

# PROTOTYPE DESIGN COLLECTION

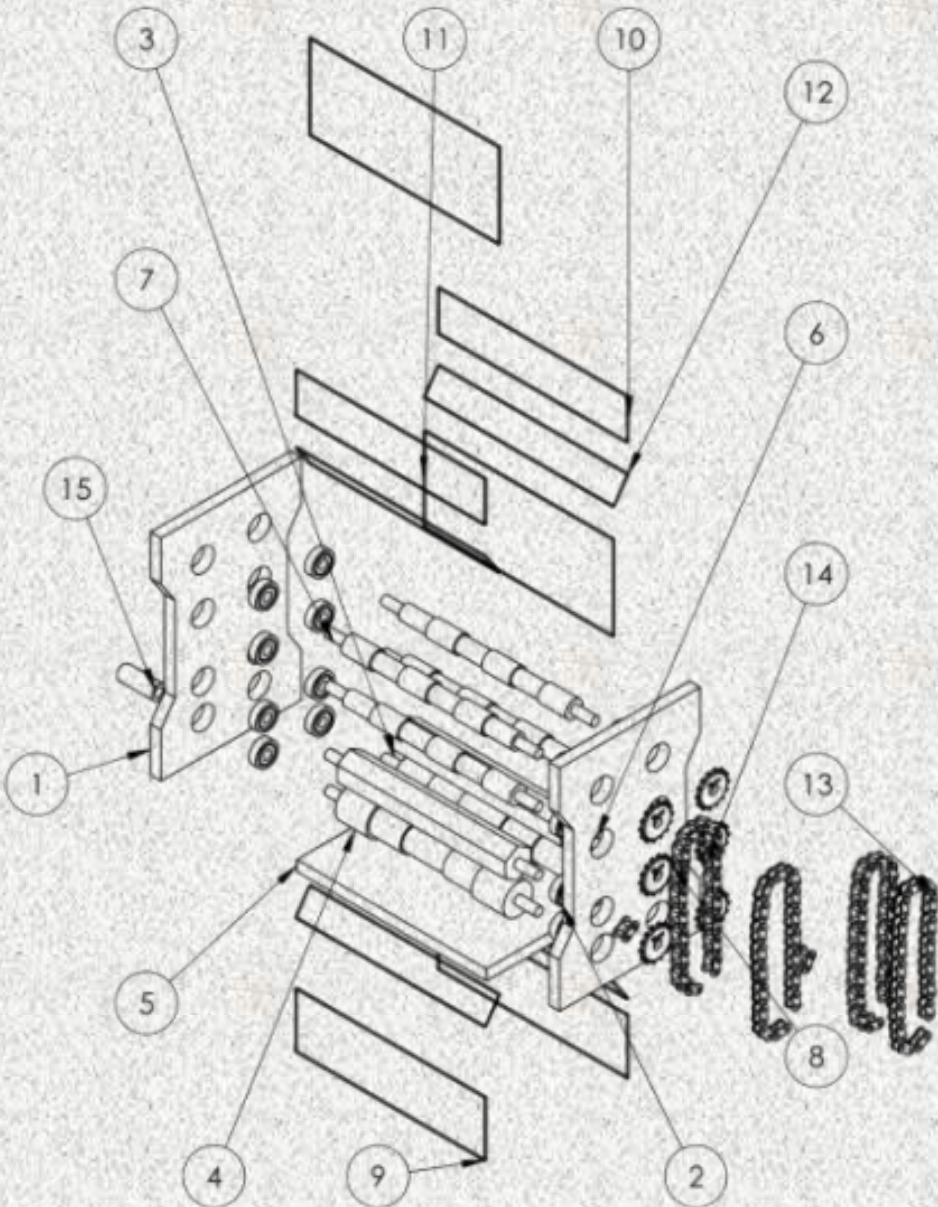
SERIES 4



Universiti Teknologi MARA  
Pasir Gudang Campus

# Prototype Design Collection

## Series 4



Ahmad Najmie Rusli

**Copyright © 2025 Universiti Teknologi MARA Cawangan Johor, Kampus Pasir Gudang,  
Jalan Purnama, Bandar Seri Alam, 81750 Masai Johor.**

All rights reserved. No part of this digital book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the written permission of the Head of the Centre for Studies, Faculty of Mechanical Engineering, Universiti Teknologi MARA Johor Branch, Pasir Gudang Campus.

**CHIEF EDITOR:**

Ahmad Najmie Rusli

**EDITOR:**

Nurul Nadiyah Rasdi

**PUBLISHER:**

Universiti Teknologi MARA  
Cawangan Johor Kampus Pasir Gudang,  
Jalan Purnama, Bandar Seri Alam, 81750 Masai, Johor  
September 2025

eISBN: 978-967-0033-62-4

# FOREWORD

This digital book on Prototype Design Collection Series 4 (PDC Series 4) is published as a reference design for mechanical engineering students. The designs presented experience a few phases of analysis before fabrication of prototype. Each project summarises the project description, prototype, figures, and design parameter. The design products vary in tools or equipment for household, workshop, entrepreneur, etc. Suggested material and detail of prototype dimension are also mentioned in this book.

