

# Assignment 1 – Robotic Workcell Design

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Advanced Robotic Systems – MANU2453

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# Robot Cell Design Assignment

- This is a **group assignment**.
- The assignment contributes 20% to your final score.
- Submit by end of Week 4, Sunday 16 Aug, i.e., 23:59 hours AEST.

# Robot Cell Design Assignment

- An equipment manufacturer asks for your expertise in automating their diesel engine cylinder block **deburring and polishing** tasks using robots.
- Requirements:
  - They produce **10 different types** of diesel engine cylinder block.
  - Each type has **different design and size** (the smallest and largest blocks are different in size by 10%).
    - Need to **recognize** block type to load the correct **robot program**.



# Robot Cell Design Assignment

- Requirements (Continued):
  - **Deburring will occur first**, right after casting of block from mould. After deburring, then the blocks will be polished.
  - The block need to be **deburred and polished** from **two sides** (top and bottom).
    - Need mechanism to **change the orientation or flip the block**.
  - The company produces a **lot of blocks** each day.
    - Need some **storage space**.
  - The system needs to run **fully autonomous** without human intervention, so that production continues at night.
    - You may need to think carefully what steps are required from the start to the end of the fully automated process.

# Robot Cell Design Assignment

- Tasks:
  - Create a **Powerpoint presentation**, which includes:
    - **Problem Statement** (Make up your own story).
    - A few **possible solutions** for each tasks.
      - E.g. for block recognition, give two or three solutions.
    - Provide a **selection matrix**, i.e. comparisons of the solutions.
    - Give a **final recommendation** to the customer.
    - Also provide some **preliminary costing**.
      - Rough estimates will do. You do not need to contact vendors to get the price. A basic 6DOF robot costs around \$50K, and you can use your engineering judgement to estimate the cost of other items.
  - Save the Powerpoint presentation **as PDF**, then submit through Canvas.
    - No “oral” presentation required.
  - Treat this as a “tender” document, for which your presentation will need to compete with other competitors.

# Robot Cell Design Assignment

- **Additional Task:**
- Read at least 6 journal papers on **collaborative manufacturing with physical human–robot(industrial manipulator) interaction**



- On the same PPT from previous page, make some slides to discuss about:
  - The problems / challenges in collaborative manufacturing.
  - Some proposed solutions to make robots suitable for collaborative manufacturing
  - The results of the proposed solutions.

# Robot Cell Design Assignment

- **Rubric for Cell Design (15%)**
- A scale of 0 – 1 – 2 – 3 for each of the subtasks.
  - 3: **Excellent**, very comprehensive design which would certainly work.
  - 2: **Good**, design which should work with some more details or thoughts.
  - 1: **Satisfactory**, some errors with the design but generally should still work.
  - 0: **Missing or wrong design**.
- Subtask 1: Part storage and part transfer
- Subtask 2: Part recognition
- Subtask 3: Flipping mechanism – You may need to design this yourself
- Subtask 4: Robot
- Subtask 5: End-Effector
- Remember: Selection matrix and costing for each subtask.

# Robot Cell Design Assignment

- **Rubric for Literature Review on Collaborative manufacturing\* (5%)**
- 5: Good review, good categorisation of problems and solutions, reviewed the problems and solutions from all angles.
- 3: Good categorisation of problems and solutions, reviewed the problems and solutions from some angles (i.e. not complete)
- 1: Poor review, no categorisation of problems and solutions.

**\* Collaborative manufacturing with physical human–robot (industrial manipulator) interaction**