DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN			
Name of the Programme and Specialization	**M. Tech- Industrial Automation**		
Course Title	**INDUSTRIAL AUTOMATION SYSTEMS**		
Course Code	**IC603**	**Course credits**	**3**
Pre-requisites Course Code	**NIL**		
Session	**July 2020**	**Section**	**NA**
Name of Faculty	**Dr. N. SIVAKUMARAN**	**Department**	**ICE**
E-mail	**nsk@nitt.edu**	**Mobile No.**	**09443745705**
Course Type	**Core course**	**Program Elective course**	
Syllabus (As approved in BoS) Available on Department website			

Automation in Manufacturing Industries:

Introduction - Automation in production system, Principles and strategies of automation, Basic elements of an automated system, Advanced automation functions, Levels of Automations, Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage, Automated flow lines with storage buffers.
Material handling and identification technologies -Overview of material handling systems, Types of material handling equipment, Design of the system, Conveyor system, Automated guided vehicle system, Automated storage systems, Interfacing handling and storage with manufacturing, Overview of Automatic Identification Methods.
Automated Manufacturing Systems (AMS) -Components, Classification and overview of manufacturing systems, Cellular manufacturing, Flexible manufacturing system (FMS), FMS and its planning and implementation, Automated assembly system – design and types of automated assembly systems, Analysis of multi station and single station assembly machine.

Automation in Process Industries:

Introduction to computer based industrial automation- Direct Digital Control (DDC), Distributed Control System (DCS) and supervisory control and data acquisition (SCADA) based architectures. SCADA for process industries includes understanding of RTUs, Pumping stations, Evacuation processes, Mass Flow Meters and other flow meters, Leak-flow studies of pipelines, Transport Automation.
Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC, Basic instruction sets, Design of alarm and interlocks, Networking of PLC, Overview of safety of PLC with case studies. Process Safety Automation: Levels of process safety through use of PLCs, Integrating Process safety PLC and DCS, Application of international standards in process safety control.
Distributed Control System- Local Control Unit (LCU) architecture, LCU Process Interfacing Issues, Block diagram and Overview of different LCU security design approaches, Networking of DCS. Introduction to communication protocols- Profibus, Field bus, HART protocols.
Data gathering, Data analytics, Real-time analysis of data stream from DCS, Historian build, Integration of business inputs with process data, Leveraging RTU (as different from PLCs and DCS).

COURSE OBJECTIVES

The subject aims

1. To introduce the importance of automation techniques manufacturing and process industries.
2. To impart the role of PLC in industry automation.
3. To expose to various control techniques employed in process automation.
4. To develop automation system for manufacturing and process industries.

COURSE OUTCOME (CO)

Course Outcome (CO)	**Aligned Program Outcomes (PO)**
On completion of this course, the students will be,	
1. familiar with various automation technologies in manufacturing and process industries.	1,2,3
2. understand various automation tools and methods in manufacturing industry.	1,2,3
3. implement various control and automation method in process industries.	1,2,3
4. familiar with various communication technologies in manufacturing and process industries.	1,2,3

COURSE OVERVIEW

This course is to familiarize students with different industrial automation techniques used in manufacturing and process industries such as PLC, DCS and communication protocol.

COURSE TEACHING AND LEARNING ACTIVITIES

LECTURE NO.	**PERIODS/ WEEKS**	**TOPIC/ CONTENT**	**LECTURE DELIVERY MODE Online through Cisco Webex Meet**
1- 3	1st week	Automation in production system, Principles and strategies of automation,Advanced automation functions, Levels of Automations, Automated flow lines and transfer mechanisms	PPT,Video
4 – 6	2nd week	Analysis of transfer lines without storage, Automated flow lines with storage buffers.Material handling and identification technologies	PPT
7 – 9	3rd week	Automated storage systems, Interfacing handling and storage with manufacturing,Components, Classification and overview of AMS	PPT
10 – 12	4th week	Flexible manufacturing system (FMS), FMS	PPT
	From 4th week	***Assessment-1:*** **Presentation and Discussions based on case studies**	PPT
13 – 15	5th week	Automated assembly system – design and types of automated assembly	PPT

