - Commonly mispronounced words

TEXT BOOK(S):

1. Communicative English by KN Shoba, LourdesJoavaniRayenPublised by Cambridge university 2017

REFERENCE(S):

1. Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively and Developing Speaking Skills for Business English, Cambridge: Cambridge University Press, 2002.
2. Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes.United Kingdom: Cambridge University Press, 2004.
3. Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.
4. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HSX202	HINDI	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- To help students to acquire the basics ofHindi
- To teach them how to converse in Hindi on variousoccasions
- To help learners acquire the ability to understand a simple technical text inHindi

Course Outcomes: At the end of this course, learners will be able to:

- An ability to communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Propervocabulary

Unit I	HINDI ALPHABET	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises. Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu&Visarg - Table of Alphabet -Vocabulary.

Unit II	NOUNS IN HINDI	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

Unit III	PRONOUNS AND TENSES	9

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

Unit IV	CLASSIFIED VOCABULARY	9

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

Unit V	SPEAKING	9

Model Sentences - Speaking practice for various occasions.

TEXT BOOK(S):

1. Elementary Hindi: Learn to Communicate in Everyday Situations byRichardDelacyTuttlePublication2013
2. Colloquial Hindi: The Complete Course for Beginners by TejK.Bhatia

REFERENCE(S):

1. B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications(P) Ltd., New Delhi, 2009.
2. Syed, PrayojanMulak Hindi, RahamathullahVaniPrakasan, New Delhi,2002.
3. Ramdev, VyakaranPradeep, SaraswathiPrakasan, Varanasi,2004.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HSX203	JAPANESE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- help students acquire the basics of Japaneselanguage
- teach them how to converse in Japanese in variousoccasions
- teach the students the Japanese cultural facets and socialetiquette

Course Outcomes: At the end of this course, learners will be able to communicate effectively with:

- Improved fluency inJapanese
- Clarity on the basic sounds of the Japaneselanguage
- Propervocabulary

Unit I	Introduction	9

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels -Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions Numerals. N1 waN2 des - N1 waN2 jaarimasen-Ska-N1mo-N1noN2-.san-Kanji-TechnicalJapaneseVocabulary(25Numbers)-Phoneticand semantic resemblances between Tamil and Japanese

Unit II	Vocabulary & Grammar 語彙と文法	9

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha-V masendeshitha - N1(Time) ne V - N1 kara
N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

Unit III	Noun&Types 名詞とタイプ	9

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye moikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1(Place) de V - V masen ka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 -
Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit IV	Vocabulary & Grammar 語彙と文法	9

Introduction to Adjectives - N1wanaadj des. N1 waii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonnaN2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 ga suki masu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi- amari - zenzen - S1karaS2-dhoshithe,N1gaarimasu-imasuN1(Place)neN2gaarimasu-iimasu-N1waN2(Place)nearimasu-iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit V	Root Word & Vocabulary 語彙と語彙	9

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period
) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 thoDhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des
- V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical Japanese Vocabulary (25 Numbers)

TEXT BOOK(S):

1. Modern Japanese Vocabulary: A Guide for 21st Century Students | Edward P. Trimnell Publisher: Beechmont Crest Publishing (April 28
2. Japanese Verbs & Essentials of Grammar" | Rita Lampkin Passport Books ,2013

REFERENCE(S):

1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd.,Delhi,2007

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HSX204	FRENCH	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- help students acquire the basics of Frenchlanguage
- teach them how to converse in French in variousoccasions

Course Outcomes: At the end of this course, learners will be able to:

- The students will become familiar with the basics of French language and start conversing inFrench.

Unit I	Alphabet Français	6

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - trémacédille - écrire son nom dans le français (spellingone -sname in French) - Les noms de jours de la semaine (Days of the week)

Unit II	Grammaire	6

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

Unit III	Moyens de transport	10

Moyens de transport (Transport) - Noms de Professions (Professions) - Nomsd'endroitscommuns (Places) - Nationalités (Nationalities) ECOUTER : (Listening) Écouter l - alphabet associéà des prénomsfrançais - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez - Vous (Introducingoneself)LIRE :Lireles phrases simples

Unit IV	Pronoms	12

Pronoms (Pronouns) - Nomscommunsmasculins et de femme (Common masculine and Femininenouns) - Verbescommuns (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profilsd'utilisateursd'interlingua (alter ego)PARLER :Parler de saville - Parler de saprofession

Unit V	Europe PARLER	11

Narration de son nom et l'endroitoù on vit - Son âge et date de naissance - Numéro de téléphoneet'dresse -Narrationdutemps-LaFranceenEuropePARLER:Conversationentredeuxamis-JouerlascèneÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune carte postale

TEXT BOOK(S):

1. Le Bon Usage by M. Grevisse Publisher- Duculot 14 edition (25 January2001)
2. Advanced French by Monique L'Huillier, Cambridge UniversityPress,2013

REFERENCE(S):

1. Alter ego+ Niveaua1
2. Grammaire Progressive duFrançais
3. Collins Easy Learning French Verbs&Practice
4. FrançaisLinguaphone
5. Françaisl.Harrisonburg: The Rosetta Stone: Fairfield LanguageTechnologies

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PROFESSIONAL ELECTIVES

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX01	DIGITAL SIGNAL PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Signals and systems & their mathematical representation.
- Discrete time systems.
- Transformation techniques & their computation.
- Filters and their design for digital implementation.
- Programmability digital signal processor & quantization effects.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the importance of Fourier transform, digital filters and DS Processors.
- Acquire knowledge on Signals and systems & their mathematical representation.
- Understand and analyze the discrete time system transformation techniques & their computation.
- Analyze Understand the types of filters and their design for digital implementation.
- Acquire knowledge on programmability digital signal processor & quantization effects.

Unit I	INTRODUCTION	9

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

Unit II	DISCRETE TIME SYSTEM ANALYSIS	9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

Unit III	DISCRETE FOURIER TRANSFORM & COMPUTATION	9

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

Unit IV	DESIGN OF DIGITAL FILTERS	9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

Unit V	DIGITAL SIGNAL PROCESSORS	9

Introduction – Architecture of TMS320C54XX – Features – Addressing Formats – Functional modes - Introduction to Commercial DS Processors.

TEXT BOOK(S):

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

REFERENCE(S):

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013
2. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014
3. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009
4. SenM.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX02	DIGITAL CONTROL SYSTEM	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Give basic knowledge in digital control system
- Impart necessary knowledge in stability analysis for discrete system
- Model systems in state space representation
- Provide a solution to state equations and to study various computational algorithms
- Know about the compensators in digital controllers

Course Outcomes: At the end of this course, learners will be able to:

- Explain the components and concepts related to the digital control system
- Investigate the stability of the discrete time system
- Formulate the discrete time system in state space form.
- Compute the solutions of discrete time state space equation using state transition matrix and Cayley Hamilton theorem.
- Design a digital compensator for the given system using frequency domain technique.

Unit I	DIGITAL CONTROL SYSTEM	9

Digital control system - sample and hold - analog to digital converter - digital to analog converter quantizing and quantizing error - sampling process - frequency response of zero order hold - first order hold - PI, PD controllers - digital PID

Unit II	RESPONSE OF DISCRETE SYSTEM	9

Pulse transfer function of cascaded elements, closed loop systems - characteristic equation - relationship between s-plane and z-plane poles - unit step response of digital control system - stability of discrete system - Jury's stability test - Root locus technique for digital system

Unit III	STATE SPACE REPRESENTATION	9

State variable formulation of discrete system - decomposition of discrete transfer function - direct decomposition - cascade decomposition and parallel decomposition - solution of state equation by recursive method - state transition matrix and its properties

Unit IV	SOLUTION OF STATE EQUATION	9

Solution of discrete time state equation - evaluation of state transition matrix - transfer function matrix Discretisation of continuous time system - Solution of discrete time state equation by Cayley Hamilton theorem

Unit V	COMPENSATION TECHNIQUES	9

Compensation by continuous network - compensation by digital computer - frequency domain technique of designing D(z)

TEXT BOOK(S):

1. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2012
2. K. Ogata, Discrete time control system, Pearson Education Asia, New Delhi 2011

REFERENCE(S):

1. I.J. Nagarath and M. Gopal, Control System Engineering, New age International P.Ltd, New Delhi 2011
2. Lawrence J. Kamm, Understanding Electro Ã¢?? Mechanical Engineering: An Introduction to Mechatronics, Prentice Hall of India Pvt., Ltd., 2000
3. NitaigourPremchandMahadik, Mechatronics, Tata McGraw-Hill publishing Company Ltd, 2009

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX03	FIELD INSTRUMENTS AND PROCESS AUTOMATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Execute the procedure to configure and calibrate the transmitters type field instruments
- Design two types of classical controller for different control schemes
- Select appropriate valve (Pneumatic or Electric) and communication protocol for different industrial application
- Execute PLC and SCADA configuration for Honeywell ML 200 and 200R
- Implement hardware interface and communication protocol of PLC and SCADA in industrial application

Course Outcomes: At the end of this course, learners will be able to:

- Execute the procedure to configure and calibrate the transmitters type field instruments
- Design two types of classical controller for different control schemes
- Select appropriate valve (Pneumatic or Electric) and communication protocol for different industrial application
- Execute PLC and SCADA configuration for Honeywell ML 200 and 200R
- Implement hardware interface and communication protocol of PLC and SCADA in industrial application

