

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

COURSE PLAN – PART I			
Course Title	Process Control		
Course Code	ICPC25	No. of Credits	4
Course Code of Pre-requisite subject(s)	NIL		
Session	Jan. 2018	Section (if, applicable)	A
Name of Faculty	S. Narayanan	Department	ICE
Email	narayanan@nitt.edu	Telephone No.	3364
Name of Course Coordinator(s) (if, applicable)	-----		
E-mail	-----	Telephone No.	
Course Type	<input checked="" type="checkbox"/> Core course	<input type="checkbox"/> Elective course	
Syllabus (approved in BoS)			
<p>Process Control System: Terms and objectives, piping and Instrumentation diagram, instrument terms and symbols. Regulatory and servo control, classification of variables. Process characteristics: Process equation, degrees of freedom, modeling of simple system, Self-regulating processes, interacting and non- interacting processes, Process lag, load disturbance and their effect on processes.</p> <p>Controller modes: Basic control action, two position, multiposition, floating control modes. Continuous controller modes: proportional, integral, derivative. Composite controller modes: P-I, P-D, P-I-D, Integral wind-up and prevention. Auto/Manual transfer, Bumpless transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow.</p> <p>Controller tuning Methods: Evaluation criteria - IAE, ISE, ITAE. Process reaction curve method, continuous oscillation method, damped oscillation method. Auto tuning. Closed loop response of I & II order systems, with and without valve, measuring element dynamics.</p> <p>Final control elements: Pneumatic and electrical actuators, Valve positioners. Pneumatic and electrical dampers, Control valves types, construction details, various plug characteristics. Valve sizing. Selection of control valves. Inherent and installed valve characteristics. Fail-safe operation, Cavitation and flashing in control valves Instrument air supply specifications.</p> <p>Advanced control system: Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, interaction of control loops. Case Studies: Distillation column, boiler drum level control and chemical reactor control.</p>			
COURSE OBJECTIVES			
The purpose of this course is to introduce the following key concepts.			

<ul style="list-style-type: none"> • How to represent dynamic systems by equations, • How dynamic systems respond to disturbances • How to estimate the stability limits for a system, with or without control • How to tune a single-loop controller for better response • How to enhance feedback control with cascade, feed forward, and model-based structures 	
COURSE OUTCOMES (CO)	
Course Outcomes	Aligned Programme Outcomes (PO)
<p>The course is delivered through a combination of lectures, tutorials and exposure to simulation programs currently used. At the end the course, students should be able to characterize and tune simple processes.</p> <ul style="list-style-type: none"> • Understand the basic principles & importance of process control in industrial process plants • Understand the use of block diagrams & the mathematical basis for the design of control systems <p>Use appropriate software tools (e.g. Matlab Control Toolbox & Simulink) for the modelling of plant dynamics and the design of well-tuned control loop</p>	1,2,3,4,5,6,7

COURSE PLAN – PART II			
COURSE OVERVIEW			
<p>To introduce</p> <ul style="list-style-type: none"> • The concepts of modeling and analysis of simple linear and non-linear dynamic systems. <p>concepts and techniques of linear and nonlinear control system</p>			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	I , II , III & IV	Mathematical modelling- mass balance equation- linearization of stirred tank heater using taylor series-introduction to servo ®ulatory problem- introduction to self-regulatory process &non self – regulatory process- problems with large dead time and inverse response- problem with interaction-parameter estimation	Chalk and talk

2	V & VI	z-n tuning – tuning of controllers using synthesize method-feedback linearization- state feedback control with full order observer- optimal control- auto tuning	Chalk and talk
3	VI & VII	Feed forward control- cascade control- time delay compensators- inverse response compensator- decoupling control- decentralized control- centralized control- adaptive control- gain scheduling	Chalk and talk
4	VIII & IX	Control valve characteristics- types of control valves- positioner- implementation issues of derivative control and integral control	Chalk and talk
5	X ,XI & XII	Case studies- distillation column- quadruple tank- reactor-Boiler drum level	Chalk and talk

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Test-1	5 th Week	One Hour	20%
2	Test-2	8 th Week	One Hour	20%
3	Assignment test	11 th Week	One Hour	8%
4	Assignment -simulation	----	-----	7%
CPA	Compensation Assessment*	One week before end sem	One Hour	20%
4	Final Assessment *	Last week	three Hours	45%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

nil

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)

ATTENDANCE

- The minimum attendance for appearing for the semester examination is 65%.
- Students who have less than 65% of attendance have to rejoin the course after a year along with the next batch. V indicates prevention due to lack of attendance (< 65%).

COMPENSATION ASSESSMENT

Students who have missed the first or second cycle test can register with the consent of faculty for the Re-Test which shall be conducted soon after the completion of the second cycle test. The students who need to appear for the Re -Test should register with proper valid justification and the test shall be conducted before the regular semester examinations.

The Re - Test examination shall be conducted for 20 marks comprising the syllabus of both first and second cycle tests

No retest for end semester exam.

ACADEMIC HONESTY & PLAGIARISM

nil

ADDITIONAL INFORMATION

nil

FOR APPROVAL

S. Noyaman.
Course Faculty _____

A. Ramani,
CC-Chairperson _____

HOD _____
28/11/18