SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Department of Instrumentation and Control Engineering

Minutes of 5th BoS Meeting (UG)

Venue : Seminar Hall,
Department of ICE,
Sri Manakula Vinayagar Engineering College

Date & Time : 16th September, 2022 at 11:00 A.M

Dr.L.M.VARALAKSHMI, M.Tech, Ph.D
Professor & Head,
Department of Instrumentation and control Engineering
Sri Manakula Vinayagar Engineering College
(An Autonomous Institution)
Madagadipet, Puducherry – 605 107

Dr.L.M.VARALAKSHMI, M.Tech, Ph.D
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Madagadipet, Puducherry – 605 107

Department of Instrumentation and Control Engineering

Minutes of Fifth Board of Studies

The Fifth Board of Studies meeting of the Department of Instrumentation and Control Engineering was held on 16th September 2022 at 11:00 A.M in the Seminar Hall, Department of ICE, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl. No	Name of the Member with Designation and official Address	Responsibility in the BoS
1	Dr. L. M. Varalakshmi Professor and Head Department of ICE,SMVEC	Chairman
2	Dr. P. A. Karthick, P.D.F. Professor Department of Instrumentation and Control Engineering National Institute of Technology, Tiruchirappalli	External Member Subject Expert
3	Dr. D. Manamalli Professor Department of Instrumentation Engineering, MIT Campus, Anna University	External Member Subject Expert
4	Dr. Anima Nanda Professor & Head/ BMI Director IQAC, Sathyabama University	External Member Subject Expert
5	Prof.T. Sudha Assistant Professor Department of ICE, SMVEC	Internal Member
6	Prof.J.Jeevanantham Assistant Professor Department of ICE, SMVEC	Internal Member

7	Dr. M. Rekha Associate Professor Department of ICE, SMVEC	Internal Member
8	Dr. D. Sivanandakumar Associate Professor Department of ICE, SMVEC	Internal Member
9	Dr. K. Naveenkumar Assistant Professor Department of ICE, SMVEC	Internal Member
10	Dr. E. Sarojpurani Assistant Professor Department of Chemistry, SMVEC	Internal Member
11	Dr. T. Gayathri Professor & Head Department of Mathematics, SMVEC	Internal Member
12	Dr. M. A. Ishrath Jahan Professor Department of English, SMVEC	Internal Member
13	Mrs. S.Geetha Assistant Professor Department of Physics, SMVEC	Internal Member
14	Mr. B. Murugan Senior Executive Engineer Biogenomonics	Co-opted Member Representative from Industry
15	Mr. S. Karthikeyan E-Beam Control Operator Siechem Technologies pvt. Ltd	Co-opted Member Alumni Member

Agenda of the Meeting

Item No.: Agenda 1/BoS/5/2022/ICE/UG	
	Welcome Address and to confirm the minutes of the Fourth Board of Studies Meeting held on 18.02.2022.
Item No.: Agenda 2/BoS/5/2022/ICE/UG	
	To ratify the Curriculum and the syllabi of VI and VII semester under Autonomous Regulations 2020, and approval of VIII semester syllabi under Autonomous Regulations 2020 for the B.Tech – Instrumentation and Control Engineering students admitted in the academic year 2020-21.
Item No.: Agenda 3/BoS/5/2022/ICE/UG	
	To apprise the BoS members about the professional elective course for the V and VIII semester under Regulations R-2020 and R-2019 respectively for the students admitted in the academic Year 2020- 21 and 2019-2020.
Item No.: Agenda 4/BoS/5/2022/ICE/UG	
	To apprise the BoS members about the open elective course for the V semester under Regulation 2020 for the students admitted in the academic Year 2020-21.
Item No.: Agenda 5/BoS/5/2022/ICE/UG	
	To review the employability enhancement courses under Autonomous Regulations R-2020 for V / III / I semester students.
Item No.: Agenda 6/BoS/5/2022/ICE/UG	
	To apprise about the Industry Institute Interactions of the department of Instrumentation and Control Engineering. To improve the internship and job opportunities for the students.
Item No.: Agenda 7/BoS/5/2022/ICE/UG	
	To apprise about the schedule of End Semester Examination.
Item No.: Agenda 8/BoS/5/2022/ICE/UG	
	To discuss and recommend the panel of examiners to the Academic Council.
Item No.: Agenda 9/BoS/5/2022/ICE/UG	
	To apprise the department activities.
Item No.: Agenda 10/BoS/5/2022/ICE/UG	
	Any other item with the permission of chair.

Minutes of the Meeting

Dr.L. M. Varalakshmi, Chairman, BoS initiated the meeting by welcoming the external members, the internal and co-opted members and thanked them for the detailed deliberations on the agenda items that had been approved by the Chairman.

Item: Minutes 1/BoS/5/2022/ICE/UG

Chairman, BoS, apprised the minutes of Fourth BoS, its implementation and confirmed with the approval for the incorporation of minor revisions needed for R-2020.

Item: Minutes 2/BoS/5/2022/ICE/UG

The Curriculum and the syllabi of VI and VII semester under Autonomous Regulations R-2020 for the B.Tech - Instrumentation and Control Engineering students was ratified and minor corrections were suggested.

Revision : (Annexure I)

R 2020 – Curriculum

The curriculum under Autonomous Regulations R-2020 was reviewed and ratified with minor correction **(Annexure I)**.

S. No	Sem	Subject and code	Type	Unit	Particulars
1	VII	Industry 4.0 (U20ICE718)	Professional Elective - IV	Entire syllabus	Industry 4.0 is moved to VII semester as Professional Elective IV and replaced in the place of Fault Detection and Diagnosis.
2	VIII	Instrumentation for Agricultural and Food Processing Industries (U20ICE828)	Professional Elective - VI	New Subject	Introduced a new subject "Instrumentation for Agricultural and Food Processing Industries" in place of Industry 4.0
3	VIII	Safety Instrumented System (U20ICE830)	Professional Elective - VI	New subject	Safety Instrumented System is replaced instead of Piping and Instrumentation Diagram

R-2020-Syllabi

The syllabi for semesters VIII under Autonomous Regulations 2020 were discussed elaborately and approved **(Annexure II)**.

Item: Minutes 3/BoS/5/2022/ICE/UG

Professional Elective:

The professional elective course for the V and VIII semester under Regulations R-2020 and R-2019 respectively for the students admitted in the academic year 2020-21 and 2019-2020 were discussed.

Item: Minutes 4/BoS/5/2022/ICE/UG	**R-2020–Open Elective-III** • The open elective course for the V semester students admitted in the academic Year 2020-21 of Regulation 2020 was apprised to the BOS members. **Open Elective Course** **R-2020, V semester** • **Product Development and Design (U20HSO501) (Annexure III)**
Item: Minutes 5/BoS/5/2022/ICE/UG	The **Employability Enhancement Courses** chosen for III, V and I Semester (R-2020) and VIII (R-2019) semester students were apprised **(Annexure III)** **Skill Development Course** **R-2020, III semester** • Skill Development Course 2: Troubleshooting of Electronic Equipments (U20ICS302) Skill Development Course 4: Foreign languages / IELTS I (V semester)and II (VI Semester) **has been replaced by** Skill Development Course 4: Career and Professional Skill Development Program – I and Skill Development Course 6: Career and Professional Skill Development Program – II. **R -2020, V Semester** • Skill Development Course 4: Career and Professional Skill Development Program – I (U20ICS504) • Skill Development Course 5: Presentation Skill using ICT (U20ICS505) **R-2019, VIII semester** • Skill Development Course 10: NPTEL / MOOC – II (U19ICS81) **Mandatory Courses** • Induction Program (U20ICM101) (R- 2020, I Semester) • Physical Education (U20ICM303) (R-2020, III Semester) • Indian Constitution (U20ICM505) (R2020, V Semester) **Certification Courses** • **(R-2020, I semester)** • **(R-2020, III semester)** • **(R-2020, V semester)**
Item: Minutes 6/BoS/5/2022/ICE/UG	• The Industry Institute Interaction of B. Tech Instrumentation and Control Engineering were apprised and the suggestions regarding the associations were deliberated. • Internship, core placement and industrial projects were discussed with the BOS expert members.

Item: Minutes 7/BoS/5/ 2022/ICE/ UG	• The End Semester Examination schedule was apprised. **(Annexure IV)**
Item: Minutes 8/BoS/5/ 2022/ICE/ UG	The panel of examiners to the Academic Council was apprised and recommended **(Annexure- V)**
Item: Minutes 9/BoS/5/ 2022/ICE/ UG	The department activities were apprised. - Guest Lecture / Hands on Training / Co - Curricular Activities / Extra-Curricular activities / Extension Activities.
Item: Minutes 10/BoS/5/ 2022/ICE/ UG	Any other item with the permission of chair.

The meeting was concluded at 1.00 PM with vote of thanks by **Dr. L. M. Varalakshmi**, Head of Department, Instrumentation and Control Engineering

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	Dr. L.M. Varalakshmi Professor and Head Department of ICE,SMVEC	Chairman	
External Members			
2	Dr. P. A. Karthick, P.D.F. Professor Department of Instrumentation and Control Engineering National Institute of Technology, Tiruchirappalli	External Member	P. A. Karthick.
3	Dr. D. Manamalli Professor Department of Instrumentation Engineering, MIT Campus, Anna University	External Member	
4	Dr. Anima Nanda Professor & Head/ BMI Director IQAC, Sathyabama University	External Member	
Internal Members			
5	Prof. T. Sudha Assistant Professor Department of ICE,SMVEC	Internal Member	T. Sudha
6	Prof. J. Jeevanantham Assistant Professor Department of ICE, SMVEC	Internal Member	
7	Dr. M. Rekha Associate Professor Department of ICE, SMVEC	Internal Member	
8	Dr. D. Sivanandakumar Associate Professor Department of ICE, SMVEC	Internal Member	D. Sivan
9	Prof. P. Kiruthika Assistant Professor Department of ICE, SMVEC	Internal Member	P. Kiruthika

10	Prof. K. Naveenkumar Assistant Professor Department of ICE, SMVEC	Internal Member	
11	Dr. E. Sarojpurani Assistant Professor Department of Chemistry, SMVEC	Internal Member	
12	Dr. T. Gayathri Professor & Head Department of Mathematics, SMVEC	Internal Member	
13	Dr. M.A. Ishrath Jahan Professor Department of English, SMVEC	Internal Member	
14	Mrs. S. Geetha Assistant Professor Department of Physics, SMVEC	Internal Member	
Co-opted Members			
15	Mr. B. Murugan Senior Executive Engineer Biogenomonics	Co-opted Member	
16	Mr. S. Karthikeyan E-Beam Control Operator Siechem Technologies pvt. Ltd	Co-opted Member	

Chairman-BoS /Dept. of ICE
(Dr. L. M. Varalakshmi)

Annexure–I

(Revision of R-2020 VI, VII Sem Curriculum and Syllabi)

Annexure – I

(1. Revised Curriculum of "U20ICE718 Industry 4.0" in R-2020)

Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE716	Power Plant Instrumentation
2	U20ICE717	Automotive Instrumentation System
3	U20ICE718	Industry 4.0
4	U20ICE719	Modern Electronic Instrumentation
5	U20ICE720	Fiber Optics and Laser Instrumentation

(2. Revised Syllabus of "U20ICE718 Industry 4.0" in R-2020)

U20ICE718	INDUSTRY 4.0	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the basic knowledge of Industry 4.0
- To learn a Conceptual Framework for Industry 4.0
- To learn the Technology Roadmap for Industry 4.0
- To get knowledge of Advances in Robotics in the Era of Industry 4.0
- To provide the knowledge of Obstacles and Framework Conditions for Industry 4.0

Course Outcomes

After completion of the course, the students will be able to

CO1 - Know the Industry 4.0. **(K1)**
CO2 - Demonstrate conceptual framework and road map of Industry 4.0 **(K2)**
CO3 - Demonstrate road map of Industry 4.0 **(K3)**
CO4 - Describe Robotic technology and Augmented reality for Industry 4.0. **(K2)**
CO5 - Demonstrate obstacle and framework conditions for Industry 4.0 **(K3)**

UNIT I INTRODUCTION TO INDUSTRY 4.0 **(9 Hrs)**

Introduction, core idea of Industry 4.0, origin concept of industry 4.0, Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0

UNIT II A CONCEPTUAL FRAMEWORK FOR INDUSTRY 4.0 **(9 Hrs)**

Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0.