Unit I	FIELD INSTRUMENTS	9

Hands on training for configuration - commissioning - troubleshooting - calibration - Pressure transmitter - Temperature transmitter - Level transmitter - Flow transmitter - pH measurement - Humidity –Vibration

Unit II	CONTROL SCHEMES	9

Controllers - two position - PID - Tuning of PID - Process characters - Single capacity process - Multi capacity process - Feed back - Feed forward - Cascade - Ratio - Split range

Unit III	FINAL CONTROL ELEMENT AND INDUSTRIAL COMMUNICATION	9

Control valve - Solenoid valve - Motor operated valve - Actuators (Pneumatic & Electric) - Serial communication - Device net - Field bus - MOD bus - Profi bus - Ethernet - Fault Tolerant Ethernet (FTE)

Unit IV	PLC AND SCADA	9

Introduction to PLCs - ladder logic programming - PLC system configuration - PLC hardware configuration - Identify Honeywell ML 200 PLC CPU, I/O Modules, Communication modules - Plan the ML 200R PLC including the selection of appropriate I/O, redundancy and communications - ML 200R configuration and use of soft master Programming tool

Unit V	PLC HARDWARE INTERFACING	9

Building a project, implementing redundancy functions and downloading to PLC - Monitoring basics (Start/Pause/Resume/Stop monitoring), online editing, and force I/O - Debugging basics, use of breakpoints, reset and clear PLC - Identify function blocks in library - Use of PID function block Communicate via SNET, FENET, Profi bus - DP modules -Overview of SCADA system

TEXT BOOK(S):

1. Curtis D. Johnson, Process Control Instrumentation technology, Pearson new international edition, 2013

REFERENCE(S):

1. George Stephanopoulos, Chemical Process Control, PHI learning Pvt. Ltd., New Delhi, 2012
2. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes/Elsevier, 2013
3. John.H. Blakelock, "Automatic control of aircraft and missiles", John wiley and sons.inc, 1991.
4. Lin.C.F, "Modern guidance, navigation and control processing", Prenticehall, 1991.
5. Keyton.M and Walker.R, Fried,"Avionics navigation systems",John Wiley, 1996.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX04	APPLIED SOFT COMPUTING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Expose the students to the concepts of feed forward neural networks.
- Provide adequate knowledge about feedback neural networks
- Provide adequate knowledge about fuzzy and neuro-fuuzy systems
- Provide comprehensive knowledge of fuzzy logic control to real time systems.
- Provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the concepts of feed forward neural networks.
- Gained knowledge about feedback neural networks
- Analyze the fuzzy and neuro-fuuzy systems
- Known about the comprehensive knowledge of fuzzy logic control to real time systems.
- Gained knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

Unit I	ARCHITECTURES – ANN	9

Introduction – Biological neuron – Artificial neuron – Neuron model – Supervised and unsupervised learning- Single layer – Multi layer feed forward network – Learning algorithm- Back propagation network.

Unit II	NEURAL NETWORKS FOR CONTROL	9

Feedback networks – Discrete time Hopfield networks – Transient response of continuous time system – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum

Unit III	FUZZY SYSTEMS	9

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic – Introduction to neuro fuzzy system- Adaptive fuzzy system.

Unit IV	APPLICATION OF FUZZY LOGIC SYSTEMS	9

Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum – fuzzy PID control, Fuzzy based motor control.

Unit V	GENETIC ALGORITHMS	9

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

TEXT BOOK(S):

1. LauranceFausett, Englewood Cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education,1992
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 3rd Edition ,2010
3. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013

REFERENCE(S):

1. Simon Haykin, 'Neural Networks', Pearson Education, 2003
2. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003
3. M.Gen and R,Cheng, Genetic algorithms and optimization, Wiley Series in Engineering Design and Automation, 2000
4. Hagan, Demuth, Beale, " Neural Network Design", Cengage Learning, 2012
5. N.P.Padhy, " Artificial Intelligence and Intelligent Systems", Oxford, 2013
6. WilliamS.Levine, "Control System Advanced Methods," The Control Handbook CRC Press 2011

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX05	SMART AND WIRELESS INSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the measurement system and sensors for various applications.
- Learn about the sensor for measurement of spatial, chemical and optical variables
- Understand the manufacturing techniques and different types of Micro sensors and actuators.
- Give a comprehensive knowledge on smart sensor Design, Development and Challenges.
- Understand the recent trends in the sensor technologies (RF-IDs - Sensor arrays - Sensor networks)

Course Outcomes: At the end of this course, learners will be able to:

- Interpret the static and dynamic characteristics of the measurement system
- Identify the sensor for measurement of spatial, chemical and optical variables
- Implement the signal conditioning circuit and communication protocol for smart sensors
- Design and fabrication of Micro sensors and actuators for industrial applications
- Analyze the recent trends in the sensor technologies (RF-IDs - Sensor arrays - Sensor networks)

Unit I	INTRODUCTION TO MEASUREMENT SYSTEMS	10

General concepts and terminology, Measurement systems, Sensor classification, Static characteristics ofmeasurement systems-accuracy, Linearity, Resolution, Precision and sensitivity etc., Estimation of errors,Dynamic characteristics of measurement systems, Zero order first-order and second-order measurementsystems and response.

Unit II	SENSORS FOR SPATIAL VARIABLES, OPTICAL VARIABLES, CHEMICAL VARIABLES	10

Spatial variable measurement: Laser Interferometer Displacement sensor-synchro /Resolver displacementtransducer. Optical variables measurement - Chemical variables measurement - Thermal compositionmeasurement - Environmental measurement: Meteorological measurement - Air pollution measurement -Water quality measurement - Satellite imaging and sensing.

Unit III	SMART SENSORS	9

Primary and Secondary sensors - Amplification - Filters - Converters - Compensation – Informationcoding / processing - Data communication, standards for smart sensor interface - Smart transmitter withHART communicator - Smart sensor for flow and temperature measurement.

Unit IV	MICRO SENSORS AND ACTUATORS	8

Micro system design and fabrication - Micro pressure sensors (piezo resistive and capacitive) Resonantsensors - Acoustic wave sensors - Bio micro sensors - Micro actuators - Micro mechanical motors andpumps.

Unit V	RECENT TRENDS IN SENSOR TECHNOLOGIES	8

Film sensors : Thick film and thin film - Integrated image sensors - Bio sensors - Integrated micro arrays -RF - IDs - Sensor arrays - Sensor network - Multisensor data fusion - Soft sensor.

TEXT BOOK(S):

1. Ernest O Doebelin and Dhanesh N Manik, Measurement Systems Application and Design, 5thEdition, Tata Mc-Graw Hill, 2012

REFERENCE(S):

1. John G Webster, Measurement, Instrumentation and Sensors Handbook, CRC press IEEE press, 2010
2. Ifan G. Hughes and Thomas P.A. Hase, Measurements and their Uncertainties: A Practical Guide to Modern Error Analysis, Oxford University Press, 2010
3. Gerord C.M. Meijer, Smart Sensor Systems, John Wiley and Sons, 2013
4. Tai-Ran Hsu, MEMS and Micro Systems: Design and Manufacture, Tata McGraw Hill, 2012

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Sem VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX06	THERMAL POWER PLANT INSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Make the students familiarize about various power generation methods.
- Identify various parameters in thermal power plant
- Learn about the furnace control
- Impart knowledge about the different types of controls and control loops.
- Familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.

Course Outcomes: At the end of this course, learners will be able to:

- Understanding various power generation process.
- Identify important parameter to be monitoredin thermal power plant.
- Explain about the furnace control
- Explain about the different types of controls and control loops.
- Gain knowledge about various building blocks and instruments involved in thermal power plant and its controlling process

Unit I	POWER GENERATION METHODS	9

Brief survey of methods of power generation: hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants: building blocks, details of boiler processes P&I diagram of boiler – cogeneration.

Unit II	MEASUREMENTS IN POWER PLANTS	9

Electrical measurements: current, voltage, power, frequency, power factor – non electrical parameters: flow of feed water, fuel, air, steam pressure and steam temperature – smoke density measurement – Flue gas oxygen analyzer – pollution monitoring instruments.

Unit III	FURNACE CONTROL	9

Coal handling: Pulverizers - Furnace Draught: natural draught, forced draught, induced draught, power requirements for draught systems - Combustion control: Fuel/Air ratio, combustion efficiency, excess air, parallel and cross limited combustion control- soot-blowing operation.

Unit IV	BOILER CONTROL	9

Boiler metal temperature measurement, pressure measuring devices – Boiler feed water processing and control - drum level measurement methods - steam temperature control: main steam and reheat steam temperature control, superheater control, deaerator control – distributed control system in power plants – interlocks in boiler operation.

Unit V	TURBINE CONTROL	9

Speed measurement, rotor and casing movement- vibration - shell temperature monitoring and control - steam pressure control - lubricant oil temperature - cooling system

TEXT BOOK(S):

1. Sam G. Dukelow, The control of Boilers, instrument Society of America, 1991
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971

REFERENCE(S):

1. Krishnaswamy KM, Bala P, Bala MP, "Power Plant Instrumentation," Prentice Hall, 2013
2. Elonka.S.M.andKohal A.L., Standard Boiler Operations, McGraw-Hill, New Delhi, 1994
3. Jain R.K., Mechanical and industrial Measurements, Khanna Publishers, New Delhi, 2008

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Sem VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX07	INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the students the method of oil recovery and the steps involved in oil gas production process.
- Make the students understand the process behavior of some of the important unit operations in petrochemical industry through mathematical model.
- Familiarize the students to apply knowledge to select the appropriate control strategy for the selective process.
- Provide information about the most important derivatives obtained from petroleum products.
- Help the students in understanding selection and maintenance of instruments in petrochemical industry.

