Course code	Course Name	L-T-P - Credits	Year of Introduction
MR202	Sensors and Actuators	3-0-0-3	2016

Prerequisites :Nil

Course Objectives

- To understand the main components of the hydraulic and pneumatic systems
- To learn controls used in NC Machines and fluidic control systems

Syllabus

Industrial Prime movers - hydraulic and pneumatic systems-pumps – types of pumps- filters and their types- Compressors - relief valves-non relieving pressure regulator. Control valves-graphic symbols –Types of control valves- Actuators-linear actuator-principle of operation-simple cylinder- -seals-anti extrusion rings-rotary actuators-constructional details-limited motion rotary actuators - Speed control of actuators - speed control by pump volume-meter in speed control-meter out speed control for overhauling load-bleed off speed control-pressure compensated flow control valve - signals and standards - the flapper nozzle - volume booster - pneumatic controllers – types of pneumatic controllers - Fail up and fail down actuators – Converters - PI and IP converters. Controls in NC Machines - stepping motors - encoders - resolvers - inductosyn – tachogenerators - Coanda effect - basic fluidic devices - fluidic logic gates - bistable flipflop - OR and NOR gates - exclusive OR gates - fluidic sensors - backpressure sensor - proximity sensor

Expected outcome.

- Upon completion of this course, students will be familiar with the main components used in hydraulic and pneumatic systems and gain knowledge on the controls in NC Machines and fluidic systems.

Text Book:

1. Andrew Parr, ‘Hydraulics and Pneumatics’, Jaico Publishing House ,Mumbai

References:

1. Anthony Esposito, ‘Fluid Power’, Pearson Education,
2. Yoram Koren, ‘Computer control of Manufacturing Systems’, TataMc.Graw Hill Publishers, New Delhi

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Industrial Prime movers-brief comparison of electrical, hydraulic and pneumatic systems-hydraulic pumps-pressure regulation-gear pump- lobe pump- unbalanced and balanced type vane pump-variable displacement vane pump-radial piston pump-piston pump with stationary cam and rotating block-axial pump with swash plate-bent axis pump-combination pumps-loading valves-filters and location of filters-full flow filter-proportional flow filter-edge type filter.	7	15%
II	Compressors-single cylinder compressor- double acting compressor and two stage compressor-combined two stage compressor-diaphragm compressor-screw compressor-rotary compressor-liquid ring compressor –lobe compressor-non positive displacement compressor-air receiver and compressor control-receiver pressure control via motor start stop –receiver pressure control using compressor outlet valve and inlet valve-stages of air treatment –filters-air driers-deliquescent and adsorption driers-lubricators-types of pressure regulators-relief	7	15%

	valves-non relieving pressure regulator-relieving pressure regulator-service units		
FIRST INTERNAL EXAMINATION			
III	Control valves-graphic symbols –Types of control valves-simple 2/2 poppet valve-3/2poppet valve 4/2 poppet valve-spool valves- two way and four way spool valves-three position four way valve- pilot operated 3/2 valve-rotary valve-Check valve-simple check valve-right angle check valve-pilot operated check valve-restriction check valve-shuttle valve-fast exhaust valves-sequence valve-time delay valve-single stage infinite position valve-flapper jet servo valve	7	15%
IV	Actuators-linear actuator-principle of operation-simple cylinder-cylinder with equal extend/ retract force-single acting cylinder-cylinder speed calculation-construction details of cylinder-cylinder cushioning-side load and stop tube-two stage telescopic piston-impact cylinder-mounting of cylinders-cylinder seals-static -anti extrusion rings-rotary actuators-constructional details-limited motion rotary actuators-Speed control of actuators-speed control by pump volume-meter in speed control-meter out speed control for overhauling load-bleed off speed control-pressure compensated flow control valve.	7	15%
SECOND INTERNAL EXAMINATION			
V	Process control pneumatics - signals and standards - the flapper nozzle - volume booster - air relay and force balance - pneumatic controllers - proportional pneumatic control - proportional plus integral pneumatic control - proportional plus integral plus derivative pneumatic control - Fail up and fail down actuators –Converters- PI and IP converters	7	20%
VI	Controls in NC Machines and fluidic control - stepping motors - feedback devices- encoders - resolvers - inductosyn – tachogenerators - principles of fluid logic control -Coanda effect - basic fluidic devices - fluidic logic gates - bistable flipflop - OR and NOR gates - exclusive OR gates - fluidic sensors - backpressure sensor - cone jet proximity sensor - interruptible jet sensor.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS

8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS

5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS

4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions

(2 x15 = 30 marks)