**20ME41O2- ROBOTICS**

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| **Course Category:** | Open Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Physics, Differential Equations, Matrices and basic Geometry. Computer Simulation skills using Matlab | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | To make the student learn about: | |
| 1. The robotics as an integrated engineering field, classification of robotic manipulators and related technologies. 2. The skills associated with robot control 3. The skills associated with sensors and machine vision systems to robot control 4. The skills in performing kinematics analysis of robot systems 5. The skills in write a robot programme. 6. The skills and interactive applications of industrial robots | |
| **Course Outcomes:** | After completing the course the student will be able to | |
| **CO1** | Understand the importance of robotics in today and future and robot configuration and subsystems |
| **CO2** | Gain the knowledge about Control systems for motion control |
| **CO3** | Gain the knowledge about sensors and machine vision. |
| **CO4** | Gain the knowledge about skills in kinematics of robot motion |
| **CO5** | Gain the competence in Design and implementation programming of robot systems. |
| **CO6** | Gain the knowledge about Industrial robots applications. |
| **Course Content:** | **UNIT –I**  **Introduction**: Need, anatomy of robot, types of joints, types of constructions- degree of freedom, coordinate system workspace/work volume, robot specification.  **End-effectors**: Types- mechanical, magnetic, pneumatic  **UNIT –II**  **Actuators**: Introduction, actuators, characteristics, types, comparison, hydraulic, pneumatic, electric- D.C, A.C, servo, stepper.  **Motion control systems**: Introduction, basic components and terminology, transfer function, open loop, feed-forward and closed-loop. microprocessor control of electric motor.  **UNIT-III**  **Sensors**: Introduction, characteristics, Types - position, velocity, acceleration, force and pressure, torque, proximity, micro switches, touch and tactile, range finders.  **Machine vision**: Introduction to machine vision, the sensing and digitizing function in machine vision, image processing and analysis- training the vision system, robotic applications.  **UNIT-IV**  **Kinematics of robots:** Introduction, reference frames, robots as mechanisms, matrix representation, transformations, forward and inverse kinematics of 2R and 3R robots, DH representation, degeneracy and dexterity.  **UNIT-V**  **Robot programming**: Methods of robot programming, a robot program as a path in space motion interpolation wait signal and delay commands branching  **Robot languages:** Introduction, generation of robot programming languages, robot language structure, operating systems, robot language elements and functions  **UNIT-VI**  **Robot applications**: Manufacturing, material transfer and machine loading and unloading, processing operations, welding, other processing operations, assembly and inspection, robotic assembly, parts presentation methods, inspection automation | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1.“Industrial Robotics”, by M.P Groover 2nd Edition, McGraw-Hill Education (SIE).  2.“Introduction to Robotics: Analysis,Control,Applications”, by Saeed B Niku , 2nd Edition Wiley publishers.  **Reference books:**  1.“Introduction to Robotics”, by Subir Kumar Saha Tata McGraw-Hill Education.  2.“Robotics: Fundamental Concepts And Analysis”, by Ashitava Ghosal oxford university press  3.“Introduction to Robotics: Mechanics and Control”, by Craig John J, 3rd Edition, Prentice-Hall, 2005.  4.“Vision and Control”, by P. Corke. Robotics, Springer Verlag, 2011. | |
| **e-Resources:** | <http://nptel.ac.in/courses>  http://freevideolectures.com/university/iitm | |