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge on oil gas production process and important unit operations in a refinery
- Having gained the process knowledge, ability to develop and analyze mathematical model of selective processes.
- Able to develop, analyze and select appropriate control strategy for selective unit operations in a refinery.
- Gain knowledge on the most important chemical derivatives obtained from petroleum products.
- Understand safety instrumentation followed in process industries.

Unit I	OIL EXTRACTION AND OIL GAS PRODUCTION	9

Techniques used for oil discovery – Oil recovery methods – oil rig system - Overview of oil gas production – oil gas separation – Gas treatment and compression – Control and safety systems

Unit II	IMPORTANT UNIT OPERATIONS IN REFINERY	9

Distillation Column – Thermal cracking – Catalytic Cracking – Catalytic reforming – mathematical Modeling and selection of appropriate control strategy – Alkylation – Isomerization.

Unit III	DERIVATIVES FROM PETROLEUM	9

Derivatives from methane – Methanol Production – Acetylene production - Derivatives from acetylene —Derivatives from ethylene – Derivatives from propylene.

Unit IV	IMPORTANT PETROLEUM PRODUCTS & MEASUREMENTS	9

BTX from Reformate – Styrene – Ethylene oxide/Ethylene glycol – polyethylene – Polypropylene – PVC production. Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments.

Unit V	SAFETY IN INSTRUMENTATION SYSTEMS	9

Hazardous zone classification – Electrical and Intrinsic safety – Explosion suppression and Deluge systems – Flame, fire and smoke detectors – leak detectors – Guidelines and standards – General SIS Design Configurations – Hazard and Risk Assessment – Failure modes – Operation and Maintenance.

TEXT BOOK(S):

1. Waddams, A.L., "Chemicals from Petroleum", Wiley, 1973. (digitized in 2007)
2. Balchen, J.G., and Mumme K.I., "Process Control Structures and Applications", Von NostrandReinhold Company, New York, 1988

REFERENCE(S):

1. Liptak, B.G., "Instrumentation in Process Industries", Chilton Book Company, 2005. (Digitized in 2008.)
2. Austin, G.T. and Shreeves, A.G.T., "Chemical Process industries", McGraw-Hill, 2012
3. HavardDevold, "Oil and Gas Production Handbook", ABB, 2006
4. Paul Gruhn and Harry Cheddie, "Safety Instrumented Systems: Design, Analysis, and Justification", 2nd Edition, ISA Press, 2006

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX08	INSTRUMENTATION AND CONTROL IN IRON AND STEEL INDUSTRIES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Know the parts of instrumentation and their working in steel industry
- Learn about the basic properties of steel and its measurement
- Know the consistency measurement and control in steel industry
- Learn the concepts of manufacturing steel in industry
- Infer the different control technique involved in steel manufacturing process

Course Outcomes: At the end of this course, learners will be able to:

- Recall the parts of instrumentation and their working in steel industry
- Analyze the basic properties of steel and its measurement
- Analyze the consistency measurement and control in steel industry
- Examine the concepts of manufacturing steel in industry
- Implement the different control technique involved in steel manufacturing process

Unit I	INTRODUCTION TO FURNACES	9

Process description in diagrammatic and functional block details - raw materials preparation - operation of blast furnace (BF) and auxiliary units, including stoves - Basic oxygen Furnace (BoF) - Electric Furnace (EF) - Open Hearth Furnace (OHF) - relative merits of various steel making furnaces.

Unit II	CASTING AND ROLLING	9

Quality of steel - impurities present and allowed limits for usable steel - waste recycling. Continuous casting and batch casting of steel - primary and secondary rolling - features of cold rolling - steel finishing operations.

Unit III	MEASUREMENTS IN IRON AND STEEL INDUSTRIES	9

Identification of various process parameters in the industry - selection of suitable measurement hardware for temperature, pressure, level, flow, weighing and proportioning - special gauges for measurement of thickness and shape - Control room layout for mill operations - graphic displays - alarm management

Unit IV	CONTROL APPLICATION	9

Special applications for controls - Blast Furnace (BF) Stove combustion control system - gas and water control system in Basic Oxygen Furnace (BoF) - Mould Level control system in Strand Casting operations.

Unit V	COMPUTER APPLICATIONS	9

Evalution of computer applications in the industry - Review of data logging, SCADA, DDC and DCS. Practices for model calculating and data logging - steel rolling mill control - annealing process control utilities management with computer system

TEXT BOOK(S):

1. Liptak, Bela G, Instrumentation in the Processing Industries, Chilton Publishers, 1973

REFERENCE(S):

2. Considine D. M., Process/Industrial Instruments and control Handbook, McGraw Hill, 5th edition 1999
3. SeropeKalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education, 2013
4. Robert H. Perry, D.W. Green and J.O. Maloney, Perry's Chemical Engineers, Handbook, McGraw Hill Inc, New York, 7th ed, 1998

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX09	INSTRUMENTATION AND CONTROL IN PAPER INDUSTRIES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the various unit operations in the paper industry
- Find the alternative sensors and transducers for various measurements
- Evolve the appropriate controls and schematics for specific applications
- Know the world-class paper mills employing IT-enabled applications
- Infer the different control technique in paper industry

Course Outcomes: At the end of this course, learners will be able to:

- Recall the parts of instrumentation and their working in paper industry
- Analyze the basic paper properties and its measurement
- Analyze the consistency measurement and control in paper industry
- Examine the concepts of making paper in industry
- Implement the different control technique in paper industry

Unit I	AN OVERVIEW OF PAPER MAKING PROCESS	9

Paper making process-Raw materials -Pulp separation-screening-Bleaching-Cooking-Chemical reactionchippers-types of digesters-H factor and Kappa factors-Stock preparation-Instrumentation needs Energy conservation and paper quality control

Unit II	PAPER PROPERTIES AND ITS MEASUREMENT	9

Physical, electrical, optical and chemical properties of paper-Basic weight, thickness, density, porosity, smoothness, softness, hardness and compressibility-stress -strain relationship-Tensile strength, bursting strength, tearing resistance, folding endurance, stiffness and impact strength -Dielectric constant, dielectric strength, dielectric loss and Properties of electrical insulating paper - Brightness, colour, gloss and capacity Starch constant acidity and pH-Measurement techniques.

Unit III	CONSISTENCY MEASUREMENT	9

Definition of consistency-Techniques for head box consistency measurement - Stock consistency measurement and control

Unit IV	PAPER MAKING MACHINE	9

Functioning of Paper making machine-Quality parameters-moisture, basic weight, caliper, brightness, colour, ash content, strength, gloss and tensile strength - Parameters monitoring Instrumentation.

Unit V	CONTROL ASPECTS	9

Machine and cross direction control technique -consistency, moisture -and basic weight control -dryer control-computer based control systems Mill wide control

TEXT BOOK(S):

1. Sankaranarayanan, P.E., Pulp and Paper Industries -Technology and Instrumentation Kotharis Desk book series, 1995

REFERENCE(S):

2. Handbook of Pulp and Paper technology, Britt K.W.VanNostrandReinbold Company, 1970
3. James P.Casey , Pulp and Paper chemistry and chemical Technology, John Wiley and sons, 1981
4. Austin G.T., Shrencs Chemical Process Industries, McGraw Hill International Student Edition, Singapore, 1985
5. B. Yagnanarayanan, Artificial Neural Networks, Prentice Hall of India Ltd .,New Delhi.2012
6. G.J. Klir and T.A. Folger, Fuzzy Sets, Uncertainty and Information, Prentice-Hall of India Ltd., New Delhi, 2009

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX10	INSTRUMENTATION IN AGRICULTURE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Get adequate knowledge the necessity of instrumentation and sensor requirements in agriculture
- Infer the soil parameters and infer the soil sensor required for the field
- Learn about the flow diagrams and instrumentation for various food process industries
- Have a knowledge about systems/instruments for agriculture using SCADA.
- Know about the appropriate electronic control circuits required for automotives used in agriculture

Course Outcomes: At the end of this course, learners will be able to:

- Interpret the necessity of instrumentation and sensor requirements in agriculture
- Analyze the soil parameters and infer the soil sensor required for the field
- Implement flow diagrams and instrumentation for various food process industries
- Analyze and design systems/instruments for agriculture using SCADA.
- Implement the appropriate electronic control circuits required for automotives used in agriculture

Unit I	AGRICULTURE FOR ENGINEERS	9

Introduction: Necessity of instrumentation and control for food processing - agriculture sensorrequirements - remote sensing, bio sensors in Agriculture - standards for food quality

Unit II	SOIL SCIENCE AND SENSORS	9

Measurement of PH, conductivity, resistivity, temperature and soil - Moisture and salinity – Ironconcentration - Measurements methods of soil analysis - Instrumentation for environmental conditioningof seed germination and growth

Unit III	PROCESSES AND INSTRUMENTATION	9

Flow diagram of sugar plant and instrumentation set-up - Flow diagram of fermented and control (Batchprocess) - Oil extraction plant and instrumentation set-up- Pesticides manufacturing process and control -Flow diagram of Diary industry and instrumentation set-up - Juice extraction control set-up