UNIT III TECHNOLOGY ROADMAP FOR INDUSTRY 4.0 **(9 Hrs)**

Introduction, Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.

UNIT IV ADVANCES IN ROBOTICS IN THE ERA OF INDUSTRY 4.0 **(9 Hrs)**

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly. Introduction, Augmented Reality Hardware and Software Technology, Industrial Applications of AR.

UNIT V OBSTACLES AND FRAMEWORK CONDITIONS FOR INDUSTRY 4.0 **(9 Hrs)**

Lack of A Digital Strategy alongside Resource Scarcity, Lack of standards and poor data security, Financing conditions, availability of skilled workers, comprehensive broadband infra- structure, state support, legal framework, protection of corporate data, liability, handling personal data.

Text Books

1. Alp Ustundag and Emre Cevikcan, "Industry 4.0: Managing the Digital Transformation", Springer; 1st edition 2018.
2. Bartodziej, Christoph Jan, "The Concept Industry 4.0", Springer Gabler; 1st ed. 2017 edition 2016.
3. Klaus Schwab, "The Fourth Industrial Revolution", Currency 2017.
4. Christian Schröder, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises", 2017.

Reference Books

1. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
2. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Study lab Publications, 2016.
3. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
4. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

Web References

1. https://nptel.ac.in/courses/106/105/106105195/
2. https://www.ibm.com/in-en/topics/industry-4-0

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	3	-	-	3	2	3	3	3	2	2
2	2	3	2	2	2	3	-	-	1	2	3	3	2	3	2
3	2	2	1	1	1	2	-	-	3	2	3	3	2	2	2
4	1	2	2	1	2	2	-	-	2	2	2	2	1	2	2
5	1	1	2	2	1	3	-	-	3	2	2	3	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

(3. Revised Professional Elective – VI in R-2020 curriculum)

Title: U20ICE828 Instrumentation for Agricultural and Food Processing Industries

Title: U20ICE830 Safety Instrumented System

Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE826	Design of Process Control System Components
2	U20ICE827	Renewable Energy Resources
3	U20ICE828	Instrumentation for Agricultural and Food Processing Industries
4	U20ICE829	Cyber Security in Industrial Automation
5	U20ICE830	Safety Instrumented System

Annexure–II

(R-2020, VIII Semester Syllabi)

Annexure II

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20ICT819	Instrumentation in Process Industries	PC	3	0	0	3	25	75	100
2	U20ICE8XX	Professional Elective - V #	PE	3	0	0	3	25	75	100
3	U20ICE8XX	Professional Elective - VI #	PE	3	0	0	3	25	75	100
Practical										
4	U20HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
Project Work										
5	U20ICW803	Project Phase - II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U20ICS809	Skill Development Course 9: NPTEL / MOOC - II	EEC	0	0	0	-	100	-	100
							18	315	285	600

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	Course Code	Course Title
1	U20ICE821	Industrial Safety
2	U20ICE822	System Identification and Adaptive Control
3	U20ICE823	Advanced Instrumentation System
4	U20ICE824	Industrial Data Networks
5	U20ICE825	Field Instrumentation and Cabling

Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	Course Code	Course Title
1	U20ICE826	Design of Process Control System Components
2	U20ICE827	Renewable Energy Resources
3	U20ICE828	Instrumentation For Agricultural And Food Processing Industries
4	U20ICE829	Cyber Security in Industrial Automation
5	U20ICE830	Safety Instrumented System

(Syllabus of R- 2020 VIII semester)

U20ICT819	INSTRUMENTATION IN PROCESS INDUSTRIES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce the basic operation of various industries.
- To understand the measurement of different process parameters in paper industry.
- To impart knowledge on placing the sensors/transducers in instruments in petrochemical industries.
- To explore the special measuring devices and sensors for the iron and steel industry.
- To provide an exposure to the process and instrumentation and control applications in pharmaceutical industries.

Course Outcomes

After completion of the course, the students will be able to

CO1 - List the basic operation of various industries.
CO2 - Summarize the process parameters with appropriate sensors/transducers in paper industry.
CO3 - Explain the measurement of different process parameters for petrochemical industries.
CO4 - Analyze the working of different Instruments used in specified industries.
CO5 - Compare diverse measurement techniques/control of process parameters.

UNIT I OVERVIEW OF INDUSTRIAL PROCESSES (9 Hrs)

Description of process in Paper Industries Description of process in petrochemical industries: Description of process in iron and steel and cement industries - Description of process in pharmaceutical and nuclear industries.

UNIT II INSTRUMENTATION IN PAPER INDUSTRIES (9 Hrs)

Measurement of Basic weight, thickness, density, Porosity, smoothness, softness, hardness and compressibility; selection of suitable measurement hardware for flow, pressure, level, temperature, density, solids, consistency - moisture analyzers oxidation - reduction potential and pH.

UNIT III INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES (9 Hrs)

P & I diagram of petroleum refinery - measurement and control of absolute pressure, density, conductivity, differential pressure and flow of evaporators. Measurement and control of column pressure, liquid distillate, vapour distillate.

UNIT IV INSTRUMENTATION IN IRON AND STEEL INDUSTRIES (9 Hrs)

Iron and steel: Selection of suitable measurement hardware for temperature, pressure, level, flow, weighing and proportioning - special gauges for measurement of thickness and shape.

UNIT V INSTRUMENTATION IN PHARMACEUTICAL INDUSTRIES (9 Hrs)

Pharmaceutical Industries: Flow measurement - pressure measurement - smoke detector.

Text Books

1. B.G. Liptak, "Instrumentation Engineers Handbook (Measurement)", Fourth Edition, Volume 1, CRC press, 2011.
2. Gregory K. McMillan's Considine D. M., "Process/Industrial Instruments and Control Handbook", McGraw Hill, 5th edition 2009

3. Norman A. Anderson, "Instrumentation for Process Measurement and Control", Routledge, Third Edition, 2017

Reference Books

1. Liptak B G, "Instrument Engineer's Handbook, Vol. 2: Process Control and Optimization", CRC Press, 2006.
2. BhaskaraRao, "a text on petrochemicals", Trendy paper, 2004.
3. Liptak B.G, "Process Measurement and Analysis", Third Edition, Chilton Book Co., 2003.

Web References

1. https://www.branom.com/instruments-type.html
2. https://www.controlengeurope.com/features/132/Process-instrumentation/
3. https://new.siemens.com/global/en/products/automation/process-instrumentation.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	3	2	-	3	1	-	-	3	3	3	3
2	3	2	3	2	3	2	-	3	1	-	-	3	3	3	3
3	3	2	3	2	3	2	-	3	1	-	-	3	3	3	3
4	3	2	3	2	3	2	-	3	1	-	-	3	3	3	3
5	3	2	3	3	3	2	-	3	1	-	-	3	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20HSP804	ENTREPRENEURSHIP MANAGEMENT	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop an ability to identify the critical challenges hindering growth of entrepreneurs
- To understand the significance of Finance Skills, Branding, and Sales Skills for an Entrepreneur
- To be aware of various Government Schemes and Subsidies available for Entrepreneurs

Course Outcomes

After completion of the course, the students will be able to

CO1- Develop and demonstrate the business models. **(K2)**
CO2- Practice cash management, brand building and enhancing turnover. **(K6)**
CO3- Understand various schemes and subsidies that are offered by various Government agencies. **(K2)**
CO4- Effectively tackle growth challenges of their venture. **(K5)**
CO5- Manage and grow their business in terms of expansion and look for partnerships. **(K3)**

UNIT I ENTREPRENEURIAL SKILLS 1 **(6 Hrs)**

Introduction to Business Model Generation , Developing Lean Business Model for the Business Idea, Developing Prototype and Evaluating assumptions in Business Model using prototype cheaply, Presentation of Business Model, Business Fair

UNIT II ENTREPRENEURIAL SKILLS 2 **(6 Hrs)**

Financial Skills – Cash Management – Problems of Poor Cash Management – Learning to be Frugal. Branding – Building a 'niche' follower for your product/service – Developing and Establishing a Brand, Sales skills – KPI of Success of Entrepreneurship – Ensuring Growth in Turnover

UNIT III ENTREPRENEURIAL OPPORTUNITIES **(6 Hrs)**

Awareness of Government Schemes and Subsidies for various Entrepreneurial Categories – Special Schemes for Women Entrepreneurs – Understanding the Procedure and Documentation Process for availing the Government Schemes – Venture Capital – Crowdfunding – Angel Investors.

Report Submission:

1. How can I get first 100 customers to pay for my products/services?
2. Information technology as a resource
3. Marketing skill and promotion for entrepreneurs
4. Assessment of factors affecting performance of women entrepreneurs
5. Entrepreneurship as a tool for sustainable employment
6. Examination of problem facing small scale business
7. Survival strategies in small business
8. The role of insurance in minimizing business risk

Text Books

1. Storey, D. J., and Greene, F. J., "Small business and entrepreneurship", Financial Times/Prentice Hall, 2010.
2. Scarborough, N. M., "Essentials of entrepreneurship and small business management", Prentice Hall, 2011.
3. Gupta C.B., and Srinivasan N.P., "Entrepreneurial Development", Sultan Chand and Sons, 2020.

Reference Books

1. Brian Tracy, "The Psychology of Selling" HarperCollins Leadership, 2022.
2. Dale Carnegie, "How to Win Friends and Influence People", 1998.
3. Robert Kiyosaki and Sharon Lechter – Rich Dad, Poor Dad, Hachette Book Group USA; 1st edition, 2000.
4. Reid Hoffman – The Startup of You: Adapt to the Future, Invest in Yourself, and Transform Your Career, RHUK, 2013.

5. Michael E. Gerber – The E-Myth Revisited, Harper Business; Updated, Subsequent edition, 2004.
6. Chris Guillebeau – The Art of Non-Conformity, Penguin USA, 2010.
7. Eric Ries, "The Lean Startup, Currency", 1st Edition, 2011.
8. Kevin D. Johnson, "The Entrepreneur Mind", Lightning Source Inc, 2012.

