

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC602	Advanced Instrumentation 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						
EXC602	Advanced Instrumentation System	20	20	20	80	--	--	--	100	

Course Objectives:

1. To understand basic functions and working of Pneumatic and Hydraulic components used in Instrumentation Process System.
2. To understand principles of process parameter transmission and conversion of process parameters to electrical and vice versa.
3. To become familiar with control system components and their application in process control.
4. Learners are expected to understand various controllers used in process control and the tuning methods of controllers.

Module No.	Unit No.	Topics	Hrs.
1.	1.1	Concepts of Advancement in Instrumentation	06
		Data acquisition and data logging, telemetry in measurement, basic requirement of control system and components	
2		Pneumatic Components	12
	2.1	ISO symbols, pneumatic air supply system, air compressors, pressure regulation devices, directional control valves	
	2.2	Special types of pneumatic valve: pilot-operated valves, non-return valves, flow control valves, sequence valves, and time delay valve	
	2.3	Single and double acting linear actuators, special type of double acting cylinder, rotary actuators, air motors	
	2.4	Process control pneumatics: flapper nozzle system, volume boosters, air relays, pneumatic transmitters and controllers, pneumatic logic gates, dynamic modeling of pneumatic circuits	
3		Hydraulic Components.	06
	3.1	Hydraulic pumps, Pressure regulation method, loading valves	
	3.2	Hydraulic valves and actuators, speed control circuits for hydraulic actuators	
	3.3	Selection and comparison of pneumatic, hydraulic and electric systems	
4		Transmitters and Converters	12
	4.1	Electronic versus pneumatic transmitters, 2-wire; 3-wire and 4-wire current transmitters	
	4.2	Electronic type: temperature, pressure, differential pressure, level, flow transmitters and their applications Smart (Intelligent) transmitters, Buoyancy transmitters and their applications.	
	4.3	Converters: Pneumatic to Electrical and Electrical to Pneumatic converters	
5		Process Control Valves	08
	5.1	Globe, ball, needle, butterfly, diaphragm, pinch, gate, solenoid, smart control valves and special designs of globe valves	
	5.2	Flow characteristics, control valve parameters, control valve capacity, valve rangeability, turn-down, valve size, valve gain	
	5.3	Selection criteria, specifications and installation of control valves	
	5.4	Valve Positioners: Necessity, types-motion balance and force-balance, effect on performance of control valve	
	5.5	Control Valve Actuators: Electrical, pneumatic, hydraulic, electro-mechanical, digital actuators. selection criteria of valve actuators	
6		Controllers and Controller Tuning	08
	6.1	Continuous and discontinuous controller: proportional controller, proportional band, RESET controller, rate controller, composite controller, cascade controller, feed-forward controller	
	6.2	Need and different method of controller tuning	
		Total	52

Recommended Books:

1. Bella G. Liptak, "*Process Control and Optimization, Instrument Engineer's Handbook*", 4th Edition, CRC Press
2. WG Andrews and Williams, "*Applied Instrumentation in the process Industries, Vol. - I and II*", Gulf Publication
3. Terry Barlett, "*Process Control System and Instrumentation*", Delimar Cengage learning Reprint-2008
4. Andrew Parr, "*Hydraulics And Pneumatics- A Technician's And Engineer's Guide*", Jaico Publishing House, Mumbai
5. C.D.Johnson, "*Process Control and Instrument Technology*", Tata Mcgraw Hill.
6. J. W. Hatchison, "*ISA Handbook of Control Valves*", 2nd Edition, ISA, 1990.

Internal Assessment (IA):

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

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 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.