Unit IV	SCADA FOR AGRICULTURE	9

Application of SCADA for agriculture process parameters and control - Water distribution andmanagement control - Auto-Drip irrigation systems - Irrigation Canal management - upstream anddownstream control concepts and supervisory control

Unit V	AGRICULTURE AUTOMATION	9

Automation in Earth Moving Equipment and farm implements - pneumatic, hydraulic and electroniccontrol circuits in harvesters, cotton pickers, tractors

TEXT BOOK(S):

1. Perry G CIGR Handbook of Agricultural Engineering: Information technology, American Society of Agricultural Engineers, 2006 Digitized 12 Apr 2011
2. Johnson C. D.Process Control Instrumentation Technology 7th Edition, Pearson Education, New Delhi, 2013

REFERENCE(S):

1. Jonathan Love Process Automation Handbook: A Guide to Theory and Practice, springer, 2007
2. Liptak B. G.Instrument Engineers Handbook, Process Measurement Volume I and Process Control Volume II, 2005
3. D.Patranabis Industrial Instrumentation Tata McGraw Hill publications, New Delhi, 2010
4. NadimMaluf, An introduction to Micro electro mechanical system design, Artech House, 2004

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX11	EMBEDDED SYSTEM	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Building Blocks of Embedded System
- Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

Course Outcomes: At the end of this course, learners will be able to:

- Understand and analyze embedded systems.
- Suggest an embedded system for a given application.
- Operate various Embedded Development Strategies
- Study about the bus Communication in processors.
- Acquire knowledge on various processor-scheduling algorithms.

Unit I	INTRODUCTION TO EMBEDDED SYSTEMS	9

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

Unit II	EMBEDDED NETWORKING	9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

Unit III	EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT	9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

Unit IV	RTOS BASED EMBEDDED SYSTEM DESIGN	9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

Unit V	EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT	9

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera.

TEXT BOOK(S):

1. Peckol, "Embedded system Design", John Wiley & Sons,2010
2. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013
3. Shibu. K.V, "Introduction to Embedded Systems", 2e, Mc graw Hill, 2017

REFERENCE(S):

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013
2. C.R.Sarma, "Embedded Systems Engineering", University Press (India) Pvt. Ltd, 2013
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning, 2009
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX12	SYSTEM IDENTIFICATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the mathematical modeling of systems.
- Observe systems by their behavior using Parametric Identification methods using online and offline Data's
- Observe systems by their behavior using Nonparametric Identification Methods using Online and Offline Data's
- Estimate and validate the data's using parametric and recursive estimation methods
- Perform case studies on electromechanical and process control systems

Course Outcomes: At the end of this course, learners will be able to:

- Familiar with different model structures, parameterization, identifiability, structure determination and order estimation
- Perform parameter estimation using different identification techniques
- Identify plants online using recursive estimation methods
- Set up an experiment, identify a nominal model, assess the accuracy and precision of this model,
- Design choices to arrive at a validated model.

Unit I	NONPARAMETRIC IDENTIFICATION	9

Transient and frequency analysis methods, impulse and step response methods, correlation method, spectral analysis.

Unit II	PARAMETRIC INDENTIFICATION	9

Steps in identification process, determining model structure and dimension, Linear and nonlinear model structures (ARX, ARMAX, Box-Jenkins, FIR, Output Error models), Input signals: commonly used signals, spectral properties, and persistent excitation, Residual analysis for determining adequacy of the estimated models.

Unit III	PARAMETRIC ESTIMATION	9

Linear regression, least square estimation, statistical analysis of LS methods, Minimizing prediction error-identifiability, bias, Least squares, relation between minimizing the prediction error and the MLE, MAP, Convergence and consistency, asymptotic distribution of parameter estimates, Instrumental Variable Method.

Unit IV	RECURSIVE ESTIMATION	9

Forgetting Factor method, Kalman Filter interpretation Identification in practice: Aliasing due to sampling, closed loop data, model order estimation, robustness considerations, model validation.

Unit V	CASE STUDIES	9

Electro Mechanical Systems, Process Control Systems using Matlab/Equivalent System Identification Toolbox

TEXT BOOK(S):

1. Jung, L. System Identification: Theory for the User, 2nd Edition, Prentice-Hall, 1999
2. TorstenSoderstrom, PetreStoica, System Identification, Prentice Hall International (UK) Ltd. 1989

REFERENCE(S):

1. Karel J. Keesman, System Identification, An introduction, Springer, 2011
2. Zhu, Y. Multivariable System Identification for Process Control, Pergamon, 2001
3. Landan ID, "System Identification and Control Design," Prentice Hall
4. ArunK.Tangirala,Principles of System Identification: Theory and Practice,CRC Press,2014

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX13	ADAPTIVE CONTROL	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the definition of adaptive control and methods of adaptation.
- Study the parameter identification of systems.
- Study the self-tuning of PID controllers based on parameter identification.
- Study the model reference adaptive control.
- Study the practical application through case studies.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the effect of parameter variation and principle of adaptive control schemes.
- Distinguish different parametric identification methods.
- Understand Deterministic and Stochastic Self Tuning Regulators.
- Design of model reference adaptive controller
- Design gain scheduling controller and apply adaptive control schemes for industrial processes.

Unit I	INTRODUCTION	9

Introduction to adaptive control – Effects of process variations –Adaptive control schemes – Adaptive control problem – Non-parametric identification – Step response method – Impulse response method – Frequency response method.

Unit II	PARAMETRIC IDENTIFICATION	9

Linear in parameter models - ARX – ARMAX – ARIMAX – Least square estimation – Recursive least square estimation – Extended least square estimation – Maximum likelihood estimation – Introduction to non-linear systems identification - Pseudo random binary sequence.

Unit III	SELF-TUNING REGULATOR	9

Deterministic in-direct self-tuning regulators – Deterministic direct self-tuning regulators -Introduction to stochastic self-tuning regulators – Stochastic indirect self-tuning regulator.

Unit IV	MODEL REFERENCE ADAPTIVE CONTROLLER	9

The MIT rule – Lyapunov theory – Design of model reference adaptive controller using MIT rule and Lyapunov theory – Relation between model reference adaptive controller and self-tuning regulator.

Unit V	TUNING OF CONTROLLERS AND CASE STUDIES	9

Design of gain scheduling controller - Auto-tuning of PID regulator – Stability analysis of adaptive controllers – Application of adaptive control in chemical reactor, distillation column and variable area tank system.

TEXT BOOK(S):

1. Karl J. Astrom& Bjorn Wittenmark, 'Adaptive Control', Pearson Education (Singapore), Second Edition, 2003
2. Shankar Sastry and Marc Bodson, 'Adaptive Control: Stability, Convergence, and Robustness', Prentice-Hall, 1994
3. D. Landau, R. Lozano, and M. M'Saad, 'Adaptive Control', NY: Springer-Verlag, 1998

REFERENCE(S):

1. Chalam, 'Adaptive Control Systems: Techniques and Applications', CRC Press, 1987
2. Landau, I.D., Lozano, R., M'Saad, M., Karimi, A, 'Adaptive Control Algorithms, Analysis and Applications', 2nd edition, Springer, 2011
3. T.C.H.A. Hsia, 'System Identification', Lexington books, 1974
4. Stephanopoulis G. 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990
5. Miroslav Krstic, IoannisKanellakopoulos, Petar V. Kokotovic, 'Nonlinear and Adaptive Control Design', 1st Edition, Wiley, 1995
6. Gang Tao, 'Adaptive Control Design and Analysis', Wiley-IEEE Press, 2003
7. Kumpati S. Narendra, Anuradha M. Annaswamy, 'Stable Adaptive Control Systems', Prentice Hall, 1989

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX14	OPTIMAL CONTROL	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the optimal control concepts and its importance
- Study the important optimal control methods existing in the industries in order obtain the required level of control
- Introduce the concept of optimal control in various system
- Help the learners in the design and the implementation of the concept of optimal control
- Study, analyze and implement discrete-Time optimal control system

Course Outcomes: At the end of this course, learners will be able to:

- Problem formulation, forms of optimal control and its necessary conditions.
- Solving the algebraic equations to design the controller and to study about various problems
- Designing optimal controllers using a class of procedures
- Predict the system dynamic behavior through solution of ODEs and formation of optimal control problem
- Solve equations to design the controllers in discrete methods representing spatial and temporal variations in physical systems through numerical methods.

Unit I	INTRODUCTION	9

Introduction to Optimal control – Comparison between the Conventional control and optimal control procedures - Statement of optimal control problem – Problem formulation and forms of optimal Control – Selection of performance measures. Necessary conditions for optimal control.

Unit II	MATHEMATICAL EVALUATION	9

Introduction and Performance Index - Basic Concept of calculus of variation- The basic variational problem - Fixed end point problem - Free end point problem - Variational Approach to Optimal Control Systems.

Unit III	CONTROL STRATEGY	9

Introduction - Time varying optimal control – LQR steady state optimal control – Frequency Domain Interpretation of LQR (LTI system) - Solution of Ricatti'sequation – Application examples.

Unit IV	PROBLEM FORMATION	9

Optimal Control: Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization. Pontryagin's Minimum/Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation and its solution.

Unit V	ADVANCED SYSTEMS	9

Discrete-Time Optimal Control Systems -Matrix Discrete Riccati Equation- Analytical Solution of Matrix Difference Riccati Equation - Optimal Control Using Dynamic Programming - The Hamilton-Jacobi-Bellman (HJB) Equation - LQR System HJB Equation-Time Optimal Control System.

