

**UNIVERSITY OF MADRAS**  
**M.Sc., DEGREE PROGRAMME IN PHYSICS**  
**SYLLABUS WITH EFFECT FROM 2023-2024**

**529S3A**

<b>Skill Enhancement Course - ARTIFICIAL INTELLIGENCE FOR ROBOTICS AND INDUSTRIAL ROBOTS</b>	<b>II YEAR –THIRD SEMESTER</b>
<b>Pre-Requisites</b>	
<b>Basic Understanding of Physics, Computer Literacy, Basic Mathematics, Familiarity with MS Office Suite Programming Fundamentals</b>	
<b>Learning Objectives</b>	
<ul style="list-style-type: none"> <li>➤ To study the concepts of Artificial Intelligence.</li> <li>➤ To learn the methods of solving problems using Artificial Intelligence.</li> <li>➤ To introduce the basic concepts, parts of robots and types of robots.</li> <li>➤ To familiarise the student with the various drive systems for robot, sensors and their applications in robots and programming of robots.</li> <li>➤ To select the robots according to their usage.</li> </ul>	
<b>UNITS</b>	<b>Course Details</b>
<b>UNIT I: INTRODUCTION</b>	History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.
<b>UNIT II: PLANNING</b>	Planning with forward and backward State space search – Partial order planning. – Planning graphs– Planning with propositional logic – Planning and acting in the real world.  Hands-on Experiments- 1. Design a Light Tracking Robot 2. Design a Sound Tracking Robot
<b>UNIT III: INTRODUCTION TO INDUSTRIAL ROBOTS</b>	Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.
<b>UNIT IV: ROBOTS FOR INSPECTION</b>	Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.  Hands-on Experiments- 1. Design a Drone 2. Design a pipe Inspection Robot
<b>UNIT V: APPLICATION OF ROBOTS</b>	Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robots for underwater applications.
<b>UNIT VI: PROFESSIONAL COMPONENT</b> (Exclusive for internal	Workshops and seminars, webinars and visits to provide insights into real-world AI & Robotics and Robots.

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assessment and should not be included in the external examination question paper)	
<b>Skills honed from participating in this course</b>	Identify problems that are amenable to solution by AI methods. Identify appropriate AI methods to solve a given problem. Formalise a given problem in the language/framework of different AI methods. Implement basic AI algorithms. Learn about the basic concepts, parts of robots and types of robots
<b>TEXTBOOKS</b>	<ol style="list-style-type: none"> <li>1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approach", Pearson Education, India 2003.</li> <li>2. Negnevitsky, M, "Artificial Intelligence: A guide to Intelligent Systems", Harlow: Addison-Wesley, 2002.</li> <li>3. Richard D Klafter, Thomas Achmielewski and Mickael Negin, "Robotic Engineering – An integrated Approach" Prentice Hall India, New Delhi, 2001.</li> <li>4. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 2nd Edition, John Wiley &amp; sons, Inc, 2007</li> </ol>
<b>REFERENCE BOOKS</b>	<ol style="list-style-type: none"> <li>1. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 1992.</li> <li>2. James A Rehg, "Introduction to Robotics in CIM Systems", Prentice Hall of India, 2002.</li> <li>3. Deb S R, "Robotics Technology and Flexible Automation", Tata McGraw Hill, New Delhi, 1994</li> </ol>
<b>WEB SOURCES</b>	<a href="https://youtu.be/Yybny8Jk3qU?si=ZXVK6Dr9y3biytDe">https://youtu.be/Yybny8Jk3qU?si=ZXVK6Dr9y3biytDe</a> <a href="https://youtu.be/Yybny8Jk3qU?si=ld-kSj1eCpJoeohD">https://youtu.be/Yybny8Jk3qU?si=ld-kSj1eCpJoeohD</a> <a href="https://youtu.be/htjRUL3neMg?si=WOGDaZJlosanPPF4">https://youtu.be/htjRUL3neMg?si=WOGDaZJlosanPPF4</a> <a href="https://youtu.be/yCXm5cgG0UA?si=tfW3IPiUTdyPQ4g4">https://youtu.be/yCXm5cgG0UA?si=tfW3IPiUTdyPQ4g4</a> <a href="https://youtu.be/xtm0oCCrNTs?si=qk6vNE78cumC7LqZ">https://youtu.be/xtm0oCCrNTs?si=qk6vNE78cumC7LqZ</a> <a href="https://youtu.be/qq6--4jtj7s?si=uHLvemHf ny6nzDG">https://youtu.be/qq6--4jtj7s?si=uHLvemHf ny6nzDG</a> <a href="https://youtu.be/bV9CnYSqLqY">https://youtu.be/bV9CnYSqLqY</a> <a href="https://youtu.be/BqL45uDIRZs?si=xXMVy76SbeBL5YmT">https://youtu.be/BqL45uDIRZs?si=xXMVy76SbeBL5YmT</a> <a href="https://youtu.be/nw6ktelfn3c?si=mcPWac7BPgyJ7-Ay">https://youtu.be/nw6ktelfn3c?si=mcPWac7BPgyJ7-Ay</a>