		systems, Analysis of multi station and single station assembly machine.	
16 – 18	6th week	Introduction to computer based industrial automation- DDC, DCS, and SCADA.SCADA for process industries includes understanding of RTUs	
19 – 21	7th week	Transport Automation - Mass Flow Meters and other flow meters, Leak-flow studies of pipelines	PPT
22 – 23	8th week	Programmable Logic Controller (PLC)- Block diagram of PLC, Programming languages of PLC	Video
25 – 27	9th week	Design of alarm and interlocks, Networking of PLC, case studies.	PPT
28-29	10th week	Process Safety Automation, Integrating Process safety PLC and DCS.Application of international standards in process safety control.	PPT
	End of 10th week	***Assessment-2:*** Written exam (20% Weightage)	**Online**
30-32	11th week	Distributed Control System- Local Control Unit (LCU) architecture, LCU Process Interfacing Issues, security design approaches.Networking of DCS. Introduction to communication protocols- Profibus, Field bus, HART protocols.	PPT
33 – 35	12th week	Data gathering, Data analytics, Real-time analysis of data stream from DCS	PPT
36 - 38	13th week	Historian build, Integration of business inputs with process data, Leveraging RTU (as different from PLCs and DCS).	PPT
39 - 41	14th week	Review of Manufacturing and Process industry automation with case studies	PPT
	Last week	***Final Assessment:*** Written exam (30% Weightage)	**Online**

COURSE ASSESSMENT METHODS

Sl.No.	Mode of Assessment	Week/Date	Duration	Percentage
1	Assessment 1 - Presentation and Discussions based on case studies	From 4th week	1 hour	20 %
2	Assessment 2 – Written Exam	End of 10th Week	1 hour	20 %
3	CPA - Compensation Assessment*	End of 14th Week	1 hour	20 %
4	Quiz/ Seminar /Assignment 1	9th week		15 %
	Quiz/ seminar / Assignment 2	12th week		15 %
5	Final Assessment* (End Semester Exam)	End of the semester	2 hours	30 %

***mandatory; refer to guidelines on page 4 and page 5**

ESSENTIAL READINGS: Textbooks, reference books, NPTEL notes, journals, etc.

Text Books

1. M. P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 5th Edition, Pearson Education, 2009.
2. John W. Webb and Ronald A. Reis, "Programmable Logic Controllers: Principles and Applications", 5th Edition, Prentice Hall Inc., New Jersey, 2003.
3. Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011.
4. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016.

Reference Books

1. Curtis D. Johnson,"Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013.
2. Lukas M.P, "Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986.
3. N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009.
4. https://nptel.ac.in/syllabus/108108098/

COURSE EXIT SURVEY

Feedback from the students during the class committee meetings.

Feedback before End-term examination through a questionnaire, for improvements in future.

COURSE POLICY

• Compensation Assessment: A student can be, upon prior approval, absent from only one out of the continuous assessments (1 or 2), for which he/she is allowed to take the compensatory assessment during mid December, 2020. Note that this assessment is not offered as an improvement test for everyone.

ATTENDANCE (REMEMBER THIS IS A 3-CREDIT COURSE)

• Cf. M.6.0 (page 6, https://www.nitt.edu/home/academics/rules/PG-Regulations-2019.pdf) 75% attendance, with an exemption up to 10% on genuine grounds (on-duty); prior information and approval from the instructor is compulsory.

• Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

• The only option for students with attendance < 65% is RE-DO.

ASSESSMENTS AND GRADING POLICY

• Cf. M.10.2 (page 10, https://www.nitt.edu/home/academics/rules/PG-Regulations-2019.pdf)A minimum of 30% should be scored in the final assessment for a pass.The passing minimum is 35% or Class Average/2, whichever is higher; grading is done for those students declared passed based on the class average – average and above shall get S, A, and B grades, and below average shall get C, D, and E.

ACADEMIC HONESTY

• Mid-term and End-term assessments in this course must be strictly individual work.

ACADEMIC DISHONESTY

For purposes of this class, academic dishonesty is defined as:

• Any attempt to pass off work on a test that didn't come straight out of your own head.

• Any collaboration on artifacts in which the collaborating parties do not clearly explain exactly who did what, at turn-in time.

• Any activity that has the effect of significantly impairing the ability of another student to learn. Examples here might include destroying the work of others, interfering with their access to resources, or deliberately providing them with misleading information.

• Please make a careful note of: ACADEMIC DISHONESTY & PLAGIARISM (cf. M.21.0 & M.22.0, page 13, https://www.nitt.edu/home/academics/rules/PG-Regulations-2019.pdf)

▪ Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.

▪ Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

▪ The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

▪ The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

The students are advised to clarify their doubts and discuss during the lecture hour. Other than, for out-of-class discussion, they can email their Queries to the Course faculty directly at **nsk@nitt.edu**

Any changes in the proposed layout of the semester, due to unavoidable circumstances, shall be intimated immediately to the students and to the Chairperson, PAC.

FOR APPROVAL

Course Faculty:	CC-Chairperson:	HOD:
(Dr. N. Sivakumaran)	(Dr. D. Ezhilarasi)	(Dr. G. Uma)