TEXT BOOK(S):

1. Kirk, D.E., Optimal Control Theory, Dover Publications, 2004
2. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009
3. Astrom, K.J. Intro. Stochastic Control Theory, Dover Publications, 2006

REFERENCE(S):

1. Gopal M, "Digital Control and State Variable Methods," Tata McGraw-Hill
2. F.L.Lewis,OptimalControl,JohnWiley&Sons,Inc.,NewYork,NY,1986
3. M.Gopal,ModernControlSystemTheory,NewAgeInternational
4. Sage A.P. & White C.C., Optimum Systems Control, Prentice Hall

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX15	OPTIMAL STATE ESTIMATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Impart Knowledge and Skills
- Design and implement a Discrete Kalman Filter
- Design and implement Extended Kalman Filter, Iterated Extended Kalman Filter, and SecondorderExtended Kalman filter
- Design and implement Derivative Free Kalman filter such as Unscented Kalman filter and its variants and Ensemble Kalman Filter
- Design and implement Particle Filter, Unscented Particle Filter

Course Outcomes: At the end of this course, learners will be able to:

- Identify Kalman Filter for Linear systems
- interpret variants of Derivative Based Kalman Filters such as Extended Kalman filter, IteratedExtended Kalman filter, Second order Extended Kalman Filter for non-linear systems
- Design and Implement variants of Derivative free Kalman Filters such as Unscented Kalmanfilter, Spherical and Simplex transformations based Unscented Kalman filter
- Apply variants of H-infinity filters.
- Select various types of Particle filters for non-linear and non-Gaussian systems.

Unit I	INTRODUCTION TO STATE ESTIMATION AND KALMAN FILTER	9

Review of Matrix Algebra and Matrix Calculus and Probability Theory - Least Square Estimation -Review of state observers for Deterministic System- Derivation of the Discrete-time Kalman filter -Kalman filter properties.

Unit II	EXTENDED KALMAN FILTER	10

Linearized Kalman filter - Extended Kalman filter - The iterated Extended Kalman filter - The Secondorder Extended Kalman filter - Constrained Extended Kalman filter- Simultaneous State andParameter Estimation using EKF.

Unit III	UNSCENTED KALMAN FILTER	9

Means and Covariance of non-linear transformations - Unscented transformation - Unscented Kalmanfiltering - General Unscented transformation - The simplex unscented transformation- SphericalUnscented transformation - Simultaneous State and Parameter Estimation using UKF ConstrainedUnscented Kalman filter.

Unit IV	THE H-INFINITY FILTER	9

The H- infinity filter - Introduction - Kalman filter Limitations - A game theory Approach to H- infinityfiltering - Steady state H- infinity Filtering: Mixed Kalman - Robust Kalman– ConstrainedH- infinity filtering.

Unit V	ENSEMBLE KALMAN FILTER AND PARTICLE FILTER	8

Bayesian state Estimation - Ensemble Kalman filter-Introduction to Particle filtering - SIS -Implementation issues: - Sample Impoverishment - SIR - Particle filter with EKF as proposal -Unscented Particle filter

TEXT BOOK(S):

1. Bruce P. Gibbs, "Advanced Kalman Filtering, Least-Squares and Modeling: A Practical Handbook", Wiley, 2011

REFERENCE(S):

1. Adrian Pizzinga, "Restricted Kalman Filtering Thoery, Methods and Application", Springer, 2012
2. Xiao-Heng Chang, "Takagi - Sugeno Fuzzy systems Non fragile H infinity filtering", Springer,2012

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX16	INTRODUCTION TO PROCESS DATA ANALYTICS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn about the experimental design
- Know about the linear regressionanalysis
- Gain knowledge about the linear model selection andregularization
- Learn about the different types of Classification
- Know about the process identification, performance monitoring and soft sensordesign.

Course Outcomes: At the end of this course, learners will be able to:

- Ability to understand the statistical terms related to dataanalytics.
- Ability to select the right regression method for a givenapplication.
- Abilitytoanalyzeandcomparetheperformanceofvariousmodelselection and regularizationmethods.
- Ability to suggest and develop right classifier for a givenapplication.
- Abilitytorecommendappropriatedataanalysistoolforsoftsensordevelopment and controller performancemonitoring.

Unit I	INTRODUCTION	9

Introduction to Process data analytics and Statistical learning - Review of Linear Algebra Concepts – Review of Probability & Statistics - Design of experiments - Industrial case studies on factorial experiments. 9

Unit II	REGRESSION	9

Linear Regression:- Simple Linear Regression, Multiple Linear Regression-K-nearest neighbors regression – Practical Consideration in the Regression Model - Validation methods to assess model quality:-The validation set approach, Leave-One-Out Cross Validation, k-Fold Cross Validation – Bias-variance Trade-off for k-Fold Cross Validation

Unit III	LINEAR MODEL SELECTION&REGULARIZATION	9

Subset Selection: - Best Subset Selection, Step-wise Selection and Choosing the Optimal Model – Shrinkage Methods: - LASSO, Ridge regression, Elastic nets – Dimension reduction Methods:- Principal Components Regression, Partial Least Squares.

Unit IV	SUPERVISED LEARNING WITH REGRESSION AND CLASSIFICATION TECHNIQUES	9

Logistic regression– Linear Discriminant Analysis - Quadratic Discriminant Analysis – Regression & Classification Trees – Support Vector Machines - Random forests, Bagging and boosting - Neural Networks – Deep Learning

Unit V	APPLICATIONS	9

Process data analysis for system identification (under open and closed loops) - Controller Performance Monitoring - Principal components analysis (PCA) for Process Monitoring and Partial Least Squares (PLS) for soft-sensor design - Data-based causality analysis for identification of process topology.

TEXT BOOK(S):

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer Texts in Statistics,2013.
2. EthemAlpaydin, Introduction to Machine Learning, MIT Press,2013
3. Thomas A. Runkler, Data Analytics: Models and Algorithms for Intelligent Data Analysis, Springer Vieweg, 2nd Edition,2016.

REFERENCE(S):

1. Arun K. Tangirala, Principles of System Identification – Theory and Practice, CRC Press,2015.
2. Huang, B. and Shah, S.L., Performance Assessment of Control Loops: Theory and Applications, Springer-Verlag,1999.
3. Fan Yang, Ping Duan, Sirish LShah,TongwenChen,Capturing Connectivity and Causality in Complex Industrial Processes, Springer,2014.

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX17	VIRTUAL INSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Provide an overview of Virtual instruments
- Bring out the overview of the software
- Know about the programming structure of the software
- Learn the procedure to install DAQ in various OS and its interfacing methods
- Know about the IMAQ Motion control and machine vision concepts for industrial application

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basics of Virtual or graphical instrumentation concepts
- Summarize the overview of G programming, labels, data types and debug the G programming
- Select the appropriate structuring concept to be used in graphical programming
- Formulate the procedure to install DAQ in various OS and its interfacing methods
- Implement the IMAQ Motion control and machine vision concepts for industrial application

Unit I	INTRODUCTION	9

General functional description of digital instrument - Block diagram of a Virtual Instrument - Advantages of Virtual Instruments over conventional instruments - Architecture of a Virtual Instrument and a its relation to the operating system. Advantages of Virtual Instruments over conventional instruments

Unit II	SOFTWARE OVERVIEW	9

VI - Graphical user interfaces - Controls and indicators - 'G' programming - Labels and Text - Shape, size and color - Owned and free labels -Data type, Format, Precision and representation - Data types - Data flow programming -Editing - Debugging and Running a Virtual Instrument - Graphical programming palettes and tools - Front panel objects - Data types

Unit III	PROGRAMMING STRUCTURE	9

FOR Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures - Arrays and Clusters Array Operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's - Attribute modes Local and Global variables. Bundle/Unbundle by name.

Unit IV	OPERATING SYSTEM AND HARDWARE ASPECTS	9

Current trends Operating system requirements - Data Acquisition Card(DAQ) : DAQ hardware, Grounding methods, Resolution, Analog I/O, Digital I/O - DAQ Software Architecture - Configuring the DAQ hardware/software for temperature measurement.

Unit V	APPLICATIONS	9

IMAQ Motion Control: components of a motion control system, configuration, prototyping and development - Interfacing Servomotor and Stepper motor in LabVIEW. Machine Vision: Edge Detection, Dimensional Measurements, Color Inspection, Optical Character Recognition

FORFURTHER READING

PCI bus : Architecture, function, configuring PCI bus in LabVIEW - GPIB : Architecture, function, configuring GPIB in LabVIEW - VISA communication

TEXT BOOK(S):

1. Garry M Johnson, Labview Graphical Programming, Tata McGraw Hill book Co, New Delhi, 2012
2. Jeffrey Travis and Jim Kring, LabVIEW for Everyone: Graphical Programming made Easy and Fun, Tata McGraw Hill book Co, New Delhi, 2011
3. LabVIEW: Basics I & II Manual, National Instruments, Bangalore, 2011

REFERENCE(S):

1. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2009
2. Donald J. Sterling, Technicians Guide to Fiber Optics, Delmar publisher, 2009.
3. M. Arumugam, Optical Fiber Communication and Sensors, Anuradha Agencies, 2010.