Web References

1. https://www.helpguide.org/articles/stress/stress-management.htm
2. https://bscdesigner.com/8-entrepreneurial-kpis.htm
3. https://www.inc.com/ilya-pozin/5-problems-most-entrepreneurs-face.html
4. https://www.inc.com/jessica-stillman/how-to-network-with-super-successful-people.html
5. https://www.entrepreneur.com/article/251603
6. https://seraf-investor.com/compass/article/understanding-crowdfunding

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
1	1	3	1	2	2	1	3	1	1	3	2	2	2	3	3
2	1	1	2	2	1	1	3	2	2	3	3	2	2	2	2
3	1	2	1	1	1	2	3	2	2	3	3	2	1	2	3
4	1	2	2	2	2	3	3	3	3	3	2	3	2	2	2
5	1	2	2	2	2	3	3	3	3	3	2	3	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICW803	PROJECT PHASE II	L	T	P	C
		0	0	16	8

Course Objectives

This course should enable the students to

- Expose students to design problem related to various disciplines of instrumentation and control engineering.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Take up any challenging practical problems and find solution by formulating proper methodology. **(K5)**

KNOWLEDGE LEVEL: **K1** – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyze and **K5** – Evaluate

DESCRIPTION

The students will be encouraged to handle the problems independently in Project work phase II with the extension of the project work Phase-I started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal review committee for 40 marks. The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner (25 marks), an internal examiner (25 marks). Based on the Publication of paper / Prototypes / Patents 10 marks will be awarded.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	3	2	2	2	2	1	3	2	1	2	3	2	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICS809	SKILL DEVELOPMENT COURSE 9: (NPTEL/MOOC-II)	L	T	P	C	Hrs
		0	0	0	0	-

Student should register online courses like MOOC/SWAYAM/NPTEL etc. approved by the department committee comprising of HoD, Programme Academic Coordinator, Class Advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

U20ICE821	INDUSTRIAL SAFETY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the concept of Industrial Safety and provide knowledge for workplace safety.
- To acquire knowledge in identification, evaluation and control of all the hazards.
- To prevent wear, corrosion and the prevention methods.
- To conduct the fault tracing in machineries.
- To conduct periodic and preventive maintenance.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify hazard and potential hazard areas. **(K1)**
CO2 - Develop safety programs to prevent or mitigate damage or losses. **(K2)**
CO3 - Acquire knowledge on wear, corrosion and its preventive methods. **(K2)**
CO4 - Understand the fault tracing in machineries. **(K2)**
CO5 - Develop knowledge on periodic and preventive maintenance. **(K2)**

UNIT I INDUSTRIAL SAFETY **(9 Hrs)**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, 103 cleanliness, fire, guarding, pressure vessels, etc., Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING **(9 Hrs)**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost and its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION **(9 Hrs)**

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING **(9 Hrs)**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE **(9 Hrs)**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books

1. Keith Mobley, "Maintenance Engineering Handbook", McGraw-hill education, eighth edition, 2014.
2. Sushil Kumar Srivastava, Maintenance Engineering and Management, S. Chand and Company Ltd, 2006.

Reference Books

1. M.P.Poonia, S.C.Sharma, "Industrial Safety Maintenance Management", Khanna Publication, 2018.
2. C.Ray Asfahl, David W.Rieske, "Industrial Safety and health Management", 5th Edition, Prentice Hall,London,2010.

Web References

1. https://www.safeopedia.com/definition/1052/industrial-safety
2. https://www.nistinstitute.com/blog/industrial-safety-scope-significance/
3. https://labour.gov.in/industrial-safety-health

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
2	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
3	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
4	2	-	1	-	-	1	1	-	-	-	-	-	1	-	-
5	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE822	SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To Introduce Non parametric methods.
- To impart knowledge on parameter estimation methods.
- To impart knowledge on Recursive identification methods.
- To impart knowledge on Adaptive control schemes.
- To introduce stability, Robustness and Applications of adaptive control methods.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply advanced control theory to practical engineering problems **(K1)**
CO2 - Define basic concepts of parameter estimation methods. **(K2)**
CO3 - Understand the recursive least square method. **(K2)**
CO4 - Acquaint the various adaptive control schemes. **(K3)**
CO5 - Illustrate issues in adaptive control and applications **(K1)**

UNIT I NON-PARAMETRIC METHODS **(9 Hrs)**

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II PARAMETERIC ESTIMATION METHODS **(9 Hrs)**

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS **(9 Hrs)**

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identification considerations – direct identification – indirect identification

UNIT IV ADAPTIVE CONTROL SCHEMES **(9 Hrs)**

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS **(9 Hrs)**

State feedback design, Pole placement by state feedback, Set point tracking controller, Full order observer, Reduced order observer, Output feedback design, Theory Examples, Introduction to optimal control, Basics of optimal control, Performance indices, Linear Quadratic Regulator (LQR) design.

Text Books

1. Arun K. Tangirala, Principles of System Identification – Theory and Practice, CRC Press,2015.
2. Karl J. Astrom and Bjorn Witten mark, Adaptive Control, Pearson Education, Second edition, Fifth impression, 2009.
3. Kannan Moudgalya, Digital Control, JohnWiley & Sons, Ltd, 2007.
4. Sastry,S. and Bodson, M., Adaptive Control– Stability, Convergence and Robustness, Prentice Hall inc., New Jersey, 1989.

5. Soder storm T and Peter Stoica, System Identification, Prentice Hall International, 1989.

Reference Books

1. Bela. G. Liptak., "Process Control and Optimization, Instrument Engineers' Handbook", volume 2, CRC press and ISA, 2005.
2. William S. Levine, "Control Systems Advanced Methods, The Control Handbook", CRC Press 2011.
3. Ljung L, "System Identification: Theory for the user", Prentice Hall, Engle wood Cliffs,1987.

Web References

1. https://nptel.ac.in/courses/103/106/103106149/#
2. https://nptel.ac.in/courses/108/102/108102113/
3. http://www.personal.reading.ac.uk/~shshawin/LN/SI2018.pdf.
4. https://uotechnology.edu.iq/dep-cse/lectures%202017/control/st4/Adaptive%20Control_5.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	2	1	-	-	-	-	-	-	2	2	1	2
2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
3	3	2	3	2	2	-	-	-	-	-	-	2	2	2	3
4	2	1	1	2	1	-	-	-	-	-	-	2	2	3	3
5	3	2	3	2	2	-	-	-	-	-	-	2	2	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE823	ADVANCED INSTRUMENTATION SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To review the instruments used for measurement of basic process parameters like level, flow, pressure and temperature.
- To explore the various types of analyzers used in industrial applications.
- To understand the requirement of safety instrumentation and risk analysis techniques.
- To familiarize with instrumentation standards.
- To familiarize with instrumentation symbols, process flow and piping diagrams.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the instrumentation behind flow, level, temperature and pressure measurement **(K1)**
CO2 - Acquire knowledge on various types of analyzers used in typical industries. **(K2)**
CO3 - Understand the role of safety instrumented systems in the industry. **(K1)**
CO4 - Explore the standards for applying instrumentation in hazardous locations. **(K2)**
CO5 - Design, develop and interpret the documents used to define instruments and control systems. **(K3)**

UNIT I MEASUREMENT OF PROCESS PARAMETERS **(9 Hrs)**

Review the various measurement techniques of temperature, pressure, flow and level- application- selection of sensors- calibration methods

UNIT II INSTRUMENTS FOR ANALYSIS **(9 Hrs)**

Ion selective electrodes: Gas and liquid chromatography- Oxygen analyzers for gas and liquid – CO, CO2, NO and SO Analyzers – Hydrocarbon and HS analyzers – Dust Analyzers, smoke analyzers, toxic gas analyzers and radiation monitoring.

UNIT III SAFETY INSTRUMENTATION **(9 Hrs)**

Introduction to safety instrumented systems – Hazards and Risk- Process Hazards Analysis (PHA) – Safety life cycle – Control and Safety Systems – Safety Instrumented function – Safety Integrity Level (SIL) – Selection, Verification and Validation.

UNIT IV INSTRUMENTATION STANDARDS **(9 Hrs)**

Instrumentation Standards – Significance of codes and standards – Overview of various types – Introduction of various Instrumentation Standards – review, interpretation and significance of specific standards – examples of usage of standards on specific applications.

UNIT V DOCUMENTATION IN PROCESS INDUSTRIES **(9 Hrs)**

Block Diagram of a typical Process – Instrumentation Symbols, Abbreviations and Identification for Instruments: - Mechanical Equipment, Electrical Equipment, Instruments and Automation Systems – Process flow diagram (PFD) – Piping and Instrumentation Diagram (P and ID) – Instrument Lists and specification – Logic Diagrams – Instrument Loop Diagrams – Instrument Hookup Diagrams – Location Plans for instruments – Cable Routing Diagrams – Typical Control / Rack Rooms Layout – Vendors Documents and Drawings.

Text Books

1. B. G. Liptak, "Instrumentation Engineers Handbook (Process Measurement and Analysis)", Fourth Edition, Chilton Book Co, CRC Press, 2005.

Reference Books

1. SwapanBasu, "Plant Hazard analysis and Safety Instrumentation Systems" Academic Press, 2016.
2. Al. Sutko, Jerry. D. Faulk, "Industrial Instrumentation", Delmer Publishers, 1996.
3. Paul Gruhn, P.E., CFSE and Harry Cheddie, P.E., "Safety Instrumented Systems: Design, Analysis, and Justification", 2nd Edition, ISA 2006.

Web References

1. https://www.eolss.net/Sample-Chapters/C05/E6-39A-04-08.pdf
2. https://www.nap.edu/read/11520/chapter/4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	1	-	-	-	-	2	-	3	2	2	2
2	3	3	3	2	2	-	-	-	-	2	-	3	1	2	2
3	3	2	3	2	2	-	-	-	-	3	-	3	1	2	3
4	2	3	2	2	1	-	-	-	-	3	-	3	2	2	3
5	3	2	3	3	2	-	-	-	-	2	-	2	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE824 **INDUSTRIAL DATA NETWORKS**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To educate on the basic concepts of data networks
- To give an overview of the Field bus
- To gain knowledge on instrumentation network design and upgrade.
- To impart knowledge in PROFIBUS protocol.
- To introduce industrial Ethernet and wireless communication

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand and analyse Instrumentation systems and their applications to various industries. **(K1)**
CO2 - Illustrate Field bus used in process digital communication. **(K2)**
CO3 - Impart knowledge on the instrumentation network design and upgrade. **(K3)**
CO4 - Summarize the operation of MODBUS, PROFIBUS protocol and its applications. **(K2)**
CO5 - Explain and adopt the different Industrial Ethernet protocol and usage of wireless communication in process applications. **(K1)**

UNIT I DATA NETWORK FUNDAMENTALS **(9 Hrs)**

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

UNIT II FIELD BUS **(9 Hrs)**

Use of fieldbuses in industrial plants, functions, international standards, performance, use of Ethernet networks, fieldbus advantages and disadvantages. Fieldbus design, installation, economics and documentation.

UNIT III INSTRUMENTATION NETWORK DESIGN AND UPGRADE **(9 Hrs)**

Instrumentation design goals, cost optimal and accurate sensor networks. Global system architectures, advantages and limitations of open networks, HART network and Foundation fieldbus network.

UNIT IV PROFIBUS-PA: **(9 Hrs)**

Basics, architecture, model, network design and system configuration. Designing PROFIBUS-PA and Foundation Fieldbus segments: general considerations, network design.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION **(9 Hrs)**

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 Books

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data, Newnes; 1st edition 2004.
2. Steve Mackay, Edwin Wright, Deon Reynders, John Park Networks Design, Installation and Troubleshooting" Newnes Publication, Elsevier 1st edition, 2004.
3. William Buchanan, "Computer Buses", CRC press, 2000.
4. B.G. Liptak, Process software and digital networks, CRC press, Florida, 3rd Edition 2011.
5. Noltingk B.E., Instrumentation Reference Book, Butterworth Heinemann, 2nd Edition, 1995.

