<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P-Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME464</td>
<td>Robotics and Automation</td>
<td>3-0-0-3</td>
<td>2016</td>
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**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:**

**Expected Outcomes:**
The students will be able to
1. Become familiar with the history, concept, development and key components of robotics technologies
2. Classify and characterize the robots based on the configuration and work volume
3. Solve the problems related to robot design and control

**Text books:**
1. Industrial Robots, Yu. Kozyrev, Mir Publishers

**References:**

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### COURSE PLAN

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>End Sem. Exam. Marks</th>
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<tbody>
<tr>
<td></td>
<td><strong>I</strong> 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.</td>
<td>7</td>
<td>15%</td>
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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% |
| VI | Teach Pendant Programming, Lead through programming, Robot programming Languages –VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs. Industrial Applications: Application of robots in machining, welding, assembly, and material handling. | 7 | 20% |

### END SEMESTER EXAMINATION

**Question Paper Pattern**

<table>
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<tr>
<th>Maximum marks: 100</th>
<th>Time: 3 hrs</th>
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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