# 19IT4101 - INTRODUCTION TO ROBOTICS AND NAVIGATION

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| **Course Category:** | Professional Core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Basics of probability and statistics, and Artificial intelligence concepts are required. | **Sessional Evaluation:**  **Univ. Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * To Learn about the Basics of Robotics and its Teleoperations. * Identify the Hierarchical Paradigm and its Functionalities. * To evaluate the Performance of different Navigation Models. | | |

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| **Course Outcomes** | Upon the successful completion of the course, the students will be able to: | |
| CO1 | Understand the evolution of Robotics and important areas of AI. |
| CO2 | Learn the Hierarchical Paradigm, Biological Foundations ofReactive Paradigm and its Importance . |
| CO3 | Know the Reactive Paradigm, Designing and its Implementation. |
| CO4 | Explore the Behavioral, Sensing Techniques for Reactive Robots. |
| CO5 | Analyze the Attributes, Architectural Aspects of Reactive Paradigm. |
| CO6 | Specify the Relational Methods, Associative Methods of Topological Path Planning and Objectives and Overview of Metrics Path Planning**.** |
| **Course Content** | **UNIT – I**  **Teleoperation To Autonomy**: How can a Machine Be Intelligent, What can Robots Be Used For, A Brief History of Robotics, Teleoperation, The Seven Areas of AI.  **UNIT – II**  **Hierarchical Paradigm:** Representative Architectures, Advantages and Disadvantages**.**  **Biological Foundations Of The Reactive Paradigm:** What are Animal Behaviors, Coordination and Control of Behaviors, Perception in Behaviors, Schema Theory.  **UNIT – III**  **Reactive Paradigm:** Attributes of Reactive Paradigm, Subsumption Architectures.  **Designing A Reactive Implementation**: Behaviors as Objects in OOP, Steps in Designing a Reactive Behavioral System.  **UNIT – IV**  **Common Sensing Techniques for Reactive Robots:** Behavioral sensor Fusion, Designing a Sensor Suite, Proprioceptive Sensors, Proximity Sensors, Computer Vision.  **UNIT – V**  **Hybrid Deliberative/Reactive Paradigm:** Attributes of the Hybrid Paradigm, Architectural Aspects, Managerial Architectures, State-Hierarchy Architectures, Model-Oriented Architectures, Other Robots in the Hybrid Architectures, Interleaving Deliberation and Reactive Control**.**  **UNIT – VI**  **Topological Path Planning:** Landmarks and Gateways, Relational Methods, Associative Methods, Case Study of Topological Navigation with a Hybrid Architecture.  **Metrics Path Planning**: Objectives and Overview, Configuration Space, Cspace Representations, Graph Based Planners, Wavefront Based Planners. | |
| **Text Books and References:** | **Text Books:**   1. Introduction to AI Robotics, Robin R Murphy. (MIT Press), 2nd edition.   **Reference Books:**   1. [From AI to Robotics: Mobile, Social, and Sentient Robots, Bhaumik&Arkapravo by CRC Press, 1st Edition.](http://b-ok.cc/book/3496299/f0afb0) 2. 2. [Behavior Trees in Robotics and AI. An Introduction, Michele Colledanchise, [Petter Ögren](http://b-ok.cc/g/Petter%20%C3%96gren)](http://b-ok.cc/book/3561341/d6ac10) by CRC Press, 1st Edition | |
| **E-Resources** | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |