1. **Course Number and Course Title:**
   CMP 49410 Intelligent Autonomous Robotics

2. **Credits Hours:**
   3–0–3

3. **Prerequisites and/or Co-Requisites:**
   Prerequisite: CMP 220 Programming II and CMP 213 Discrete Structures or
   MTH 213 Discrete Mathematics

4. **Name and Contact Information of Instructor:**
   Dr. Michel Pasquier

5. **Course Description (Catalog Description):**
   Introduces the fundamental concepts, principles, and algorithms for perception, computation, and action in the physical world. Studies robot tasks and architectures, sensors and vision, localization, mapping, manipulation, motion planning and navigation. Examines selected advanced topics such as geometric reasoning, autonomous exploration, as well as case studies such as autonomous vehicles for smart cities.

6. **Textbook and other Supplemental Material:**
   Textbook:
   - N. Correll, *Introduction to Autonomous Robots,* Magellan Scientific, 2016.

   Other supplemental material:
   - R. Murphy, *Introduction to AI Robotics,* 2nd edition, MIT Press, 2018.
   - R. Seigwart and I.R. Nourbakhsh, *Introduction to Autonomous Mobile Robots,* 2nd edition, MIT Press, 2011.
   - G. Bekey, *Autonomous Robots: From Biological Inspiration to Implementation and Control,* MIT Press, 2005.
   - Notes, articles, and simulation software provided by the instructor.

7. **Course Learning Outcomes:**
   Upon completion of the course, students will be able to:
   1. Describe autonomous robots and explain their growing importance in society.
   2. Discuss various robot types and architectures, tasks and environments.
   3. Model the kinematics of simple manipulators and mobile robots.
   4. Characterize different types of sensors and data processing techniques.
   5. Explain state estimation, localization, and mapping techniques.
   6. Apply concepts of manipulation and motion planning to realize robot tasks.
   7. Use state-of-the-art robotics software tools to program autonomous robots.

8. Teaching and Learning Methodologies:

Methods include lectures, problem-based learning, class discussions, and group work, as well as laboratory sessions. Students learning is assessed via in-class quizzes, exams, homework, and programming assignments/projects.

9. Course Topics and Schedule:

Topic	Weeks
Introduction to intelligent autonomous robots	Week #1
Robot types and architectures	Week #2
Hierarchical architectures, subsumption	Week #3
Locomotion, forward and inverse kinematics	Week #4
Sensors (range finders, GPS, IMU)	Week #5
Sensor fusion, knowledge extraction	Week #6
Vision, image processing, feature recognition	Week #7
Object and place identification	Week #8
Path planning and collision avoidance	Week #9
Path planning and routing algorithms	Week #10
Mapping and collision avoidance	Week #11
Mapping and localization	Week #12
State estimation, localization, and mapping	Week #13
Manipulation and dexterous grasping	Week #14
Revision	Week #15
Final exam	Week #16