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX18	ADVANCED PROCESS CONTROL	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Teach students to build and analyze models for time-varying systems and non-linear systems.
- Develop the skills needed to design adaptive controllers such as gain-scheduled adaptive controller, Model-reference adaptive controller and Self-tuning controller for various applications
- Make the students learn to formulate optimal control schemes
- Provide basic knowledge about Fractional-order systems and Fractional-order- controller and to lay the foundation for the systematic approach to Design controller for fractional order systems
- Introduce FDI Techniques, such as Principal component Analysis, state observer to detect and diagnose faults in sensors and actuators.

Course Outcomes: At the end of this course, learners will be able to:

- Apply knowledge of mathematics, science, and engineering to build and analyze models for time-varying systems and non-linear systems.
- Design and implement adaptive controllers such as gain-scheduled adaptive controller, Model-reference adaptive controller and Self-tuning controller
- Identify, formulate, and solve optimal controller
- Analyze Fractional-order systems, Fractional-order- controller and Design controller for fractional order systems
- Design and implement H2 and H-infinity Controllers and to use the FDI Techniques, such as Principal component Analysis, state observer to detect and diagnose faults in sensors and actuators.

Unit I	CONTROL OF TIME-VARYING AND NONLINEAR SYSTEMS	6+6

Models for Time-varying and Nonlinear systems – Input signal design for Identification –Realtime parameter estimation – Model Validation - Types of Adaptive Control - Gain scheduling - Adaptive Control - Deterministic Self-tuning Controller and Model Reference Adaptive Controller – Control of Hammerstein and Wiener Systems.

Unit II	OPTIMAL CONTROL & FILTERING	6+6

Introduction – Performance Measure for optimal control problem – Dynamic Programming – Computational Procedure for solving Control Problem – LQR – Introduction to Optimal Filtering – Discrete Kalman Filter – Linear Quadratic Gaussian (LQG)

Unit III	FRACTIONAL ORDER SYSTEM & CONTROLLER	6+6

Fractional-order Calculus and Its Computations – Frequency and Time Domain Analysis of Fractional-Order Linear Systems - Filter Approximations to Fractional-Order Differentiations – Model reduction Techniques for Fractional Order Systems –Controller Design Studies for Fractional Order.

Unit IV	H-INFINITY CONTROLLER	6+6

Introduction – Norms for Signals – Robust Stability – Robust Performance – Small Gain Theorem – Optimal H2 Controller Design - H-Infinity Controller Design — Effects of Weighting Functions in H-Infinity Control.

Unit V	FAULT DIAGNOSIS AND FAULT-TOLERANT CONTROL	6+6

Process Monitoring - Introduction – Statistical Process Control – Fault Detection with Principal Component Analysis – Fault Detection with State Observers – Fault Detection with signal models - Fault Detection of Control Loops- Sensor and Actuator Fault-Tolerant Control Design.

TEXT BOOK(S):

1. Karl J. Astrom& Bjorn Wittenmark, 'Adaptive Control', Pearson Education (Singapore), Second Edition, 2003
2. Shankar Sastry and Marc Bodson, 'Adaptive Control: Stability, Convergence, and Robustness', Prentice-Hall, 1994
3. D. Landau, R. Lozano, and M. M'Saad, 'Adaptive Control', NY: Springer-Verlag, 1998

REFERENCE(S):

1. K.J. Astrom and B.J.Wittenmark, "Adaptive Control", Pearson Education, Second Edition, 2008
2. Donald E.Kirk, "Optimal Control Theory – An Introduction", Dover Publications, Inc. Mineola, New York,2012
3. D.Xue, Y.Q.Chen, D.P.Atherton, "Linear Feedback Control Analysis and Design with MATLAB, Advances InDesign and Control", Society for Industrial and Applied Mathematics, 2008
4. R. Isermann, "Fault-Diagnosis Systems: An Introduction from Fault Detection to Fault Tolerance", Springer,2006

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX19	FIBRE OPTICS AND LASERINSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Expose the students to the basic concepts of optical fibres and their properties.
- Provide adequate knowledge about the Industrial applications of optical fibres.
- Expose the students to the Laser fundamentals.
- Provide adequate knowledge about Industrial application of lasers.
- Provide adequate knowledge about holography and Medical applications of Laser

Course Outcomes: At the end of this course, learners will be able to:

- Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers
- Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.
- Understand laser theory and laser generation system.
- Explain about Industrial application of lasers.
- Apply laser theory for the selection of lasers for a specific Industrial and medical application.

Unit I	OPTICAL FIBRES AND THEIR PROPERTIES	9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa), Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode (LED), – Optical detectors: PIN Diode.

Unit II	INDUSTRIAL APPLICATION OF OPTICAL FIBRES	9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacement sensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

Unit III	LASER FUNDAMENTALS	9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

Unit IV	INDUSTRIAL APPLICATION OF LASERS	9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

Unit V	HOLOGRAM AND MEDICAL APPLICATIONS	9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

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Dept. of EIE - ESEC

TEXT BOOK(S):

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCE(S):

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968
5. John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002
6. Keiser, G., "Optical Fiber Communication", McGraw-Hill, 3rd Edition, 2000

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	Semester VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIX20	INSTRUMENTATION IN FOODPROCESSING INDUSTRIES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Provide exposure to various techniques and methods that occurs in the various regions of foodanalysis
- Get an adequate knowledge about various techniques for analysis of food substances
- Learn about different controllers and indicators used in food industry
- Know chromatography and mass spectrometry to the analysis of food products
- Understand the concepts of electrodes and biosensors that has potential applications in foodand beverage industries

Course Outcomes: At the end of this course, learners will be able to:

- Exemplify the Role of moisture content in food and also about the measurement of Turbidity andHumidity
- Classify enzyme sensors, biosensors, Electronics Nose used in food manufacturing industries
- Summarize the concepts of automatic controllers and Indicators used in food industry
- Implement chromatography and mass spectrometry to the analysis of food products
- Execute other Analytical Equipment like Scanning electron microscopy, Tandem ElectronMicroscopy

Unit I	MOISTURE, TURBIDITY AND HUMIDITY MEASUREMENTS	9

Role of moisture content in food - wet and dry method - IR technique. Humidity - Definitions - role infood processing - classical types - wet and dry bulb hygrometer - Electronic methods. Turbidity andcolour: Definition and role, standards and units, basic turbidity meter, light scattering and absorbtion type.

UNIT II	FOOD ENZYMES AND FLAVOUR	9

Food enzymes and flavour: Human olfaction - Importance of enzyme sensors - biosensors -sensing arrays- Electronics Nose.

UNIT III	CONTROLLERS AND INDICATORS	9

Basic control concept - Temperature controller in dryer - ration control in food pickling –atmosphericcontroller in food preservation

UNIT IV	CHROMATOGRAPHY AND MASS SPECTROMETRY IN FOOD INDUSTRY	9

Basics of gas and liquid chromatography - GC and HPLC Application in food analysis - MS applicationin food analysis

UNIT V	OTHER ANALYTICAL EQUIPMENTS	9

Fourier transform Infra red spectroscopy, Scanning electron microscopy, Tandem Electron Microscopy. X-ray fluorescence - Differential Scanning Calorimenter

TEXT BOOK(S):

1. Nielsen, S.S,-Introduction to the chemical analysis of foods- Jones and Bartlett Publishers, Boston, London 2004
2. Mahindru,S.N, -Food additives. Characteristics, detection and estimation-. Tata Mc Graw-Hill Publishing Company Limited, New Delhi 2000

REFERENCE(S):

1. B.G.Liptak, ed -Instrument Engineers Handbook: Process Measurement and Analysis-, Butterworth &Heinemann, 1995
2. R G. Moreira, T.P Coultate Automatic Control for Food Processing System. 2001
3. Willard, H.H., L. L. Merrit, J. A. Dean and F. L. Seattle, Instrumental Methods of Analysis, CBS Publishing Co, New York,2010

Chairman - BoS
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OPEN ELECTIVES

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIY01	RADAR AND NAVIGATION AIDS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Derive and discuss the Radar equation and the nature of detection
- Apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- Refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- Learn about the principles of navigation, in addition to approach and landing aids as related to navigation
- Know about the navigation ships from shore to shore

Course Outcomes: At the end of this course, learners will be able to

- Explain principles of navigation, in addition to approach and landing aids as related to navigation
- Derive and discuss the Range equation and the nature of detection.
- Describe about the navigation systems using the satellite.
- Understand principles of navigation, in addition to approach and landing aids as related to navigation
- Understand navigation ships from shore to shore

Unit I	INTRODUCTION TO RADAR EQUATION	9

Introduction- Basic Radar –Equation- Block Diagram- Frequencies –Applications– The Origins of Radar - Detection of Signals - Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm Antenna Parameters- System losses

Unit II	MTI AND PULSE DOPPLER RADAR	9

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI - Pulse Doppler Radar –Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy

Unit III	RADAR TRANSMITTERS AND RECEIVERS	9

Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources.- The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

Unit IV	RADIO DIRECTION AND RANGES	9

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adhoc Direction Finders - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.

Unit V	SATELLITE NAVIGATION SYSTEM	9

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) Inertial Navigation - Principles of Operation - Navigation Over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System (GPS)

TEXT BOOK(S):

1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003.
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.

REFERENCE(S):

1. N.Levanon, Radar Signals, Wiley,2005.
2. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
3. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIY02	ELECTRONIC INSTRUMENTATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Introduce different types of electronic voltmeters and their applications.
- Provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- Introduce different types of waveform generators and analyzers and their applications.
- Educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
- Give exposure to telemetry, modulation techniques and multiplexing.

