

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

Department of Chemical Engineering

COURSE OUTLINE				
Course Title	ADVANCED PROCESS CONTROL			
Course Code	CL 601	No. of Credits	3	
Department	Chemical Engineering	Faculty	Dr. T.K. Radhakrishnan	
Pre-requisites Course Code	None			
Course Type	Core course			
COURSE OVERVIEW				
The Advanced Process Control course is offered in the first semester to the PG Chemical Engineering and Process Control & Instrumentation students for the understanding of principles of process control in industries.				
COURSE OBJECTIVES				
Expose students to the advanced control methods used in industries and research. This course prepares the student to take up such challenges in his profession.				
COURSE OUTCOMES (COs)				
Upon completing the course, the student will be able to				
<ol style="list-style-type: none"> 1. perform stability analysis and controller tuning 2. select and design advanced controllers that need to be used for specific problems 3. design controllers for interacting multivariable systems 4. understand the dynamic behavior of discrete time processes and design discrete controllers 				
COURSE TEACHING AND LEARNING ACTIVITIES				
L. No	Week	Brief outline of the content to be delivered	Mode of Delivery	
			C & T	PPT
1-9	3 weeks	First order systems – Examples- level, concentration and temperature process- Response of first order systems - Higher order systems - Non-interacting and Interacting- Second order system analysis - Transient response of control systems – stability - Frequency response- Bode stability - Nyquist stability – Nichols chart - Closed loop log modulus	✓	✓

10-17	2-3 weeks	Step and pulse testing – First and second order model estimation - -Relay tuning – integral error methods for tuning - Direct synthesis method for controller design - Non-minimum phase systems - inverse response - delay systems – open loop unstable systems - compensator design.	✓	✓
18-24	2-3 weeks	Cascade systems – Feed forward control – Ratio control – IMC – MPC.	✓	✓
25-33	2-3 weeks	Multivariable systems - State space model - Interaction – RGA - Pairing recommendation – Niederlinski index Non square systems – Singular value – SVR analysis – stability - MV Nyquist plots – BLT tuning for decentralized controller design –Decoupling.	✓	✓
34-40	2-3 weeks	Sampling and reconstruction of signals- aliasing- sampling period selection - Signal processing and filtering – analog and signal filter – Z transforms - Pulse transfer function- closed loop transfer function – stability – minimum variable and design of digital controllers.	✓	✓

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle test I	On completion of two Units	1 Hr	20%
2.	Cycle Test II	On completion of 3 and 4 th units	1 Hr	20%
3.	Assignment			10%
4.	Semester exam	After completing the syllabus	3 hrs	50%

ESSENTIAL READINGS : Textbooks, reference books etc

1. D.R. Coughanowr, S.E. LeBlanc, *Process Systems Analysis and Control*, McGraw-Hill, 2nd Edition, 2009.
2. D.E. Seborg, T.F. Edgar, and D.A. Millichamp, *Process Dynamics and Control*, John Wiley and Sons, 2nd Edition, 2004.
3. B.A.Ogunnaike and W.H.Ray, *Process Dynamics, Modelling and Control*, Oxford Press, 1994.
4. B.W. Bequette, *Process Control: Modeling, Design and Simulation*, PHI, 2006.
5. S. Bhanot, *Process Control: Principles and Applications*, Oxford University Press, 2008.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire

COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

- 75% attendance is mandatory. Any student, who fails to maintain 75% and having above 50% attendance need to appear for the compensation assessment (CPA) and score minimum 30% marks in the CPA for attending the end semester examination. Students who maintained less than 50% will redo the course.
- Those who indulge in malpractice such as copying, plagiarism shall have to redo the course.
- Those who are absent for any of the assessment tests (Sl. Nos. 1 or 2) on genuine grounds shall be given an opportunity only once for the retest with the prior permission of the concerned faculty member. The retest shall be conducted before the end semester exam and the portions will be up to Cycle Test II.
- The minimum marks for passing this course and grading pattern will adhere to the regulations of the Institute.
- Those who fail in the course can appear for the supplementary exam. The total marks will be 100
- Any misbehavior, indiscipline in the classroom/exam hall will be dealt with seriously. In the worst case, the departmental disciplinary committee is empowered to debar the student from the course.

ADDITIONAL COURSE INFORMATION

- Queries may be emailed to the Course Coordinator directly at radha@nitt.edu
- The Course Coordinator can be contacted in person for clarifications by the student on a mutually convenient time.

FOR SENATE'S CONSIDERATION

Course Faculty

Radhakrishnan

(Dr. Radhakrishnan)

CC-Chairperson

damodhar

HOD

Prasanna