It is hoped that this book will assist the students to have more ideas on innovation design products in the future.

## Table of Contents

<b>CHAPTER 1</b> .....	1
<b>Design and Fabrication of a Multipurpose Baby Cot</b> .....	1
Nabil Qayyum Bin Roslan <sup>1</sup> and Miqdad Bin Khairulmaini <sup>2*</sup> .....	1
<b>CHAPTER 2</b> .....	3
<b>Design and Fabrication of a Weather Sensing Cloth Drying Rack</b> .....	3
Mustaqim Syah Bin Kamarul Zaman <sup>1</sup> and Miqdad Bin Khairulmaini <sup>2*</sup> .....	3
<b>CHAPTER 3</b> .....	5
<b>Design and Fabrication of a Patient Transfer Aid for Seamless Bed to Wheelchair Mobility</b> ..	5
Fateen Aqela Binti Azzaidi <sup>1</sup> and Miqdad Bin Khairulmaini <sup>2*</sup> .....	5
<b>CHAPTER 4</b> .....	7
<b>Prototype of a Donut Topping Machine</b> .....	7
Nurul Athirah Binti Ramizan Nassir <sup>1</sup> and Ahmad Najmie Rusli <sup>2*</sup> .....	7
<b>CHAPTER 5</b> .....	9
<b>Prototype of a PLA Filament Extruder</b> .....	9
Abdul Harith Hazim Bin Abd Rashid <sup>1</sup> and Ahmad Najmie Rusli <sup>2*</sup> .....	9
<b>CHAPTER 6</b> .....	11
<b>Prototype of a Candy Sorting Machine</b> .....	11
Hairul Ikhwan Bin Hazizan <sup>1</sup> and Ahmad Najmie Rusli <sup>2*</sup> .....	11
<b>CHAPTER 7</b> .....	13
<b>Prototype of a 3D Printing Scrap Recycling Machine</b> .....	13
Raziq Amir Bin Rosdi <sup>1</sup> and Ahmad Najmie Rusli <sup>2*</sup> .....	13
<b>CHAPTER 8</b> .....	15
<b>Manual Compaction Machine for Casting</b> .....	15
Muhammad Hazim Md Azli <sup>1</sup> , Najibah Ab Latif <sup>2*</sup> and Ainaa Maya Munira Ismail <sup>3</sup> .....	15
<b>CHAPTER 9</b> .....	17
<b>Convertible Cart-Ladder</b> .....	17
Mohamad Aimi Zuhairi Fikri Mohd Aimi Zamani <sup>1</sup> , Najibah Ab Latif <sup>2*</sup> and Ainaa Maya Munira Ismail <sup>3</sup> .....	17
<b>CHAPTER 10</b> .....	19
<b>Design and Fabrication of Mini Firefighting Device</b> .....	19
Adam Faris Bin Ahmad Zaidy <sup>1</sup> and Muhamad Faris Syafiq Bin Khalid <sup>2*</sup> .....	19
<b>CHAPTER 11</b> .....	21
<b>Design and Fabrication of Shuttlecock Launcher Machine</b> .....	21

## CHAPTER 30

### Design and Fabrication of Manual Gearbox Transmission Systems for STEM Educational Kits

Arief Daniel bin Mohd Nizam <sup>1</sup>, Ainaa Maya Munira Ismail <sup>2\*</sup> and Najibah Ab Latif <sup>3</sup>

<sup>1,2,3</sup>*Faculty of Mechanical Engineering, Universiti Teknologi MARA Johor Branch, Pasir Gudang Campus, 81750 Masai, Bandar Seri Alam, Johor Darul Ta'zim.*

*\*Corresponding author (e-mail): ainaa7609@uitm.edu.my*

#### PROJECT DESCRIPTION

This project aims to enhance the Science, Technology, Engineering, and Mathematics (STEM) education of Malaysian students by introducing them to the practical application of manual gearbox transmissions. The project addresses the gap in students' understanding of manual transmission systems, which are commonly used in vehicles, but often not thoroughly grasped in educational settings. By providing an engaging, hands-on kit, students will explore the fundamental principles of manual gearboxes, developing a deeper comprehension of how these systems work. The kit is designed to integrate key STEM concepts while encouraging students to engage in real-world problem-solving and practical investigations. Through activities focused on the diagnosis, repair, and assembly of manual transmissions, students gain valuable skills applicable to automotive engineering careers. This initiative not only aims to improve STEM education but also sparks an interest in the automotive field, preparing students for future employment in related industries. The project includes a combination of theoretical lessons, hands-on exercises, and evaluations, ensuring students understand both the science behind and the practical application of manual gearbox systems.

**Keywords:** *STEM, Transmissions*

#### PROTOTYPE



DESIGN PARAMETER