Reference Books

1. Behrouz Forouzan, Data Communications and Networking, Tata McGraw Hill Education, New Delhi, 2010.

2. Steve Mackay, Edwin Wright, Deon Reynders, John Park, "Practical Industrial Data", Newnes 1st edition 2004.
3. Networks: Design, "Installation and Troubleshooting", Newnes, An imprint of Elsevier, 2004.
4. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Prentice Hall of India Pvt. Ltd., 5th Edition, 2011

Web References

1. https://nptel.ac.in/courses/106/105/106105082/.
2. https://lecturenotes.in/subject/903/industrial-data-networks-idn.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	3	-	2	1	1	2
2	3	2	1	-	1	-	-	-	-	3	-	2	2	1	2
3	3	2	2	-	1	-	-	-	-	3	-	2	2	1	2
4	2	2	2	-	1	-	-	-	-	3	-	2	2	1	2
5	3	2	2	-	1	-	-	-	-	3	-	2	2	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE825	FIELD INSTRUMENTATION AND CABLING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To review the IC technologies.
- To obtain knowledge on foundation field bus networks.
- To get adequate Knowledge on the model and design of profibus networks.
- To understand and acquaint fiber optic networks.
- To enable the students to understand the network installation and security.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Impart knowledge on IC technologies. **(K1)**
CO2 - Describe working of foundation fieldbus. **(K2)**
CO3 - Understand and outline profibus networks. **(K1)**
CO4 - Understand and explore fiber optic networks. **(K1)**
CO5 - Interpret and to specify use of network installation and security. **(K3)**

UNIT I REVIEW OF IC TECHNOLOGIES **(9 Hrs)**

Proprietary and open networks- Hardware selection for Field bus systems -Sorting the protocols. Field bus trends-Advantages and Disadvantages- Design- installation-economics and documentation. Hart Networks-Hart protocol, field Devices- calibration- Hart applications, installing Hart Networks, Device Descriptions and Applications. Wireless transmitters and their architecture, Wireless Hart.

UNIT II FOUNDATION FIELDBUS NETWORKS **(9 Hrs)**

Standards, field bus Architecture and user Layer, H1 and HSE specifications, Segment design.

UNIT III PROFIBUS NETWORKS **(9 Hrs)**

Basics, Block Model, Applications, Network Design-system configuration and Developments. Profibus PA and DP specifications. Segment design.

UNIT IV FIBER-OPTIC NETWORKS **(9 Hrs)**

Principles- Types of Cables- Network Design-installation finishing- inspection and Testing, Modulation/Demodulation techniques.

UNIT V NETWORK INSTALLATION AND SECURITY **(9 Hrs)**

Network components, Configuring routers and switches. Physical security, security policies, Encryption, Identity verification, OS security, Login and password security, protection from viruses, preventive measures, internet access, Digital certificates, Network security with Firewalls.

Text Books

1. Instrument Engineers Handbook 'Process software and Digital Networks': Bela Liptak, CRC process. 2012.
2. Sunit Kumar Sen, "Fieldbus and Networking in Process Automation", CRC Press,2021.
3. Jonas Berge, "Fieldbuses for Process Control", ISA Publisher, 2004.

Reference Books

1. Samuel M. Herb, "Understanding Distributed Process system for control", ISA,2016.
2. Rich Mcmahon, "Introduction to Networking", McGraw Hill Education, 2014.
3. Terry L. M. Bartelt, "Instrumentation and Process Control", Delmar Cengage Learning, 1st edition, 2010.

Web References

1. https://www.youtube.com/watch?v=IVzANPsrEOs

2. https://www.specialcables.co.in/instrumentation-cables/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	3	-	2	1	1	2
2	3	1	1	-	1	-	-	-	-	3	-	2	2	1	2
3	3	1	2	-	2	-	-	-	-	3	-	2	2	1	2
4	2	2	2	-	2	-	2	-	-	3	-	2	2	1	2
5	3	2	2	-	2	-	2	-	-	3	-	2	2	1	2

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE826	DESIGN OF PROCESS CONTROL SYSTEM COMPONENTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the working of process control systems.
- To impart knowledge measurement of instrumentation systems.
- To understand about the control valves types and its characteristics.
- To make the students to understand about the types of pumps and its characteristics
- To obtain knowledge on Interlocks and alarms and its types

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret and formulate design specifications for instrumentation systems that meet accuracy and sampling speed requirements. **(K1)**

CO2 - Design, construct, and verify an instrumentation system to meet desired Specifications. **(K3)**

CO3 - Get familiar with control valves, types and its characteristics. **(K2)**

CO4 - Acquaint with the concept Pumps and its characteristics and types. **(K1)**

CO5 - Understand and interpret the concept of Interlocks and alarms. **(K3)**

UNIT I INTRODUCTION TO PROCESS CONTROL COMPONENTS **(9 Hrs)**

Orifice meter - design of orifice for given flow condition - design of rotameter - design of RTD measuring circuit - design of cold junction compensation circuit for thermocouple using RTD - Transmitters – zero and span adjustment in D/P transmitters and temperature transmitters

UNIT II MEASUREMENTS OF INSTRUMENTATION SYSTEMS **(9 Hrs)**

Bourdon gauges - factors affecting sensitivity - design aspect of Bourdon tube -design of Air purge system for level measurement. Electronic P+I+D controllers - design - adjustment of set point, bias and controller settings.

UNIT III CONTROL VALVES **(9 Hrs)**

Control valves - characteristics of control valves - types of valve bodies - valve characteristics - materials for body and trim - sizing of control valves - cavitations, flashing in control valves- selection of body materials and characteristics of control valves for typical applications

UNIT IV TYPES OF PUMPS **(9 Hrs)**

Types of pumps - pump performance - Different types of pump systems- characteristics of pump system- pressure, friction and flow - pump operation - maintenance - instruments used in pumping practice - pump noise and vibration - selection of pumps.

UNIT V INTERLOCKS AND ALARMS **(9 Hrs)**

Interlocks and alarms: Interlock design principles, fail-safe design - alarms and their types. Design of logic circuits for alarm and annunciator circuits, interlocks design

Text Books

1. N.A. Anderson, Instrumentation for Process Measurement and Control, Chilton Company,2012.
2. D.M. Considine, Process Instruments and Controls Handbook, McGraw-Hill, reprint 2013.

Reference Books

1. R.H. Warring, Pumping Manual, Gulf Publishing Co., 2011.
2. P. Bentley, Principles of Measurement Systems, Longman Inc., 2008.
3. Dr. R.K. Bansal, "Fluid Mechanics",Laxmi Publications Private limited, 2015.

Web References

1. https://www.youtube.com/watch?v=sF88DdDCrRA
2. https://www.youtube.com/watch?v=1rO9nJriVR0

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	2	1	1	1	-	-	1	1	1	-	1	2	1
2	2	2	2	1	1	1	-	2	1	1	1	-	1	2	1
3	1	1	2	1	1	1	-	1	1	1	1	-	1	2	1
4	1	1	2	1	1	1	-	-	1	1	1	-	1	2	1
5	1	1	2	1	1	1	-	1	1	1	1	-	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE827	RENEWABLE ENERGY RESOURCES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the trends in energy consumption
- To know the operation of solar power system
- To know the operation of wind energy system
- To obtain knowledge on fuel cells
- To acquire knowledge on distributed generations

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the energy scenario for different energy resources. **(K1)**
CO2 - Acquire knowledge on the operation and types of solar power system. **(K2)**
CO3 - Obtain knowledge on the operation of wind energy systems **(K2)**
CO4 - Acquaint with the concept fuel cells and its types **(K1)**
CO5 - Understand the concept distributed generations. **(K1)**

UNIT I INTRODUCTION **(9 Hrs)**

Trends in energy consumption - Energy sources and their availability – Yield Energy ratio: Classification of Energy sources, Conventional Energy Resources: Coal Oil, Natural Gas, Nuclear Power and Hydro. Sector-wise Energy Consumption, Energy Scenario in India, Growth of Energy Sector and its planning in India - Need for Renewable Energy sources

UNIT II SOLAR POWER SYSTEMS **(9 Hrs)**

Solar Thermal Systems: Principle and operation – Low, Medium and High Temperature Systems. Solar Photovoltaic Systems: Solar cells and their characteristics - Influence of Insolation and Temperature - PV arrays – Maximum Power Point Tracking Algorithms.

UNIT III WIND ENERGY SYSTEMS **(9 Hrs)**

Nature and Power in the wind - Wind Energy Conversion System (WECS) - Components and Classification of a WECS - Yaw and Pitch Control - Betz model - Wind Turbines – Types - Horizontal and Vertical Axis Wind Turbines. Generators for WECS – Types - Selection of Generators – Permanent Magnet Synchronous Generators - Schemes for Fixed and Variable Speed Wind Turbines

UNIT IV FUEL CELLS **(9 Hrs)**

Principle and operation – Types –Efficiency –Effect of Polarization on Efficiency- Construction and Working of H2O2 and Proton Exchange Membrane Fuel Cell. Introduction to Hydrogen Energy Production and Storage.

UNIT V DISTRIBUTED GENERATION **(9 Hrs)**

Distributed Generation – Concept and topologies, Role of Renewable Energy in Distributed Generation, Standards for Interconnecting Distributed Generation to Power Systems –SMART grid Definition, Various components, Smart Grid architecture, Application and standards in Distributed Generation, Grid Connected PV System – Overview of Islanding – Stand-alone PV systems – Concentrated Solar PV systems.

Text Books

1. Khan B H, "Non-Conventional Energy Resources‖", Tata McGraw-Hill, New Delhi 2010.
2. Mukund R Patel, "Wind and Solar Power Systems‖", CRC Press, New York, 2011.
3. Gregory W. Massey, PE., "Essentials of Distributed Generation Systems", Jones and Bartlett Publishers, Sudburg, 2009.
4. J. Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley-IEEE Press, 1st Edition, 2012.

Reference Books

1. Rai G D, "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2004.
2. Bhadra S N, Banerjee S, Kastha D, "Wind Electrical Systems II", Oxford University Press, New Delhi, 2008.
3. Colleen Speigel, "PEM Fuel Cell Modeling and Simulation Using MATLABII", Academic Press, New Delhi, 2008.
4. G. Masters, "Renewable and Efficient Electric Power Systems", IEEE- John Wiley and Sons Ltd. Publishers, 2nd edition, 2013

Web References

1. https://www.energy.gov/eere/renewable-energy
2. https://www.nationalgrid.com/stories/energy-explained/what-are-different-types-renewable-energy
3. http://www.nibe.res.in/
4. https://mnre.gov.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	-	-	2	-	3	-	1	2
2	3	3	3	2	-	-	-	-	-	2	-	3	-	2	2
3	3	2	3	2	-	-	-	-	-	3	-	3	-	2	3
4	2	3	2	2	-	-	-	-	-	3	-	3	-	2	3
5	3	2	3	3	-	-	-	-	-	2	-	2	-	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE828	INSTRUMENTATION FOR AGRICULTURAL AND FOOD PROCESSING INDUSTRIES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide an understanding on the need of instrumentation in agriculture and food processing sector.
- To impart knowledge on food quality assessment.
- To acquaint knowledge on agriculture associated activities and instruments.
- To impart knowledge on green houses and instrumentation.
- To provide design knowledge in food processing equipment.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the necessity of instrumentation in agriculture and food processing. **(K2)**
CO2 - Understand the usage of instrumentation for food quality assurance. **(K2)**
CO3 - Familiarize with instrumentation requirement in agriculture and food processing. **(K2)**
CO4 - Understand the green houses and instrumentation. **(K3)**
CO5 - Design equipment for agriculture and food processing. **(K4)**

UNIT I INTRODUCTION TO FOOD PROCESSING AND AGRICULTURE SENSOR **(9 Hrs)**

Introduction: Necessity of instrumentation and control for food processing and agriculture sensor requirement, remote sensing, biosensors in Agriculture, standards for food quality.

UNIT II INSTRUMENTATION FOR FOOD QUALITY ASSURANCE **(9 Hrs)**

Instrumentation for food quality assurance: Instrumental measurements and sensory parameters. Inline measurement for the control of food processing operations: colour measurements of food, food composition analysis using infrared, microwave measurements of product variables, pressure and temperature measurement in food process control, level and flow measurement in food process control, ultrasonic instrumentation in food industry.