Course Outcomes: At the end of this course, learners will be able to

- Understand and analyze Instrumentation systems and their applications to various industries.
- Gained knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- Describe the different types of waveform generators and analyzers and their applications.
- Understand the virtual instrumentation, its applications, programming and DAQ cards and modules.
- Exposed to telemetry, modulation techniques and multiplexing.

Unit I	ELECTRONIC INSTRUMENTS	9

Electronic Voltmeter and their advantages – Types, Differential amplifier, source follower, rectifier – Truerms reading voltmeter – Electronic multimeter and ohmmeter – Current measurement – Power measurement - Microprocessor based DMM with auto ranging and self diagnostic features.

Unit II	CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS	9

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

Unit III	WAVEFORM GENERATORS	9

Wien's bridge and phase shift oscillators – Hartley and crystal oscillators – Square wave and pulse generators – Triangular wave-shape generator - Signal and function generators – Q meter – Electronic Counters.

Unit IV	VIRTUAL INSTRUMENTATION	9

Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation - VI programming techniques – DAQ cards for VI applications – DAQ modules with serial communication.

Unit V	TELEMETRY	9

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing.

TEXT BOOK(S):

1. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India Private Ltd., New Delhi, 2010.
2. David A Bell, "Electronic Instrumentation and Measurements", Ox for University Press, 2013.
3. Jerome J., Virtual Instrumentation using Lab VIEW, Prentice Hall India Private Ltd., New Delhi,2010.

REFERENCE(S):

1. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010.
2. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011.
3. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, Prentice Hall India, New Delhi, 2009.
4. Sanjay Gupta, VirtualInstrumentationusingLabview,TataMcGraw-Hill Education,2010.

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Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIY03	SENSOR TECHNOLOGY	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Impart knowledge about various sensors in multidisciplinary engineering domain
- Understand the concept of sensing circuits and its static and dynamic characteristics.
- Familiarize students with different applications and its material handling technology.
- Learn about sensor for different industrial applications.
- Knowledge about the modern technologies to design various sensors.

Course Outcomes: At the end of this course, learners will be able to

- Summarize the static and dynamic characteristics of measuring instruments
- Compare the characteristics and working principles of Resistance, Inductance and Capacitance type sensors
- Construct the interfacing and signal conditioning circuit for measurement system using different types of sensor
- Select suitable sensor for different industrial applications
- Integrate the modern technologies to design various sensors

Unit I	SENSORS FUNDAMENTALS AND CHARACTERISTICS	9

Sensors: Principles of Sensing-Sensor Classification and terminology- Units of Measurements - Measurands- Sensor Characteristics: static and Dynamic.

Unit II	PHYSICAL PRINCIPLES OF SENSING	9

Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements

Unit III	INTERFACE ELECTRONIC CIRCUITS	9

Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors

Unit IV	SENSORS IN DIFFERENT APPLICATION AREA	9

Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors

Unit V	SENSOR MATERIALS AND TECHNOLOGIES	9

Materials, Surface Processing-MEMS microsystem components- Microfluidics microsystem components - Nano-Technology- Electronic/wireless integration

TEXT BOOK(S):

1. J. Fraden, Handbook of Modern Sensors:Physical, Designs, and Applications, AIP Press, Springe.

REFERENCE(S):

1. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi.
2. Mechatronics -Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited)

Chairman - BoS
Dept. of EIE - ESEC

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIY04	INSTRUMENTATION IN AEROSPACE AND NAVIGATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concept of instruments used in the aircraft and aerospace.
- Analyze the different types of flight control system and navigation.
- Identify the sensor and controls used in satellite and space vehicle.
- Identify the suitable flight control scheme for a given situation.
- Learn about the working principle of instrumentation in satellite and space vehicle

Course Outcomes: At the end of this course, learners will be able to

- Explain the principles of measuring instruments and indicators for aircraft and aerospace
- Applications
- Select an appropriate navigation system for a given problem
- Analyze suitable flight control scheme for a given situation.
- Understand the working principle of instrumentation in satellite and space vehicle

Unit I	AIR CRAFT AND AEROSPACE VEHICLE INSTRUMENTATION	9

Basic T instruments - types of air speeds - Air data instruments: altimeter, air speed indicator, altitude indicator, Mach meter - gyroscopic instruments - turn and back indicator - artificial horizon – Electronic flight instrument unit - Accelerometers - sensors and actuators.

Unit II	RADIO NAVIGATION AIDS	9

Navigation and its types - Automatic direction finder - distance measuring equipment's - non directional beacons - course deviation indicator - instruments landing system - microwave landing system - very high frequency omni directional range instrument - Tactical Air Navigation - radar basic terminology – primary and secondary surveillance radar.

Unit III	FLIGHT CONTROL SYSTEM	9

Principles of flight control, flight control surfaces, flight control linkage systems, Autopilot system , trim and feel, flight control actuation, fly by wire system, fly by light fcs, Airbus and Boeing implementations, Interrelationship of flight control, guidance and vehicle management systems.

Unit IV	SATELLITE AND SPACE VEHICLE INSTRUMENTATION	9

Global Positioning System (GPS) - propulsion controls - propulsion unit - Sun sensors - Horizon sensors - star tracker - Stabilisation controls - GPS Aided GEO Augmented Navigation (GAGAN) and Indian Regional Navigation Satellite System (IRNSS) - Local Area Augmentation System (LASS), Wide Area Augmentation System (WAAS).

Unit V	AIR CRAFT FLIGHT SIMULATION INSTRUMENTATION	9

Basic description of a flight simulator - Solution of Aerodynamics equations - various types of aircraft engine instruments - Vibration measurements - Tachometers -Temperature gauges - Pressure gauges - Operation and Principles - Horizontal Situation Indicator - Simulation of autopilot system - Doppler and Inertial Navigation instruments

TEXT BOOK(S):

1. John G. Webster and HalitEren, "Measurement, Instrumentation, and Sensors Handbook", CRC Press, Taylor & Francis Group, New York, 2014.

REFERENCE(S):

1. Nagaraja N.S., "Elements of Electronic Navigation", Tata Mcgraw Hill Publishing Ltd., New Delhi, 2006.
2. Keyton.M and Walker.R, Fried,"Avionics navigation systems",John Wiley, 1997.
3. Pallett E.G.H., "Aircraft Instrumentation and Integrated Systems", Longman Scientific and Technical, 1992
4. Ching-Fang Lin, "Modern guidance, navigation and control processing", Prentice hall, Englewood cliffs, New Jersy, 1991
5. John.H. Blakelock, "Automatic control of aircraft and missiles", John wiley and sons.inc, 1991.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIY05	INDUSTRIAL PROCESS AUTOMATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the fundamentals of Programmable Logic Controller(PLC), Supervisory Control
- Data Acquisition (SCADA) and Distributed Control System (DCS)
- Program and configure the advanced controller for a given application
- Learn about the interfacing methods in DCS
- Familiarize the functions of different communication protocols

Course Outcomes: At the end of this course, learners will be able to

- Interpret the architecture and concepts of PLC program
- Execute PLC and Supervisory Control and Data Acquisition (SCADA) for various applications
- Examine the concepts of Distributed Control System
- Analyze the interfacing methods in DCS
- Implement the communication protocol for given application

Unit I	PROGRAMMABLE LOGIC CONTROLLER	9

Evolution of PLCs- Components of PLC - Architecture of PLC - Discrete and analog I/O modules - Programming languages -- Ladder diagram

Unit II	PLC SCADA AND ITS APPLICATIONS	9

Instructions in PLC - Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions - Introduction to SCADA - components of SCADA - features of SCADA

Unit III	DISTRIBUTED CONTROL SYSTEM	9

DCS - Various Architectures - Comparison - Local control unit - Process interfacing issues

Unit IV	INTERFACES IN DCS	9

Operator interfaces - Low level and high level operator interfaces - Displays - Engineering interfaces - Low level and high level engineering interfaces - Factors to be considered in selecting DCS

Unit V	COMMUNICATION PROTOCOLS	9

Introduction to communication protocols- TCP/IP protocol - HART communicator protocol – Media access Protocol- Data link control protocol - PROFI bus - Mod bus - CAN bus- Field bus: General Field bus architecture, Field bus standard, Field bus topology

TEXT BOOK(S):

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010 Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India,2012

REFERENCE(S):

1. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes/Elsevier, 2013
2. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2011
3. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013
4. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1985

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019		OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EIY06	PROGRAMMABLE LOGIC CONTROLLER	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Impart knowledge about automation.
- Learn about architecture of PLC
- Understand the PLC programming using timers and counters and
- Learn about the advanced PLC functions
- Familiarize the student with applications

Course Outcomes: At the end of this course, learners will be able to

- Explain the fundamentals Concepts of Automation
- Summarize the architecture and interfacing techniques of PLC
- Select the suitable PLC Programming languages
- Attribute the various functions and instruction sets of PLC
- Generate a suitable logical programming for given applications

Unit I	INTRODUCTION TO AUTOMATION	9

Evolution of automation -Types of automation -Fixed, flexible and programmable automation – Batch process and continuous process - open loop system and closed loop system - Function of sensors - Proximity sensors: Capacitive and Inductive - Infrared and Laser - Actuators : Solenoid valve – servo motor.

