Subject	Controllers	**Course Code**	CT320	**Theoretical**	3hrs / wk
Semester	5	**Prerequisite**	CT227	**Practical**	3hrs / wk

Program Learning Component

Week 1

12. Use of analog controllers in a feedback control system

Specific Learning Outcomes	Resources	Practical
• Introduction to controllers systems • Operational amplifier circuits • The Response in Time Domain and Frequency Domain specifications	Power point slides whiteboard	• The selection of the electronic circuit components to apply analog control systems • (simulation by electronic workbench • And implementation in test board

Week 2

13. Study the proportional controller (design ,simulation and implementation)

Specific Learning Outcomes	Resources	Practical
• Proportional controllers • The characteristics of proportional controller • Design proportional controllers • Advantages of proportional controllers • The electronic circuit of the P controller	Power point slides whiteboard	• Applying analog P controller to real process in the Lab • Such as (speed control, level control, flow control, temperature control,etc)

Week 3

14. Study the proportional plus integral controller (design ,simulation and implementation)

Specific Learning Outcomes	Resources	Practical
• Proportional plus integral controllers • The characteristics of roportional plus integration block • Design proportional plus integration block • Advantages proportional plus integration block	Power point slides whiteboard	• Applying analog PI controller to real process in a closed loop control system in the Lab • Such as (speed control, level control, flow

	• The electronic circuit of the PI controller		control and temperature control,etc)
Week 4	**15. Study the proportional plus derivative controller (design ,simulation and implementation)**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Proportional plus derivative block • The characteristics of proportional plus derivative block • Design proportional plus derivative block • Advantages proportional plus derivative block • The electronic circuit of the PD controller	Power point slides whiteboard	• Applying analog PD controller to real process in a closed loop control system in the Lab • Such as (speed control, level control, flow control, temperature control,etc)
Week 5	**16. Study the proportional plus integral plus derivative controller (design ,simulation and implementation)**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Proportional plus derivative plus integral • The characteristics of proportional plus integral plus derivative block • Design proportional plus integral plus derivative block • Advantages proportional plus integral plus derivative block • The electronic circuit of the PID controller	Power point slides whiteboard	• Applying analog PID controller to real process in closed loop control systems in the Lab • Such as (speed control, level control, flow control, temperature control,etc)
Week 6-7	**17. Study the digital control systems**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Introduction to the Digital control systems • (Principles of Digital Control, • Theory of Z-Transform and • Principles of Z-Transform}. • Stability and analysis of digital control systems • Obtaining the difference equation of	Power point slides whiteboard	• Simulation ,analysis and design of digital control Systems using MATLAB.

	digital control system • Selection of the sample time		
Week 8-9	**18. Study the digital PID controller design, simulation and implementation**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Digital PID controller (design ,simulation and implementation)	Power point slides whiteboard	• Applying digital PID controller to a real process in the Lab • Such as (speed control, level control, flow control, temperature control,etc)
Week 10	**19. Study the state space representation of dynamic control systems**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Control system representation in state space model and it's digital • form	Power point slides whiteboard	• Design and simulation of state feedback control system by Matlab.
Week 11	**20. Study how to design and simulate state feedback control system**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Controllability check of digital control systems and the design method of state feedback control system	Power point slides whiteboard	• Design and simulation of state feedback control system by Matlab.
Week 12	**21.Study how design and simulate state estimator**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Observability check of digital control systems and the design method of state estimator	Power point slides whiteboard	• Design and simulation of state estimator control system by Matlab.
Week 13-14	**22.Study the cascade control theory and application**		
	Specific Learning Outcomes	**Resources**	**Practical**
	• Principles and application of the Cascade control systems	Power point slides whiteboard	• Applying different types of controllers to real process as a cascaded control systems in the Lab

			• (water level and flow control system)