UNIT III INSTRUMENTATION FOR AGRICULTURE **(9 Hrs)**

Instrumentation for Agriculture: Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems & it's performance, comparison of different irrigation systems, soil moisture measurement methods. Major Processes: Application of SCADA for DAM parameters and control, Water distribution and management control, Auto-Drip irrigation systems, Irrigation Canal management, upstream and downstream control concepts, supervisory control.

UNIT IV GREEN HOUSES AND INSTRUMENTATION **(9 Hrs)**

Green houses and Instrumentation: Ventilation, cooling and heating wind speed, temperature and humidity, rain gauge, carbon dioxide enrichment measurement and control.

UNIT V DESIGN CONSIDERATIONS OF AGRICULTURAL AND FOOD PROCESSING EQUIPMENTS **(9 Hrs)**

Design considerations of agricultural and food Processing Equipments: Design of Food Processing equipments, dryers, design of dryers PHTC, RPEC, LSU and Drum Dryer, determination of heat and air requirement for drying grains.

Text Books

1. Erika Kress-Rogers, Christopher J.B. Brimelow., "Instrumentation and Sensors for the Food Industry", Woodhead Publishing, 2001.
2. Manabendra Bhuyan., "Measurement and control in food processing", CRC/Taylor & Francis Publications, 2007.

3. P.J. Fellows, "Food Processing Technology Principles and Practice", Woodhead Publishing, 3rd edition, 2009.
4. Semioh Otles, "Methods of analysis of food components and additives", CRC Press, Taylor and Francis group, 2nd edition, 2012.

Reference Books

1. McMillan G. K., Considine D. M., "Process/Industrial Instruments and Controls Handbook", McGraw Hill International, 5th edition,1999.
2. Liptak B. G., "Instrument Engineers Handbook", Process Measurement Volume I and Process Control Volume II, CRC press, 4th Edition,2005.
3. Hall C. W., Olsen W. C, "The literature of Agriculture Engineering", Cornell University Press, 1992.
4. Sahu J. K., "Fundamentals of Food Process Engineering", Alpha Science Intl Ltd, 2016.
5. G.E. Meyer and Yufeng Ge., "Instrumentation and Controls for Agricultural and Biological Engineering Applications, using LabVIEW® and other Modern tools as Support Systems", Semantic Scholar, 2008.

Web References

1. https://www.linkedin.com/pulse/importance-instrumentation-agriculture-shamitha-kr
2. https://www.branom.com/instruments-industry-food-beverage
3. https://www.foodengineeringmag.com/keywords/instrumentation
4. https://www.nuvisioninstrumentation.com/instrumentation-food-and-beverage-industry/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	-	2	2	2	-	-	-	1	3	1	2	2
2	2	2	2	-	2	2	2	-	-	-	2	3	1	3	2
3	3	2	3	-	2	2	2	-	-	-	3	3	1	3	3
4	2	2	3	-	2	2	2	-	-	-	1	3	1	2	3
5	2	2	3	-	2	2	2	-	-	-	-	2	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE829	CYBER SECURITY IN INDUSTRIAL AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To get adequate knowledge on the security process for Industrial Control System.
- To learn about the threats in Industrial Control System
- To gain more idea and to apply Industrial Control System vulnerabilities
- To develop critical thinking for Cyber security in SCADA system
- To make the students to understand and to apply Industrial Sectors Cyber Security

Course Outcomes

Upon completion of the course, students shall have ability to

CO1 - Learn detail about cyber security for Industrial Control System. **(K1)**
CO2 - Describe about threats in Industrial Control System. **(K2)**
CO3 - Achieve basic idea and to apply Industrial Control System vulnerabilities. **(K3)**
CO4 - Attain critical thinking for Cyber security in SCADA system. **(K3)**
CO5 - Understand and apply Industrial Sectors Cyber Security. **(K3)**

UNIT I CYBER SECURITY FOR INDUSTRIAL CONTROL SYSTEM (9 Hrs)

Industrial Control System-Industrial control system security different than regular IT security-ICS-ICS compare to safety instrument system-Components of Typical ICS/SCADA systems-SCADA system-Supervisory Control and Data Acquisition-Remote Terminal Unit (RTU)-Distributed Control System (DCS)-Programmable Logic Controller.

UNIT II THREATS TO ICS (9 Hrs)

Threats to ICS: Threat treatment in ICS and IT-Threats to ICS-Threat –to and threat-from-most series treat to ICS-Hi-jacking malware-The reproductive cycle of modern malware- A socks 4/sock 5/HTTP connect proxy-SMTP spam engine-porn dialers

UNIT III ICS VULNERABILITIES (9 Hrs)

ICS Vulnerability versus IT vulnerability-Availability, Integrity and Confidentiality-Purdue Enterprise Reference Architecture-PERA levels-Levels 5- level 4-level 3-level 2-level1-level 0- an ironic comment on PERA

UNIT IV CYBER SECURITY FOR SCADA SYSTEMS (9 Hrs)

SCADA security architecture: Commercial hardware and software vulnerabilities - Operating system-TCP/IP Firewalls-Traditional security feature of SCADA system-Eliminating the vulnerabilities of SCADA system reporting and investigation – measuring safety performance – workman compensation rules.

UNIT V INDUSTRIAL SECTORS CYBER SECURITY (9 Hrs)

ICS Application security: Application security-Application security testing_ ICS application patching-ICS secure SDLC-Case Studies: Water/waste water industry specific cyber security-Piping Industry-specific cyber security issues-Emerging cyber threat to SCADA system

Text Books

1. K S Manoj, "Cyber Security: In Industrial Automation", India: Notion Press, 2020.
2. Pascal Ackerman, "Industrial Cyber Security Efficiently secure critical infrastructure systems", Packt Publisher, 2017.
2. William T.Shaw, "Cyber security for SCADA systems", Pennwel publisher, 2006.

Reference Books

1. Culp. A. W, "Principles of Energy Conservation", McGraw Hill Book Co., 2012.
2. R.A. Kisner, W.W. Manges, "Cyber security through Real-time Distributed Control Systems", UT-Battelle, publisher, 2010.

Web References

1. https://www.assetguardian.com/cyber-security-management-of-industrial-automation-and-control-systems-iacs/
2. https://www.youtube.com/watch?v=SCzdtXDus7A

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	-	-	2	-	3	2	1	2
2	3	3	3	2	-	-	-	-	-	2	-	3	1	1	2
3	3	2	3	2	-	-	-	-	-	3	-	3	1	1	3
4	2	3	2	2	-	-	-	-	-	3	-	3	2	1	3
5	3	2	3	3	-	-	-	-	-	2	-	2	2	1	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ICE830	SAFETY INSTRUMENTED SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To get adequate knowledge on the safety instrumented system.
- To learn about protection layers and safety requirements
- To gain more idea of the safety integrity level for an application.
- To Develop critical thinking for system evaluation
- To make the students to understand and to apply safety instrument system case studies

Course Outcomes

Upon completion of the course, students shall have ability to

CO1 - Analyse the role of safety instrumented systems in the industry. **(K3)**

CO2 - Identify and analyse the hazards. **(K2)**

CO3 - Determine the safety integrity level for an application. **(K3)**

CO4 - Analyse the failure modes, failure rates and MTBF using various reliability engineering tools. **(K3)**

CO5 - Apply the design, installation and maintenance procedures for SIS applied to industrial processes. **(K4)**

UNIT I INTRODUCTION **(9 Hrs)**

Safety Instrumented System (SIS): need, features, components, difference between basic process control system and SIS - Risk: how to measure risk, risk tolerance, Safety integrity level, safety instrumented functions - Standards and Regulation – HSE-PES, AICHE-CCPS, IEC-61508, ANSI/ISA-84.00.01-2004 (IEC 61511 Mod) & ANSI/ISA – 84.01-1996, NFPA 85, API RP 556, API RP 14C, OSHA (29 CFR 1910.119 – Process Safety Management of Highly Hazardous Chemicals – SIS design cycle - Process Control vs. Safety Control.

UNIT II PROTECTION LAYERS AND SAFETY REQUIREMENT SPECIFICATIONS **(9 Hrs)**

Prevention Layers: Process Plant Design, Process Control System, Alarm Systems, Procedures, Shutdown/Interlock/Instrumented Systems (Safety Instrumented Systems – SIS), Physical Protection - Mitigation Layers: Containment Systems, Scrubbers and Flares, Fire and Gas (F&G) Systems, Evacuation Procedures - Safety specification requirements as per standards, causes for deviation from the standards.

UNIT III SAFETY INTEGRITY LEVEL (SIL) **(9 Hrs)**

Evaluating Risk, Safety Integrity Levels, SIL Determination Method: As Low as Reasonably Practicable (ALARP), Risk matrix, Risk Graph, Layers of Protection Analysis (LOPA) – Issues related to system size and complexity – Issues related to field device safety – Functional Testing.

UNIT IV SYSTEM EVALUATION **(9 Hrs)**

Failure Modes, Safe/Dangerous Failures, Detected/Undetected Failures, Metrics: Failure Rate, MTBF, and Life, Degree of Modeling Accuracy, Modeling Methods: Reliability Block Diagrams, Fault Trees, Markov Models - Consequence analysis: Characterization of potential events, dispersion, impacts, occupancy considerations, consequence analysis tools - Quantitative layer of protection analysis: multiple initiating events, estimating initiating event frequencies and IPL failure probabilities.

UNIT V CASE STUDY **(9 Hrs)**

SIS Design checklist - Case Description: Furnace/Fired Heater Safety Shutdown System: Scope of Analysis, Define Target SILs, Develop Safety Requirement Specification (SRS), SIS Conceptual Design, Lifecycle Cost Analysis, verify that the Conceptual Design Meets the SIL, Detailed Design, Installation, Commissioning and Pre-start-up Tests, Operation and Maintenance Procedures.

Text Books

1. Lucchini, S., Gruhn, P. "Safety Instrumented Systems: A Life-cycle Approach", United States: International Society of Automation, 2019.
2. Paul Gruhn and Harry L. Cheddie, "Safety Instrumented systems: Design, Analysis and Justification", ISA, 2nd edition, 2018.
3. Eric W. Scharpf, Heidi J. Hartmann, Harlod W. Thomas, "Practical SIL target selection: Risk analysis per the IEC 61511 safety Lifecycle, exida" 2nd edition 2016.

Reference Books

1. William M. Goble and Harry Cheddie, "Safety Instrumented Systems Verification: Practical Probabilistic Calculations ISA", 2005.
2. Edward Marszal, Eric W. Scharpf, "Safety Integrity Level Selection: Systematic Methods Including Layer of Protection Analysis", ISA, 2002.

Web References

1. https://instrumentationtools.com/category/safety-instrumented-system/
2. https://www.safeopedia.com/definition/5011/safety-instrumented-systems-sis
3. https://www.aiche.org/sites/default/files/2009-07-Beacon-English.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	3	-	2	1	1	2
2	3	2	1	-	1	2	2	-	-	3	-	2	2	2	2
3	3	2	2	-	2	2	1	-	-	3	-	2	2	2	2
4	2	2	2	-	2	2	1	-	-	3	-	2	2	2	2
5	3	2	3	-	2	2	2	-	-	3	-	2	2	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

Annexure–III

(Professional Electives, Open Electives and Employability Enhancement Courses)

Annexure III

Professional Elective Course to be opted for Batch 2020-2024 for V semester, R-2020

Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20ICE506	Telemetry and Telecontrol
2	U20ICE507	Advanced Control System
3	U20ICE508	Industrial Electronics
4	U20ICE509	MEMS and NEMS
5	**U20ICE510**	**Industrial Unit Operations**

U20ICE510	INDUSTRIAL UNIT OPERATIONS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge on pertaining to overview of unit operations.
- To give an idea about unit operations in transport of solids, liquids & gases
- To understand the various unit operations involved in chemical reactors, steam boilers, furnaces.
- To Gain knowledge about the operations of evaporators, crystallizers and dryers.
- To Gain knowledge on the operation of Pumps, compressors, and centrifuges.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Define unit operations, unit process and types of reactions involved in different industries. **(K2)**

CO2 - Understand the unit operations in transportation of solids, liquids and gases. **(K2)**

CO3 - Develop knowledge on the unit operations in different processes of distillation. **(K2)**

CO4 - Outline the working principle and operation of different processes of Dryers, Crystallizers and Evaporators. **(K2)**

CO5 - Analyze the unit operation in pumps compressors with case studies. **(K3)**

UNIT I OVERVIEW OF UNIT OPERATIONS **(9 Hrs)**

Introduction to industrial processes - Concepts of unit operations and unit processes - Material balance and energy balance -Types of reactions - General idea of controlling operations.