Unit II	ARCHITECTURE OF PLC	9

Components of PLC - Processor - Memory: Types of memory, Memory Mapping - Input and Output modules: Discrete, Analog -Scan time of PLC -Interfacing computer and PLC: RS232, RS485, Ethernet - Selection criteria for PLC

Unit III	PLC PROGRAMMING	9

Programming methods - Ladder logic - Function block diagram (FBD) - Structure text - Ladder logic components: Boolean logic using ladder logic programming-Timers: On Delay timer, OFF Delay timer and Retentive timer - Counters: Up Counter and Down Counter

Unit IV	ADVANCED PLC FUNCTONS	9

Instructions in PLC: Program Control Instructions, Math Instructions, Data Manipulation Instructions: Data compare operations, Data transfer operations - Sequencer and Shift register instructions- Analog Instructions: PID Controller - Scaling Instructions

Unit V	APPLICATIONS OF PLC	9

Case Studies: Bottle filling system - Pick and place robot - Car Parking - Traffic light control (4 ways with pedestrian signal) -Elevators - Pneumatic stamping system

TEXT BOOK(S):

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2015

REFERENCE(S):

1. Benjamin C Kuo, Automatic Control Systems, Prentice Hall of India,2014.
2. John Park, Steve Mackay, Edwin Wright, Practical data communications for instrumentation and control, Newnes/Elsevier, 2015
3. K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, 2014
4. John W Webb and Ronald A Resis, Programmable Logic Controller, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.

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ADDITIONAL ONE CREDIT COURSES

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ01	ENTREPRENEURSHIP DEVELOPMENT	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of
- development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge about entrepreneurship, motivation and business.

BASICS OF ENTREPRENEURSHIP & GENERATION OF IDEAS — **15**

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurshipprocess. Role of entrepreneurship in economic development, Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractionation, Reversal Method, Brain Storming, Analogies

REFERENCE(S):

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, TataMcGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ02	INDUSTRIAL SAFETY STANDARDS FOR INSTRUMENTATION PRODUCTS	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Acquire basic concepts of instrumentation in food, petro chemical and continuous processindustries.

Course Outcomes: At the end of this course, learners will be able to:

- Provide awareness on the different safety standards.

INDUSTRIAL SAFETY STANDARDS FOR INSTRUMENTATION PRODUCTS — **15**

Introduction to instrumentation involved in food industry / petrochemical industry /continuous process industry - Different standard requirements for safety products - Hazardous environment and instrumentation - Protection methods for instrumentation electronics - Wiring and installation best practices

REFERENCE(S):

1. Nicholas P. Cheremisinoff, Practical Guide To Industrial Safety, Marcel Dekker, Inc, 2006
2. Walt Boyes, Instrumentation Reference Book, Butterworth-Heinemann, 2008

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ03	DETAILED INSTRUMENTATION ENGINEERING	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Acquire basic knowledge in understanding the piping and instrumentation diagrams.

Course Outcomes: At the end of this course, learners will be able to:

- Analyze the P& I diagramsfor smart plants.

DETAILED INSTRUMENTATION ENGINEERING — **15**

Process flow diagrams - P&ID concepts - Standards and symbols - Indications on P&ID - Conventions inP&ID - Instrumentation standards - API - IEC - ISA - Selection and sizing of instruments - Selection andsizing of valves - Project management

REFERENCE(S):

1. Instrumentation symbols and identification - ISA 5.1, International Society of Automation
2. Process Measurement Instrumentation - API RP 551, International Society of Automation

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ04	CALIBRATION TECHNIQUES	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Impart necessary knowledge in calibration techniques and its applications

Course Outcomes: At the end of this course, learners will be able to:

- Understand the calibration techniques in field instruments

CALIBRATION	15

Introduction - Industry Protection Standards - Temperature Calibration - Resistance Temperature Detectors (RTD) - Thermocouple - Thermostat - Calibration ofPressure Transmitter -Pressure switches with Documenting Process Calibrators (DPC)- Calibration of Control Valve Positioner - Loop Calibration and Maintenance-Calibrating Highway Addressable Remote Transducer (HART) communication protocol based transmitters-Calibration of non-contact type transmitters

REFERENCE(S):

1. Mike Cable, "Calibration - A Technician's Guide, The Instrumentation, Systems and AutomationSociety, 2014.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ05	IoT USING RASPBERRY PI	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of IoT using Raspberry Pi

Course Outcomes: At the end of this course, learners will be able to:

- Develop Phyton Programming in IoT applications using Raspberry Pi.

IOT USING RASPBERRY PI	15

Introduction to IoT - PYTHON Programming - Accessing Internet - SMTP mail server - Camera Interfacing and its Applications - Creating a project on security - HTML Programming - Interfacing of Analog Sensors - IoT based Location Finder with Map Integration - IoT based Electrical Applications (Demo) - Linking MATLAB and Raspberry Pi

REFERENCE(S):

1. Simon Monk, Programming the Raspberry Pi: Getting Started with Python, McGraw Hill, 2013.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ06	MODELING AND ANALYSIS OF INSTRUMENTATION	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Modeling the continuous and discrete systems.

Course Outcomes: At the end of this course, learners will be able to:

- Simulate the solutions for instrumentation problems.

MODELING AND ANALYSIS OF INSTRUMENTATION	15

Working with the MATLAB User Interface - Variables and Expressions - Automating Commands with Scripts - Analysis and Visualization with Matrices - Analysing Data from Files - Flow Control - Writing Functions - Creating and Simulating a Model - Modeling Programming Constructs - Modeling Discrete Systems - Modeling Continuous Systems - Instrumentation linear and nonlinear system examples with MATLAB/Simulink

REFERENCE(S):

1. KristerAhlersten, An Introduction to Matlab, BookBoon , 2012.
2. Fornetti Francesco, Instrumentation Control, Data Acquisition and Processing with MATLAB,Explore RF Ltd, 2013.

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ07	HIGH TEMPERATURE INSTRUMENTATION	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Learn the various types of sensors for high temperatures for use in propulsion and other applications.

Course Outcomes: At the end of this course, learners will be able to:

- Import knowledge on high temperature measurements

HIGH TEMPERATURE INSTRUMENTATION — **15**

Introduction - importance of high temperature measurements in Aerospace industry - Heat flux measurement - Types of heat flux sensors - slug gauge, Gordon gauge, Thermopile and thin film gauges - calorimetric methods - calibration of heat flux sensors using black bodyfurnace - Types of thermocouples and their calibration, combustion chamber temperature measurements using refractory thermocouples - surface temperature measurement techniques using thermo couples and pyrometers - optical, radiation, two colour and infrared pyrometers - spectroscopic methods for flame temperature measurement - Sodium line reversal method, LDA etc. Total temperature measurements - recovery factor calibration - major errors associated with high temperature measurements and estimation of accuracies.

REFERENCE(S):

1. J.P Hartnett et al, Recent Advances in Heat and Mass Transfer, Literary Licensing, LLC, 2012
2. R.P. Benedict, Fundamentals of temperature, pressure and flow measurements, Third Edition,1984.
3. ASTM committee on E20, Manual on the use of thermocouples in temperature measurement, ASTM publication,1981

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ08	DESIGN OF LOW-COST AUTOMATION FOR INDUSTRIES	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Learn the designing and building a Low costautomation controls inmanufacturing and process industries

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge in designing and building a Low cost automation controls in manufacturing and process industries

DESIGN OF LOW COST AUTOMATION FOR INDUSTRIES — **15**

Introduction to manufacturing and process industries - Need for automation - Need for low cost automation - Automation system development methodologies - Interoperability in automation products - OLE / OPC Standards - Testing and validation of automation systems - Introduction to factory acceptance test - Hands on Designing an low cost SCADA with LABVIEW

REFERENCE(S):

1. John Park, Steve Mackay, Practical Data Acquisition for Instrumentation and Control Systems, Elsevier, 2010
2. Terry Bartelt, Industrial Automated Systems: Instrumentation and Motion Control, CENGAGE Learning, 2011

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Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ09	ENERGY MANAGEMENT SYSTEMS IN INDUSTRIES	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Study the role of an instrumentation engineers in energy conservation.

Course Outcomes: At the end of this course, learners will be able to:

- Understand the role of an instrumentation engineers in energy conservation

ENERGY MANAGEMENT SYSTEMS IN INDUSTRIES	15

Need for energy conservation in manufacturing / process industries - Role of instrumentation engineer in energy conservation programme - Practical case studies on development of instrumentation and control for energy management programme - Energy measurement - Data logging methods - Modbus, Can Bus & Ethernet protocols - Hands on training in development of an energy management system with LabVIEW

REFERENCE(S):

1. Richard A. Panke, Energy Management Systems and Direct Digital Control, 2011.
2. Dr. Parag Diwan & Mohammed, Energy Management, Pentagon Energy Earth, 2012.

Department	ELECTRONICS AND INSTRUMENTATION ENGINEERING					R 2019	
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EIZ10	SMART PLANT INSTRUMENTATION	1	0	0	1	15	100

Course Objective (s): The purpose of learning this course is to

- Study about the smart plant instrumentation statistical tools.

Course Outcomes: At the end of this course, learners will be able to:

- Access and update the instruments used for different tasks and ensures that the consistency is maintained in the project.

SMART PLANT INSTRUMENTATION	15

System and Project Administration Overview-Instrument Index-Process Data- Calculations-Specifications-Wiring-Loop Diagrams-Hookups-Foundation Fieldbus-Brief overview of Field Bus, External Spec Editor, External Process Data Editor and Integration Specific to SPI

REFERENCE(S):

1. Introduction to SmartPlant (R) P&ID: The Piping and Instrumentation Diagrams (P&ID) Handbook, 6 August 2020 by Jagadeesh Pandiyan

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