



DEPARTMENT OF INSTRUMENTATION & CONTROL ENGG.

COURSE PLAN – PART I			
Name of the programme and specialization	B Tech in Instrumentation and Control Engineering		
Course Title	Process Control - (V Semester)		
Course Code	ICPC22	No. of Credits	3
Course Code of Pre-requisite subject(s)	ICPC16	--	--
Session	July 2022	Section (if, applicable)	B
Name of Faculty	Dr. K. Srinivasan	Department	ICE Department
Official Email	srinikkn@nitt.edu	Telephone No.	0431-2503363
Course Type (please tick appropriately)	<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. Controller modes: Basic control action, two position, multi-position, floating control modes. Continuous controller modes: proportional, integral, derivative. Composite controller modes: P-I, PD, 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. Final control elements: Pneumatic and electrical actuators, Valve positioners. Pneumatic and electrical dampers, Control valves types, construction details, various plug characteristics. Energy efficient valves - Valve sizing - selection of control valves. Inherent and installed valve characteristics. Fail-safe operation, Cavitation and flashing in control valves, Instrument air supply specifications. 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. Advanced control system: Cascade control, ratio control, feed forward control. Over-ride, split range and selective control. Multivariable process control, interaction of control loops. Introduction to Dynamic Matrix Control. Case Studies: Distillation column, boiler drum level control and chemical reactor control.</p>			
COURSE OBJECTIVES			
<ol style="list-style-type: none"> 1. To introduce the terminology and concepts associated with Process control domain. 2. To impart knowledge in the design of control systems and PID controller tuning for processes. 3. To familiarize the students with characteristics, selection, sizing of control valves 4. To elaborate different types of control schemes such as cascade control, feed forward control and Model Based control schemes. 			



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MAPPING OF COs with POs	
Course Outcomes	Programme Outcomes (PO)
1. To understand technical terms and concepts associated with process control domain.	1,3
2. To build models using first principles approach as well as analyze models.	3,4,5,6
3. To design, tune and implement PID Controllers to achieve desired performance for various processes	3,4,5
4. To analyze the systems and implement control schemes for various processes.	3,5,12
5. To comprehend on advanced process control strategies	3,5,8,12

COURSE PLAN – PART II			
COURSE OVERVIEW			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	First – Three Week	Need, importance and characteristics of process control. Mathematical of linear/non-linear system. Linearization of non-linear system. Open/closed loop Response of system and servo/regulatory response. P& I Diagram.	Chalk & Talk / Power point presentation
2	Fourth - Sixth week	Basics of control action: ON/OFF, PID controller etc. PID controller enhancements: integral wind-up and prevention. Auto/Manual transfer, Bumpless transfer. Response and selection of controller for different process application. Tuning of PID controller, IAE, ISE, ITAE, Auto tuning. Closed loop response of I & II order systems	Chalk & Talk / Power point presentation
3	End of Sixth Week	Assessment -1 : Assignment based on problem solving (High level problem) with seminar	15 % Weightage
4	Seventh and Eighth week	Final control elements, Pneumatic and electronic valves with and without positioner, Control valves types, - Valve sizing - selection of control valves. Inherent and installed characteristics. Fail-safe operation, Cavitation and flashing.	Chalk & Talk / Power point presentation
5	End of Seventh week or As per guidelines from academic office	Assessment –2 : Written exam	25% Weightage
6	Ninth –Eleventh week	Cascade control, ratio control, feed forward	Chalk & Talk /



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		control. Over-ride, split range and selective control.	Power point presentation
7	End of Twelfth week	Assessment –3 : Assignment based on Problem solving (High level problem) and validation using simulation software	20 % Weightage
8	Twelfth – Fourteenth week	Multivariable process control, interaction of control loops, Dynamic Matrix Control, Kalman Filter and Case Studies: Distillation column, boiler drum level control and chemical reactor control.	Chalk & Talk / Power point presentation
9	Thirteenth Week	Assessment -4: Seminar/Mini project	10% Weightage
10	End of Fourteenth week	Compensation Assessment	25% Weightage
11	End of Sixteenth week or As per guidelines from academic office	Final Assessment: Written Exam	30% Weightage

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment based on problem solving (High level problem) with seminar	End of Sixth week	---	15%
2	Written exam	End of Seventh week or As per guidelines from academic office	One and a half hours	25%
3	Assignment based on Problem solving (High level problem) and validation using simulation software	End of Twelfth week	---	20%
4	Seminar (or) Mini project	Thirteenth Week	---	10%
CPA	Compensation Assessment*	End of Fourteenth week	One and a half hours	25%
5	Final Assessment *	End of Sixteenth week or As per guidelines from academic office	Three hours	30%

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

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

1. Indirect feedback through questionnaire.
2. Direct feedback from the students.
3. Feedback from the students during the class committee meetings.



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COURSE POLICY (including compensation assessment to be specified)

Only one compensation will be conducted during Fourteenth week for the students absent for assessment due to medical, on-duty and other genuine reasons. The course faculty decision will be the final to decide about retest. The exam will be conducted based on entire syllabus. The duration of the exam is 1 and half hours. If the student absents themselves for more than one assessment, other assessment marks will be awarded as zero.

Grading Policy/Passing Criteria:

All assessment of a course will be done on the basis of marks. The Performance Analysis Committee shall finalise the grades as per the guidelines (B.29.0). The passing minimum for the course shall be 35% or Class Average/2, whichever is maximum and he/she must score a minimum of 20% in the final assessment to complete the course.

Retest / Re-examination:

If the student got F grade with satisfactory attendance requirement (Refer Attendance policy), he/she has to undergone retest / supplementary examination.

Retest / Supplementary examination will be conducted on **Seventeenth week** for 3-hour duration.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- 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.