UNIT II TRANSPORT OF SOLIDS, LIQUIDS AND GASES **(9 Hrs)**

Study of Unit operation in Transport of Solids, liquids and gases - Different crushers and grinders - Adjusting of particle size, Mixing- Separation- Leaching and extraction.

UNIT III DISTILLATION, CHEMICAL REACTORS, STEAM BOILERS, FURNACES **(9 Hrs)**

Study of Unit operation in Distillation: Flash distillation - Batch distillation- Continuous distillation- Operational features- construction and working principle of Chemical reactors- Steam boilers- Furnaces

UNIT IV DRYERS, CRYSTALLIZERS, EVAPORATOR **(9 Hrs)**

Study of Unit operation in Dryers, Crystallization, Evaporators, Heat exchangers, Humidification, De-humidification - Different types - operational features, construction and working principle.

UNIT V PUMPS, COMPRESSORS,EXTRUDERS, BLOWERS, CENTRIFUGES **(9 Hrs)**

Study of Unit operation in Pumps, Compressors, Extruders, Blowers, Centrifuges - operational features, construction and working principle. **Case studies:** Unit Operations and Control schemes applied to Thermal Power plant, Paper and Pulp Industry.

Text Books

1. Balchen ,J.G., and Mumme, K.J., " Process Control structures and applications", Van Nostrand Reinhold Co., New York,1988.
2. Warren L. McCabe, Julian C. Smith and Peter Harriot, "Unit Operations of Chemical Engineering", McGraw-Hill International Edition, New York, Sixth Edition,2001.
3. James R.couper, Roy Penny, W., James R.Fair and Stanley M.Walas, "Chemical Process Equipment Selection and Design", Gulf Professional Publishing,2010.

Reference Books

1. Waddams, A.L., "Chemicals from petroleum", Butler and Taner Ltd., UK,1969.

2. Liptak, B.G., "Process measurement and analysis", Chilton Book Company, USA,1995
3. Luyben W.C., "Process Modeling, Simulation and Control for Chemical Engineers", McGraw- Hill.
4. McCabe, W.L., J.C. Smith and P. Harriot, "Unit Operations of Chemical Engineering". McGraw Hill. Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001 ,
5. Geankoplis C.J.1999. Transport Process and Unit Operations. Prentice-Hall of India Private Limited, New Delhi.

Web References

1. https://www.youtube.com/watch?v=9M0HqQEFL6k
2. https://nptel.ac.in/courses/103107127/
3. https://www.docsity.com/en/ontroductions-unit-operations-lecture-slides/394376/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	1	1	-	-	-	-	-	3	-	2
2	3	-	-	-	-	1	1	-	-	-	-	-	3	-	3
3	3	-	-	-	-	1	1	-	-	-	-	-	3	-	3
4	3	-	-	-	-	1	1	-	-	-	-	-	3	-	3
5	3	-	-	-	-	1	1	-	-	-	-	-	3	-	3

Correlation Level: 1-Low, 2-Medium, 3- High

Professional Elective Course to be opted for Batch 2019-2023 for VIII semester, R-2019

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE80	**Industrial safety**
2	U19ICE81	System Identification and Adaptive Control
3	U19ICE82	Advanced Instrumentation system
4	U19ICE83	Industrial Data Networks
5	U19ICE84	Field Instrumentation and cabling
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ICE85	**Design of Process Control System Components**
2	U19ICE86	Renewable Energy Resources
3	U19ICE87	Industry 4.0
4	U19ICE88	Cyber Security in Industrial Automation
5	U19ICE89	Piping and Instrumentation Diagram

U19ICE80	INDUSTRIAL SAFETY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the concept of Industrial Safety and provide knowledge for workplace safety
- To acquire knowledge in identification, evaluation and control of all the hazards
- To prevent harm or damage to people, property, or the environment.
- To conduct safety audits
- To improve safety practices

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify hazard and potential hazard areas **(K1)**
CO2 - Develop safety programs to prevent or mitigate damage or losses. **(K1, K2)**
CO3 - Assess safety practices and programs. **(K1,K2, K3)**
CO4 - Conduct safety audits. **(K1,K2)**
CO5 - Improve safety practices. **(K1)**

UNIT I INDUSTRIAL SAFETY **(9 Hrs)**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, 103 cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING **(9 Hrs)**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost and its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION **(9 Hrs)**

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING **(9 Hrs)**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE **(9 Hrs)**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books

1. Higgins and Morrow, Maintenance Engineering Handbook, Da Information Services, 1994.

2. H. P. Garg, Maintenance Engineering, S. Chand and Company Ltd, 2012

Reference Books

1. Frank D Graham, Audels Pumps-Hydraulic Air Compressors, Mcgraw Hill Publication, 1949.
2. Fang, Hsai-Yang,Foundation Engineering Handbook, Chapman & Hall, London

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
2	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
3	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-
4	2	-	1	-	-	1	1	-	-	-	-	-	1	-	-
5	3	-	1	-	-	1	1	-	-	-	-	-	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

U19ICE85	DESIGN OF PROCESS CONTROL SYSTEM COMPONENTS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the health and safety implications of working with process control systems
- To know the operation of typical instrumentation systems
- To Identify the various methods of signal transmission
- To make the students to understand about the types of pumps and its characteristics
- To obtain knowledge on Interlocks and alarms and its types

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret and formulate design specifications for instrumentation systems that meet accuracy and sampling speed requirements. **(K1)**

CO2 - Design, construct, and verify an instrumentation system to meet desired Specifications. **(K1, K2, K3)**

CO3 - Get familiar with safety issues concerning design of instrumentation, including the effects of electric current through tissue and defibrillation **(K1, K2)**

CO4 - Acquaint with the concept Pumps and its characteristics and types **(K1)**

CO5 - Understand and interpret the concept Interlocks and alarms. **(K1, K3)**

UNIT I INTRODUCTION TO PROCESS CONTROL COMPONENTS **(9 Hrs)**

Orifice meter - design of orifice for given flow condition - design of rotameter - design of RTD measuring circuit - design of cold junction compensation circuit for thermocouple using RTD - Transmitters – zero and span adjustment in D/P transmitters and temperature transmitters

UNIT II MEASUREMENTS OF PH CONTROLLERS **(9 Hrs)**

Bourdon gauges - factors affecting sensitivity - design aspect of Bourdon tube -design of Air purge system for level measurement. Electronic P+I+D controllers - design - adjustment of set point, bias and controller settings.

UNIT III CONTROL VALVES **(9 Hrs)**

Control valves - characteristics of control valves - types of valve bodies - valve characteristics - materials for body and trim - sizing of control valves - cavitations, flashing in control valves- selection of body materials and characteristics of control valves for typical applications

UNIT IV TYPES OF PUMPS **(9 Hrs)**

Types of pumps - pump performance - Different types of pump systems- characteristics of pump system- pressure, friction and flow - pump operation - maintenance - instruments used in pumping practice - pump noise and vibration - selection of pumps.

UNIT V INTERLOCKS AND ALARMS **(9 Hrs)**

Interlocks and alarms: Interlock design principles, fail-safe design - alarms and their types. Design of logic circuits for alarm and annunciator circuits, interlocks design

Text Books

1. N.A.Anderson, Instrumentation for Process Measurement and Control, Chilton Company,2012
2. D.M.Considine, Process Instruments and Controls Handbook, McGraw-Hill.reprint 2013

Reference Books

1. R.H.Warring, Pumping Manual, Gulf Publishing Co., 2011.

2. P.Bentley, Principles of Measurment Systems, Longman Inc., 2008.

Web References

1. https://www.youtube.com/watch?v=sF88DdDCrRA
2. https://www.youtube.com/watch?v=1rO9nJriVR0

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	2	1	1	1	-	-	1	1	1	-	1	2	1
2	2	2	2	1	1	1	-	2	1	1	1	-	1	2	1
3	1	1	2	1	1	1	-	1	1	1	1	-	1	2	1
4	1	1	2	1	1	1	-	-	1	1	1	-	1	2	1
5	1	1	2	1	1	1	-	1	1	1	1	-	1	2	1

Correlation Level: 1-Low, 2-Medium, 3- High

Open Elective-III

Open Elective Course to be opted for Batch 2020-2024 for V semester, R-2020

Open Elective – II / Open Elective – III		
U20HSO501	**Product Development and Design**	MBA
U20HSO502	Intellectual Property and Rights	MBA
U20HSO503	Marketing Management and Research	MBA
U20HSO504	Project Management for Engineers	MBA
U20HSO505	Finance for Engineers	MBA

U20HSO501	PRODUCT DEVELOPMENT AND DESIGN	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide the basic concepts of product design, product features and its architecture.
- To have a basic knowledge in the common features a product has and how to incorporate them suitably in product.
- To enhance team working skills.
- To design some products for the given set of applications.
- To compete with a set of tools and methods for product design and development.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply the concept for new product development. **(K3)**
CO2 - Validate knowledge on the concepts of product specification. **(K5)**
CO3 - Describe the principles of industrial design and prototyping. **(K2)**
CO4 - Apply knowledge on product architecture. **(K3)**
CO5 - Review the concept of product development and customer needs. **(K5)**

UNIT I INTRODUCTION TO PRODUCT DEVELOPMENT **(9 Hrs)**

Product development versus design, product development process, product cost analysis, cost models, reverse engineering and redesign product development process, new product development, tear down method.

UNIT II PRODUCT SPECIFICATIONS **(9 Hrs)**

Establishing the product specifications– Target specifications – Refining specifications, concept generation- Clarify the problem – Search internally – Search externally – Explore systematically - Reflect on the Results and the Process.

UNIT III PRODUCT CONCEPTS **(9 Hrs)**

A: Concept generation, product configuration, concept evaluation and selection, product embodiments.
B: Quality function deployment, product design specification, physical prototypes-types and technique, dimensional analysis, design of experiments.

UNIT IV PRODUCT ARCHITECTURE **(9 Hrs)**

Concept selection- Screening – scoring, Product architecture – Implication of architecture - Establishing the architecture – Related system level design issues.

UNIT V PROTOTYPING **(9 Hrs)**

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging.

Text Books

1. Kari T.Ulrich and Steven D.Eppinger,"Product Design and Development", McGraw-Hill International Edns.
2. Stephen Rosenthal, "Effective Product Design and Development", Business One Orwin, Homewood,
3. Otto, K. N. Product design: techniques in reverse engineering and new product development.

