



MECHATRONICS

PROF. PUSHPARAJ MANI PATHAK

Department of Mechanical Engineering
IIT Roorkee

INTENDED AUDIENCE : Mechanical/Electrical/Electronic under graduate and post graduate students

INDUSTRIES APPLICABLE TO : Automobile, DRDO, Railways

COURSE OUTLINE :

The word mechatronics is composed of "mecha" from mechanism and the "tronics" from electronics. It is the synergistic integration of mechanical engineering, with electronics and intelligent computer control in the design and manufacturing of industrial products and processes. Mechatronics generally involves (i) implementing electronics control in a mechanical system (ii) enhancing existing mechanical design with intelligent control and (iii) replacing mechanical component with an electronic solution This course will cover all aspects related with mechatronics such as sensors and transducers, actuators and mechanisms, signal conditioning, microprocessors and microcontrollers, modeling & system response and design and mechatronics.

ABOUT INSTRUCTOR :

Prof. Pushparaj Mani Pathak is currently a Professor at IIT Roorkee. He was graduated from N.I.T., Calicut in 1988 in Mechanical Engineering. He completed his M. Tech in Solid Mechanics and Design from IIT Kanpur in 1998. Later he was awarded the PhD degree from IIT Kharagpur in 2005. His areas of research are Robotics, Dynamics, Control, and Bond Graph Modelling. He has served in different industries from 1989 to 1994. He is in teaching profession since 1994. He is serving in Mechanical and Industrial Engineering Department, IIT Roorkee since 2006. He has co-authored one book on Intelligent Mechatronic Systems: Modeling, Control and Diagnosis published by Springer, London and has published more than 40 papers in International Journals in the field of Robotics and Control. He has supervised 34 M. Tech theses and 7 PhD theses in different areas.

COURSE PLAN :

Week 1: Introduction to mechatronics : Introduction, Examples of Mechatronic systems, Electric circuits and components, Semiconductor Electronics, Transistor Applications

Week 2: Electric Circuits and Semiconductor Electronics : Performance terminology of sensors, Displacement, Position & Proximity Sensors-I, Displacement, Position & Proximity Sensors-II, Force, Fluid pressure, Liquid flow sensors, temperature, light sensor, Acceleration and Vibration measurement, Semiconductor sensor and MEM, SAW

Week 3: Sensors and transducers : Mechanical Actuation System, Hydraulic & Pneumatic Actuation System, Electrical Actuation System-I, Electrical Actuation System-II, Data Presentation system

Week 4: Actuators and mechanisms: Introduction to signal processing & Op-Amp, Op-Amp as signal conditioner, Analogue to Digital Converter, Digital to Analogue Converter, Artificial intelligence

Week 5: Signal conditioning: Digital circuits-I, Digital circuits-II, Microprocessor Micro Controller, Programming of Microcontrollers

Week 6: Microprocessors and microcontrollers: Mechanical system model, Electrical system model, Fluid system model, Dynamic response of systems, Transfer function and frequency response.

Week 7: Modeling and system response: P,I, PID Controllers, Digital Controllers, Program Logic Controllers, Input/output & Communication systems, Fault findings

Week 8: Design and mechatronics: Project using Microcontroller-Atmega 16, Myoelectrically Controlled, Robotic Arm, Robocon-Part I, Robocon-Part II, Design of a Legged Robot