Modules Covered Module #1- Module #5(Till Graph Based Planners only)
Total Marks: 20   **Deadline: As announced on eLearn**
Type: Work-Integrated Learning Assignment (Part A - Research Paper Study, Part B -Python Implementation)
Submission: PDF report (3–4 pages **only**) + Python code notebook with screenshots

Learning Objectives

After completing this assignment, students will be able to:
- Apply robotics concepts to realistic workplace-inspired problems.
- Evaluate how robot phases perform using AI&ML technique.
- Design & implement localization, mapping & planning inROS2.

Part A – Study

Research Paper: To access the assigned paper, click here with your BITS EMAIL ONLY. Review the Phases of Robotic Design in the given research paper and identify below pointers: Refer to the live contact session for further clarity on the below requirement.

I.   Objective
II.   Domain
III.   Scope of the Work
IV.   Key area open for future enhancement and/or Optimization
V.   List precisely key design aspect w.r.t following phases of mobile robotics (Important Note: Brief each of the below in no more than 3 sentences)
   A. Deployment Platform
   B. Sensors & Types
   C. Perception: Sensor Measurement Model & Motion Model
   D. Localization & Mapping
   E. Trajectory Planning
   F. Control Technique
   G. Communication Infrastructure (IoT/Cloud/Wifi etc.,)

Part B – Implementation

Scenario: You are working in a team deploying autonomous robots in a workplace setting. **Choose the same domain based on your group's preference chosen during assignment 1 from below**:

   - Warehouse logistics and inventory movement
   - Hospital or service robotics (delivery, monitoring, assistance)
   - Manufacturing process inspection or material handling
   - Agricultural or environmental field robotics

Implement all the following algorithms for the chosen domain with a simulation tool of your choice. Ensure that all the group members consent & are ready to work in your group preferred simulation tool of choice.

    A. Monte Carlo Localization
    B. Feature based SLAM
    C. A* Planner
    D. In any one of the above phases, use (any) traditional machine learning algorithm. Justify your choice & relevance to the algorithm.

Submission Format (Applicable only for Part A questions)
    ● File 1: Assignment Report (PDF, max 4 pages)
    ● File 2: Code notebook (.ipynb) . Mention the BITS ID and NAME of the group members who contributed to the assignment exercises.
    ● Screenshots/ Simulation output copy of the codes can be appended in the File 1 PDF report.
Tools: Python, Google Colab, PyBullet or Gazebo/RVIZ.
Deadline: As announced on eLearn

Marking Scheme
The grading will be relative based on the class performance. **Key factors** which will be considered for scoring includes (but not limited to) : Creativity, Originality, Uniqueness, Relevance to the chosen domain's open problems, Code Modularity, Representation, Reproducibility, Similarity to AI tool solutions.

Component	Description	Marks
Part A – Research Paper Study	Components & Phases of Robotics - Design , Modelling & Implementation, Comparative Analysis to traditional techniques	2
Part B – Python Implementation	Ability to apply, relate to Assignment 1 chosen domain, implement using python programming, infer the outcome , critically evaluate the performance	8
Part B – Python Implementation	Usage of the BITS Virtual Cloud Labs, Implementation in ROS2(at least one part (not limited to) of the above assignment subparts must be in ROS2)	2
Viva(Individual)	Ability to demonstrate implementation skills in all the above. Irrespective of individual contribution a student may be examined on any parts of the assignment done by the group	8
Total		20