Reference Books

1. Ashby, M. F., & Johnson, K... Materials and design: the art and science of material selection in product design. Butterworth-Heinemann.
2. Kevin Otto and Kristin Wood, "Techniques in Reverse Engineering and New Product Development", Pearson Education, Chennai, Edition III.
3. Chitale A.V. and Gupta R.C., "Product Design and Manufacturing", 6th Edition, PHI.
4. Taurt Pugh,"Tool Design – Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY

5. Kumar, A., Jain, P. K., & Pathak, P. M. Reverse engineering in product manufacturing: an overview. DAAAM international scientific book,

Web References

1. http://www.worldcat.org/title/product-design-and-development/oclc/904505863
2. https://www.pdfdrive.com/product-design-and-development-e38289913.html
3. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
4. https://www.smashingmagazine.com/2018/01/comprehensive-guide-product-design/
5. https://ocw.mit.edu/courses/sloan-school-of-management/15-783j-product-design-and-development-spring-2006/lecture-notes/clas1_int_crse_6.pdf
6. https://swayam.gov.in/nd1_noc20_de05/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	3	-	3	-	-	-	-	-	-	2	-	-	-
2	1	-	2	-	3	-	-	-	-	-	-	3	-	-	-
3	1	-	3	-	2	-	-	-	-	-	-	2	-	-	-
4	3	-	1	-	3	-	-	-	-	-	-	1	-	-	-
5	1	-	3	-	3	-	-	-	-	-	-	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

Employability Enhancement Course

R-2020, III semester

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST320	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U20EST356	Data Structures	ES	3	0	0	3	25	75	100
3	U20EST361	Solid and Fluid Mechanics	ES	2	2	0	3	25	75	100
4	U20ICT305	Analog Integrated circuits	PC	3	0	0	3	25	75	100
5	U20ICT306	Digital Logic Circuits	PC	2	2	0	3	25	75	100
6	U20ICT307	Electrical and Electronic Measurements	PC	3	0	0	3	25	75	100
Practical										
7	U20HSP301	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U20ESP357	Data Structures Lab	ES	0	0	2	1	50	50	100
9	U20ESP362	Solid and Fluid Mechanics Lab	ES	0	0	2	1	50	50	100
10	U20ICP303	Analog and Digital Circuits Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ICC3XX	Certification Course - III **	EEC	0	0	4	-	100	-	100
12	U20ICS302	Skill Development Course 2*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20ICM303	Physical Education	MC	0	0	2	-	100	-	100
							22	650	650	1300

U20ICS302	SKILL DEVELOPMENT COURSE 2	L	T	P	C	Hrs
		0	0	2	-	30

1. TROUBLESHOOTING OF ELECTRONIC EQUIPMENTS

Course Content:

1. Reliability Aspects of Electronic Equipment.
2. Fundamental Troubleshooting Procedures.
3. Electronic Test Equipment.
4. Tools and Aids for Servicing and Maintenance.
5. PCB Testing and Soldering Techniques.
6. Power Supply and Subsystems Troubleshooting.
7. Mechanical and Electro-mechanical Components.
8. Passive Components and Their Testing.
9. Testing of Semiconductor Devices.
10. Troubleshooting Digital Circuits.
11. Troubleshooting Microprocessor-Based Systems.

U20ICM303	PHYSICAL EDUCATION	L	T	P	C	Hrs
		0	0	2	-	30

Physical Education is compulsory for all the Undergraduate students and Pass in this course is mandatory for the award of degree. Physical Education activities will include games and sports/extension lectures. The student participation shall be for minimum period of 30 hours. Physical Education activities will be monitored by the Director of Physical Education. Pass/Fail will be determined on the basis of participation, attendance, performance and conduct. If a candidate fails, he/she has to repeat the course in the subsequent years.

R -2020, V Semester

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST547	Numerical Methods	BS	2	2	0	3	25	75	100
2	U20ICT510	Analytical Instrumentation	PC	3	0	0	3	25	75	100
3	U20ICT511	Embedded System Design	PC	3	0	0	3	25	75	100
4	U20ICT512	Industrial Instrumentation - I	PC	3	0	0	3	25	75	100
5	U20ICE5XX	Professional Elective - II #	PE	3	0	0	3	25	75	100
6	U20XXO5XX	Open Elective - II $	HS	3	0	0	3	25	75	100
Practical										
7	U20BSP549	Numerical Methods Lab	BS	0	0	2	1	50	50	100
8	U20ICP506	Embedded System Design Lab	PC	0	0	2	1	50	50	100
9	U20ICP507	Industrial Instrumentation Lab	PC	0	0	2	1	50	50	100
10	U20ICP508	Instrumentation System Design Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ICC5XX	Certification Course - V **	EEC	0	0	4	-	100	-	100
12	U20ICS504	Skill Development Course 4: Career and Professional Skill Development Program - I	EEC	0	0	2	-	100	-	100
13	U20ICS505	Skill Development Course 5: Presentation Skill using ICT	EEC	0	0	2	-	100	-	100
Mandatory Course										
14	U20ICM505	Indian Constitution	MC	2	0	0	-	100	-	100
							22	750	650	1400

U20ICS504	SKILL DEVELOPMENT COURSE 4: Career and Professional Skill Development Program – I	L	T	P	C	Hrs
		0	0	2	-	30

1. BASIC APTITUDE & MATHEMATICAL SKILLS:

- Number System – Basics
- Number System – Advanced
- Surds & Indices
- Ratio & Proportion
- Problem On Ages & Partnership

2. APPLIED APTITUDE & MATHEMATICAL SKILLS:

- Average
- Alligations & Mixtures
- Profit & Loss, Discounts
- Percentage
- Time, Speed & Distance
- Problem On Trains
- Boats & Streams
- Time & Work
- Chain Rule
- Pipes & Cisterns
- Calendars

3. ENGINEERING APTITUDE SKILLS:

- Simple & Compound Interest
- Probability
- Permutation & Combination
- Mensuration
- Data Interpretation

U20ICS505	SKILL DEVELOPMENT COURSE 5: (Presentation Skills using ICT)	L	T	P	C	Hrs
		0	0	2	-	30

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

CT skills

- Understand ICT work flow in cloud computing.
- Manage multitasking.
- Deal with main issues using technology in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Teaching tools

- Different ways to create audio visual activities.
- Handle audio visual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study and have to prepare are port, running to 15 or 20 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee for a total of 100 marks. The marks attained for this course is not considered for CGPA calculation.

U20ICM505	INDIAN CONSTITUTION	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand historical background of the constitutional making and its importance for building a democratic India, the structure of Indian government, the structure of state government, the local Administration

CO2 - Understand knowledge on directive principle of state policy, the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

UNIT I INDIAN CONSTITUTION

Salient Features – Preamble – Fundamental Rights– Directive Principles of State Policy-Fundamental Duties

UNIT II PARLIAMENTRY SYSTEM

Powers and Functions of President and Prime Minister –Council of Ministers-The Legislature Structure and Functions of LokSabha and RajyaSabha –Speaker

UNIT III THE JUDICIARY

Organization and Composition of Judiciary- Powers and Functions of the Supreme Court –Judicial Review–High Courts.

UNIT IV STATE GOVERNMENTS

Powers and Functions of Governor and Chief Minister– Council of Ministers – State Legislature

UNIT V LOCAL GOVERNMENTS

73rd and 74th Constitutional Amendments–Federalism – Center–State Relations

Text Books

1. Basu D.D, "Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics",Vikas Publishing House, New Delhi, 2010.

Reference Books

1. Pylee M.V,"Introduction to the Constitution of India",Vikas Publishing House,New Delhi, 2011.
2. Kashyap S,"Our Constitution", National BookTrust, New Delhi, 2010

R-2019, VIII semester

- Skill Development Course 10: NPTEL / MOOC – II (U19ICS81)

Sl.No.	Name of the certification course	NPTEL/ Edx / Coursera, etc	Duration of the course (12 / 8/ 4 weeks/ others)
1	Introduction to Internet of Things	NPTEL	12
2	Microprocessor and Microcontrollers	NPTEL	12
3	Practical Introduction to cloud computing	CODERED	Self-paced
4	Android Bug Bounty Hunting	CODERED	Self-paced
5	Introduction to dark web, Anonymity	CODERED	Self-paced
6	Transistors in Electronics	EUROPEAN ACADEMY	Self-paced
7	Engineering control Systems	EUROPEAN ACADEMY	Self-paced

Annexure- IV

B.TECH ESE SCHEDULE

I YEAR & II YEAR

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

OFFICE OF THE CONTROLLER OF EXAMINATIONS

End Semester Examinations - October 2022

Schedule for B. Tech First Year Students [2021-25]

Date	Department	Year / Sem	Session	Course Code	Course
29/09/22	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, BME, MCTR, AI&DS, CCE, CSBS, FT	I/II	FN	U20BST215	Engineering Mathematics – II (Multiple Integrals and Transforms)
				U20HST202	Business Communication & Value Science – II
				U20BST219	Basics Textile Chemistry
01/10/22	EEE	I/II	FN	U20EST238	Basic Engineering Science for Electrical Engineering
	ECE	I/II	FN	U20EST239	Electrical Engineering
	CIVIL	I/II	FN	U20EST242	Green Buildings
	AI&DS	I/II	FN	U20EST243	Computer Programming – II (Programming in Python)
	CSBS	I/II	FN	U20HST203	Fundamentals of Economics
	FT	I/II	FN	U20EST253	Applied Mechanics for Textile Technologists
03/10/22	EEE	I/II	FN	U20EET203	Electric Circuit Analysis
	CSE	I/II	FN	U20CST201	Microprocessors and Microcontrollers
	IT	I/II	FN	U20ITT201	Microprocessors and Microcontrollers
	ICE	I/II	FN	U20ICT201	Circuit Theory
	MECH	I/II	FN	U20MET201	Manufacturing Processes
	CIVIL	I/II	FN	U20CET202	Mechanics of Solids – I
	BME	I/II	FN	U20BMT201	Electron Devices and Circuits
	AI&DS	I/II	FN	U20EST245	Data Structure and Applications
	CCE	I/II	FN	U20CCT201	Introduction to Web Technologies
	CSBS	I/II	FN	U20BST216	Linear Algebra
	FT	I/II	FN	U20EST254	Basic Engineering Graphics for Textile Designing
07/10/22	EEE	I/II	FN	U20EET204	Electrical Machines – I
	ECE	I/II	FN	U20EST240	Electronic Measurements and Instrumentation
	CSE	I/II	FN	U20CST202	Front-End Web Development
	IT	I/II	FN	U20ITT202	Front End Web Development
	ICE	I/II	FN	U20ICT202	Electronic Circuits
	MECH	I/II	FN	U20MET202	Engineering Metallurgy
	BME	I/II	FN	U20BMT202	Pathology and Microbiology
	MCTR	I/II	FN	U20EST249	Introduction to Electronics Engineering
	AI&DS	I/II	FN	U20EST247	Object Oriented Programming

	CCE	I/II	FN	U20CCT202	Electronic Circuits
	CSBS	I/II	FN	U20BST217	Statistical Methods
	FT	I/II	FN	U20FTT203	Basics of Yarn and Fabric Manufacturing
10/10/22	EEE	I/II	FN	U20EET205	Electronic Circuits
	ECE	I/II	FN	U20ECT201	Network Theory
	CSE	I/II	FN	U20CST203	Computer Organization and Architecture
	IT	I/II	FN	U20ITT203	Computer Organization and Architecture
	ICE	I/II	FN	U20ICT203	Signals and Systems
	MECH	I/II	FN	U20MET203	Concepts of Engineering Design
	CIVIL	I/II	FN	U20CET203	Fluid Mechanics and Machinery
	BME	I/II	FN	U20BMT203	Measurements and Instruments
	MCTR	I/II	FN	U20MCT202	Materials Science and Metallurgy
	AI&DS	I/II	FN	U20EST248	Computer and Communication Networks
	CCE	I/II	FN	U20CCT203	Digital Electronics
	CSBS	I/II	FN	U20EST251	Principles of Electronics
	FT	I/II	FN	U20FTT204	Concepts of Fashion and Design
12/10/22	EEE	I/II	FN	U20EET206	Digital Electronics
	ECE	I/II	FN	U20ECT202	Electron Devices
	CSE	I/II	FN	U20CST204	Computer Graphics
	IT	I/II	FN	U20ITT204	Information Systems: Theory and Applications
	ICE	I/II	FN	U20ICT204	Transducer Engineering
	MECH	I/II	FN	U20MET204	Engineering Thermodynamics
	CIVIL	I/II	FN	U20CET204	Building Construction
	BME	I/II	FN	U20BMT204	Communication Systems
	MCTR	I/II	FN	U20MCT203	Manufacturing Technology
	AI&DS	I/II	FN	U20ADT202	Database Management Systems
	CCE	I/II	FN	U20CCT204	Computer Organization
	CSBS	I/II	FN	U20CBT201	Data Structures & Algorithms
	FT	I/II	FN	U20FTT205	Fabric Surface Design

