Course code	Course Name	L-T-P-Credits	Year of Introduction
ME464	**Robotics and Automation**	**3-0-0-3**	**2016**

Prerequisite : Nil

Course Objectives: :
- To provide the concepts of vision system and image processing
- To equip students to write programs for automatic functioning of a robot
- To familiarise various robot sensors and their perception principles that enable a robot

Syllabus:

Definition ,Co-ordinate Systems, Work Envelope, types and classification, Robot drive systems, End Effectors, Grippers, Sensors and machine vision, Robot kinematics and robot programming, Application of robots in machining.

Expected Outcomes:

The students will be able to
  i. Become familiar with the history, concept, development and key components of robotics technologies
 ii. Classify and characterize the robots based on the configuration and work volume
iii. Solve the problems related to robot design and control

Text books:

1. Industrial Robots, Yu.Kozyrev, Mir Publishers
2. Janakiraman.P.A., Robotics and Image Processing, Tata McGraw-Hill, 1995
3. M.P.Groover, Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, 2001
4. Yoram Koren, Robotics for Engineers, McGraw-Hill Book Co., 1992

References:

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw-Hill Book Co., 1987
2. K.S.Fu., R.C.Gonalez, C.S.G.Lee, Robotics Control sensing, Vision andIntelligence, McGraw Hill International Edition, 1987
3. Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Robotic engineering-An Integrated Approach , Prentice Hall Inc, 1989

COURSE PLAN

Module	Contents	Hours	End Sem. Exam. Marks
I	Definition – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Basic robot motions - Point to point control, Continuous path control. Robot Parts and Their Functions – Need for Robots Different Applications.	**7**	**15%**
II	Robot drive systems: Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications	**7**	**15%**

	and Comparison of all these Drives.		
FIRST INTERNAL EXAMINATION			
III	End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations	7	15%
IV	Sensors and machine vision: Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Laser Range Meters).	7	15%
SECOND INTERNAL EXAMINATION			
V	Proximity Sensors(Inductive, Capacitive, and Ultrasonic), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Robot kinematics and robot programming: Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional) – Deviations and Problems.	7	20%
V1	Teach Pendant Programming, Lead through programming, Robot programming Languages –VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs. Industrial Applications: Application of robots in machining, welding, assembly, and material handling.	7	20%
END SEMESTER EXAMINATION			

Question Paper Pattern

Maximum **marks: 100**   **Time: 3 hrs**

The question paper should consist of three parts

Part A

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: in all parts each question can have a maximum of four sub questions