GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Master of Technology					Branch/Spec.	Chemical Engineering		
Semester	I					Version	1.0.0.0		
Effective from Academic Year			2026-27			Effective for the batch Admitted in			July 2026
Subject code	**3CH1104**		Subject Name			**Advanced Process Control**			
Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	0	0	3	Theory	40	60	100
Hours	3	0	0	0	3	Practical	0	0	0

Pre-requisites:

Process control on UG level

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	Highlighting the basics of process control using SISO systems.
CO2	Apply linear algebra and other mathematical techniques to find the response of MIMO process
CO3	Analyze the system's controllability and stability.
CO4	Compose FSFB, dynamic-decoupler, and MPC-based controllers.

Theory syllabus

Unit	Content	Hrs
1	**SISO systems, Transfer function approach:** Laplace transformation, transfer function models; the transient response of first and second-order processes for impulse, step, sinusoidal, ramp inputs; P, PI, and PID controllers; frequency response; stability analysis, controller tuning methods.	10
2	**MIMO systems:** continuous-time (CT) state-space models; CT transfer function matrix models; introduction to computer-controlled systems, simple discrete-time (DT) systems; sampling, Shanon-Nyquist sampling theorem, and analog-to-digital transformation; zero-order-hold and digital-to-analog transformations, DT state-space model, Z-transformation, Z - transfer function models, inter-conversion of models.	15
3	**Linear Algebra:** row, column space of a matrix, linear independence, the rank of a matrix, Eigen-value and Eigen-vector analysis, diagonalization of a matrix, exponential of a matrix; Controllability of state-space models, controllability matrix and condition for a controllable system, and Popov-Belevitch-Hautus (PBH) test; stability of various CT and DT models.	10
4	**Controllers for MIMO processes:** Relative-gain-array, Dynamic-decoupler design; Full-state feedback controller design using pole-placement method (CT&DT both); Linear quadratic regulator, FIR and FSR models, prediction and control horizon, introduction to model predictive control.	10

Text Books

1	G. Stephanopoulos, Chemical Process Control, Prentice-Hall India Learning Pvt.Ltd., 2008

Reference Books

1	K.J. Åström, B. Wittenmark, Computer-Controlled System – Theory and Design, Prentice-Hall, 1996.
2	A. K. Tangirala, Principles of System Identification: Theory and Practice, CRC Press, 2014.

ICT/MOOCs references

https://nptel.ac.in/courses/103101142

Mapping of CO with PO and PSO:														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	1	-	-	-	-	-	1	2	1	-
CO2	3	3	2	1	2	-	-	-	-	-	1	3	2	-
CO3	3	3	2	2	2	-	-	-	-	-	1	3	2	-
CO4	3	3	3	2	3	-	-	-	-	1	2	3	2	1