FN: 10:00 am to 1:00 pm

Controller of Examinations

Dr. S. JAYAKUMAR, M.Tech., Ph.D.,
Controller of Examination
Sri Manakula Vinayagar Engineering College
(An Autonomous Institution)
Madagadipet, Puducherry

Sri Manakula Vinayagar Engineering College
An Autonomous Institution
Madagadipet, Puducherry
Controller of Examinations

Director cum Principal

Dr. V.S.K Venkatachalapathy, M.E., Ph.D.,
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OFFICE OF THE CONTROLLER OF EXAMINATIONS

End Semester Examinations - October 2022

Schedule for B. Tech Second Year Students [2020-24]

Date	Dept	Year/ Sem	Session	Course Code	Course
30/09/22	EEE	II/IV	FN	U20BST430	Probability and Statistics
	ECE	II/IV	FN	U20BST431	Probability and Random Processes
	CSE	II/IV	FN	U20BST432	Discrete Mathematics and Graph Theory
	IT				
	ICE	II/IV	FN	U20BST430	Probability and Statistics
	MECH	II/IV	FN	U20BST433	Probability and Queuing Theory
	CIVIL	II/IV	FN	U20BST434	Numerical Methods
	BME	II/IV	FN	U20BST433	Probability and Queuing Theory
	MCTR	II/IV	FN	U20BST438	Numerical Methods and Statistics
	AI&DS	II/IV	FN	U20BST432	Discrete Mathematics and Graph Theory
	CCE	II/IV	FN	U20BST436	Probability and Stochastic Process
	CSBS	II/IV	FN	U20BST440	Operations Research
	FT	II/IV	FN	U20FTT411	Pattern Engineering -II
06/10/22	EEE	II/IV	FN	U20EST467	Programming in JAVA
	ECE				
	CSE				
	IT				
	ICE				
	MECH				
	CIVIL				
	BME				
	MCTR				
	CCE				
	AI&DS	II/IV	FN	U20ADT405	Data Visualization
	CSBS	II/IV	FN	U20HST405	Introduction to Innovation, IP Management & Entrepreneurship
	FT	II/IV	FN	U20FTT412	Textile Chemical Processing
08/10/22	EEE	II/IV	FN	U20EET411	Measurements and Instrumentation for Electrical Engineering
	ECE	II/IV	FN	U20ECT407	Analog and Digital Communication Systems
	CSE	II/IV	FN	U20CST408	Database Management Systems
	IT	II/IV	FN	U20ITT408	Operating System
	ICE	II/IV	FN	U20ICT408	Linear Control Systems
	MECH	II/IV	FN	U20MET408	Kinematics of Machinery
	CIVIL	II/IV	FN	U20CET409	Design of RC Elements

	BME	II/IV	FN	U20BMT409	Biosignal Processing
	MCTR	II/IV	FN	U20MCT408	Power Electronics and Drives
	AI&DS	II/IV	FN	U20ADT406	Advanced Machine Learning Techniques
	CCE	II/IV	FN	U20CCT408	Principles of Data Communication
	CSBS	II/IV	FN	U20CBT406	Operating Systems
	FT	II/IV	FN	U20FTT413	Apparel machinery and Equipment
11/10/22	EEE	II/IV	FN	U20EET412	Microprocessor and Microcontroller
	ECE	II/IV	FN	U20ECT408	Linear Integrated Circuits
	CSE	II/IV	FN	U20CST409	Design and Analysis of Algorithms
	IT	II/IV	FN	U20ITT409	Web Application Development
	ICE	II/IV	FN	U20ICT409	Microcontroller Based System Design
	MECH	II/IV	FN	U20MET409	Heat and Mass Transfer
	CIVIL	II/IV	FN	U20CET410	Geotechnical Engineering- II
	BME	II/IV	FN	U20BMT410	Linear Integrated Circuits
	MCTR	II/IV	FN	U20MCT409	Theory of Machines
	AI&DS	II/IV	FN	U20ADT407	Expert system and Decision Making
	CCE	II/IV	FN	U20CCT409	Design and Analysis of algorithms
	CSBS	II/IV	FN	U20CBT407	Software Engineering
	FT	II/IV	FN	U20FTT414	Garment Construction - I
13/10/22	EEE	II/IV	FN	U20EEE401	**PE I:** Electrical Safety Engineering
				U20EEE405	**PE I:** Energy Storage Technology
	ECE	II/IV	FN	U20ECE401	**PE I:** Computer Networks
				U20ECE402	**PE I:** Sensors for Industrial Application
				U20ECE403	**PE I:** Computer Architecture
				U20ECE404	**PE I:** PLC and SCADA Systems and its Application
	CSE	II/IV	FN	U20CSE402	**PE I:** E-Business
				U20CSE403	**PE I:** Object Oriented Analysis and Design
	IT	II/IV	FN	U20ITE402	**PE I:** Computer Vision
				U20ITE403	**PE I:** Object Oriented Analysis and Design
	ICE	II/IV	FN	U20ICE403	**PE I:** Communication Systems
	MECH	II/IV	FN	U20MEE403	**PE I:** Product Design and Development
				U20MEE404	**PE I:** Industrial Casting Technology
				U20MEE405	**PE I:** Non-Conventional Energy Sources
	CIVIL	II/IV	FN	U20CEE405	**PE I:** Alternative Building Materials and Technologies
	BME	II/IV	FN	U20BME402	**PE I:** Hospital Equipment Safety and Management
	MCTR	II/IV	FN	U20MCE403	**PE I:** Computer Integrated Manufacturing
	AI&DS	II/IV	FN	U20ADE401	**PE I:** Automata and Compiler Design
	CCE	II/IV	FN	U20CCE405	**PE I:** Operating Systems
	CSBS	II/IV	FN	U20CBT408	Design and Analysis of Algorithms

	FT	II/IV	FN	U20FTE405	**PE I:** High Fashion Designing
15/10/22	EEE	II/IV	FN	U20ECO401	**OE I:** Engineering Computation with MATLAB
				U20CSO401	**OE I:** Web Development
	ECE	II/IV	FN	U20CSO401	**OE I:** Web Development
				U20ICO401	**OE I:** Sensors and Transducers
				U20CCO401	**OE I:** Basic DBMS
				U20ADO402	**OE I:** Introduction to Data Science
	CSE	II/IV	FN	U20ECO402	**OE I:** Consumer Electronics
				U20EEO402	**OE I:** Electrical Safety
	IT	II/IV	FN	U20AD0401	**OE I:** Knowledge Representation and Reasoning
				U20ADO402	**OE I:** Introduction to Data Science
				U20ICO401	**OE I:** Sensors and Transducers
	ICE	II/IV	FN	U20ADO402	**OE I:** Introduction to Data Science
	MECH	II/IV	FN	U20ECO401	**OE I:** Engineering Computation with MATLAB
				U20CSO401	**OE I:** Web Development
				U20ICO401	**OE I:** Sensors and Transducers
	CIVIL	II/IV	FN	U20ICO401	**OE I:** Sensors and Transducers
	BME	II/IV	FN	U20ADO402	**OE I:** Introduction to Data Science
	MCTR	II/IV	FN	U20BMO401	**OE I:** Medical Electronics
	AI&DS	II/IV	FN	U20ICO401	**OE I:** Sensor and Transducers
	CCE	II/IV	FN	U20ECO402	**OE I:** Consumer Electronics
	FT	II/IV	FN	U20MEO403	**OE I:** Industrial Engineering for Textile

FN: 10:00 am to 1:00 pm

Controller of Examinations

Dr. S. JAYAKUMAR, M.Tech., Ph.D.,
Controller of Examination
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Madagadipet, Puducherry-605 107.

Sri Manakula Vinayagar Engineering College * An Autonomous Institution Madagadipet, Puducherry Controller of Examinations

Director cum Principal

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Madagadipet, Puducherry - 605 107.

(Annexure- V)

Panel of Examiners

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

DETAILS OF EXAMINERS FOR QUESTION PAPER SETTER AND EVALUATORS

Sl. No	Name of the Examiner	Specialization	Designation, Department and Institution in which currently working	Contact number and mail id
1	Dr. G. Sakthivel	Embedded System, Process Control	Professor, Department of EIE, Annamalai university, Chidambaram-608401	9443270714 gsauei@gmail.com
2	Dr. S. Mourouga Prakash	Process Control	Asst prof/ EIE Pondicherry Engineering, College	9894463366 smpragash@pec.edu
3	Dr. M. Manivannan	Process Control and Instrumentation	Department of EIE, Annamalai University, Chidambaram-608401	9442646555 Manivannan1978@gmail.com
4	Dr. P. A. Sridhar	Biomedical Instrumentation	Assistant Professor, Department of Electronics & Instrumentation Engineering, Kattankulathur Campus, SRM Institute of Science and Technology	7598227170 sridhara1@srmist.edu.in
5	Dr. Palanivel	Process Control, Transducer and Measurements	Associate Professor Dept of E&I Annamalai university, Annamalai Nagar, Chidambaram	9842565026 S_palanivel@yahoo.com
6	Dr.M. Jagannath	Biomedical Instrumentation	Assoc. Prof, School of Electronic Engineering, VIT, Chennai-600127	9884386262 jagan.faith@gmail.com
7	Dr.A. Saraswathi	Drives and Control	Assistant Professor / HOD University college of engineering, Villupuram-605103	9994549910 saraswathiask@gmail.com
8	Dr.P. Shanmugaraja	Medical Electronics Embedded Systems	Department of EIE Annamalai university. Chidambaram-608401.	9443275120 psraja70@gmail.com

9	Dr.S. Yazhinian	VLSI	Assoc. Prof/ECE /Sri Venkateshwara Engineering College and Technology	9751112057 yazhinian.s@gmail.com
10	Dr.P.Vijayakumar	Wireless Networks and Communications	Associate Professor, School of Electronics Engineering, Vellore Institute of Technology, Melakottaiyur, Chennai–600127	9894727271 vijayrgcet@gmail.com
11	Dr. D. Palani.	Image Processing	Assistant professor/dept of ECE. University college of engineering, Villupuram - 605103	8667377226 palani.dinesh@gmail.com
12	Dr. M. Phemina Selvi	Electronics and Communications	Assistant professor/dept of ECE. University college of engineering, Villupuram - 605103	9994267707 vm.femina@gmail.com
13	Dr.V.Devarajan	Wireless Communication	Professor & Head Department of ECE Dhanalakshmi Srinivasan College of Engineering and Technology, Mamallapuram.	9894040479 devarajan@live.fr
14	Dr.B.Karthik	Embedded System	Associate Professor, Department of ECE, Bharath Institute of Higher Education and Research. Chennai.	9842580740 karthikguru33@gmail.com
15	Dr.V.Ganesan	Electronics Circuits	Associate Professor, Department of ECE, Bharath University. Chennai.	9443723032 vganesh1711@gmail.com
16	Dr.A.Ashokan	Electronics Circuits	Department of ECE Government College of Engineering, Thanjavur.	9150376648