Introduction to Robotics
(Syllabus)
(Institute Elective for UG L-T-P-3-0-2)

- ❖ **Introduction:** Fundamentals of Robot and Robotic system, Definition of robot, Functions of robot, Difference between robot and automated machines, Laws of Robotics, Fundamental unit structure of a robot, Advantages and disadvantages of a robot, Various models of a robotic system.

- ❖ **Mechanical Aspects of Robotic system**
  - **Robotic system:** Sensor, Controller, Base, End efforts, Manipulator arm
  - **Various coordinate systems:** Cartesian, Cylindrical, Spherical, Jointed arm
  - **Joints and types of joints:** Linear, Orthogonal, Rotational, Revolving
  - **The terminologies :** Work envelope, Degree of freedom, Workspaces, Stability and accuracy
  - **Gears, pulleys, chain drives and belt drives**
  - **Pneumatic and hydraulic system:** Basics, Hydraulic and pneumatic circuits, Design of a circuit
  - **End effectors, Grippers and Actuators :** Introduction, End Effectors ,Types, Grippers,Mechanical gripper, Vacuums gripper, Adhesive gripper, Magnetic gripper, Design of a gripper, Actuators, Fluid power, Mechanical Actuator, Electrical Actuator, Hydraulic Actuator, Pneumatic Actuator
  - **Design and simulation tools:** Practicing session on following software tools for Modeling: Catia, solid works.Practice session in making: gears, joints, grippers as an assignment.

- ❖ **Electrical and Electronics Aspects of robotic system**
  - **Switches and relays :** Switches- Introduction, Types of switches Application circuits, Relays- Introduction, Working,Application circuits
  - **Diodes, LEDs and Transistors:** Introduction, Working, Types, Applications
  - **Sensors:** Introduction and basic structure,Internal states sensors, Pots, LVDT, RVDT, Accelerometer, Optical encoders, Tachometer, Optical interrupts, External state sensors, Strain gauge, Proximity device, Pressure transducers, Ultrasonic sensor, Electromagnetic sensor,Application circuits
  - **Motors :** Introduction and working principle, DC Motors, Stepper Motors, Servo Motors, Speed torque relation, Back emf and the H.bridge Circuits,Requirement of driving circuits
  - **Microcontroller, Microprocessors and its peripherals:** Introduction to Microprocessor, Introduction to Microcontroller, Difference between Microprocessor & Microcontroller, Architecture of 8051, IO ports, Registers, Timers, Counters, Interrupts, Programming the microcontroller
  - **Arduino:** Introduction, Architecture , Programming, Peripheral Devices and their Interfacing
  - **Programming, designing & Simulation tools:** Tools for PCB layout and etching.

Text/Reference Books:

Rattan, S.S.: "Theory of Machines", 2nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.

V.B.Bhandari, "Design of Machine Element," Tata McGraw Hill Publications, 4th Edition, 1997

J. E. Shigley, J. J. Uicker, "Theory of Machines & Mechanism," McGraw Hill Publication– New Delhi, 2nd Edition

Mechatronics: "Electronic control system in Mechanical and Electrical Engineering," W. Bolton, Pearson Education Asia.

Kastuhiko Ogatta, "Modern Control Engineering" [Phi]

Sudhir Gupta, "Elements of Control system," Prentice Hall
A.K. Sawhney: "A course in Electrical and Electronic measurements and Instrumentation", Dhanpat Rai and Company.

B.L.Theraja, A.K. Theraja, A Textbook of Electrical Technology, Vol-II, S.Chand & Co., New Delhi,2005.

Muhammad Ali Mazidi and Janice Gillispe, The 8051 Microcontroller and embedded Systems, Pearson Education Asia, Indian reprint 2002.

R. S. Gaonkar "Microprocessor Architecture, Programming and application with 8085/8085A", Fourth Edition, Willey Eastern Ltd.

U. V. Kulkarni and T. R. Sontakke "The 8085A Basics: Programming and Interfacing", Sadusudha Prakashan, Nanded.