Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/Practical	Tutorial	Total
EXC 8043	Digital Control System	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 8043	Digital Control System	20	20	20	80	--	--	--	100

Course Prerequisites:
- EXC404: Principles of Control System
- EXC504: Signals and Systems

Course Objective:
1. To study the importance of digital control
2. To study stability analysis of digital control systems
3. To study the design of digital control systems

Course Outcomes:
1. Students will be able to differentiate between analog and digital control and importance of digital control
2. Student will be able to analyze the digital control systems
3. Students will be able to design digital controllers

Module No.	Unit No.	Topics	Hrs.
1.0		**Introduction**	
	1.1	Why digital control system? Advantages and limitations, comparison of continuous and discrete data control, block diagram of digital control system	12
	1.2	Data conversion and quantization, sampling and reconstruction of analog signal, zero and first order hold	
	1.3	Impulse invariance, bilinear transformation, finite difference approximation of derivatives	
2.0		**Modeling of Digital Control System**	04
	2.1	Linear difference equation, pulse transfer function, input output model	
	2.2	Examples of first order continuous and discrete time systems	
	2.3	Signal flow graph applied to digital control system	
3.0		**Time Domain Analysis and Stability of Digital Control System**	08
	3.1	Mapping between s plane and Z plane, Jury's method, R. H. criteria	
	3.2	Comparison of time response of continuous and digital control system	
	3.3	Steady state analysis of digital control system, effect of sampling on transient response	
4.0		**State Space Analysis**	08
	4.1	Discrete time state equation in standard canonical form, similarity transformation	
	4.2	State transition matrix, solution of discrete time state equation	
	4.3	Discretization of continuous state space model and its solution.	
5.0		**Pole Placement and Observer Design**	10
	5.1	Concept of reachability, controllability, constructability and observability	
	5.2	Design of controller using pole placement method, dead beat controller design	
	5.3	Concept of duality, state observer design, concept of multi rate output feedback based state estimation	
6.0		**Transfer Function Approach to Controller Design**	10
	6.1	Control structures, internal stability,	
	6.2	Internal model principle and system type, well behaved signals	
	6.3	Discretization of PID controllers, pole placement controllers with performance specifications	
		Total	52

Recommended Books:

1. M. Gopal, "Digital Control and State Variable Methods", McGraw Hill companies, 3rd edition, 2009.
2. K. Ogata, "Discrete-Time Control Systems", PHI, 2nd edition, 2009.
3. B. C. Kuo, "Digital Control Systems", Oxford University press, 2nd edition, 2007.
4. K. M. Moudgalya, "Digital Control", Wiley India, 2012.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules