

MUHAMMAD HAFZUL HAIKAL

Chemical Engineering Graduate | Process Control | Dynamic Simulation | Utility & Energy Systems

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EDUCATION

Bachelor of Engineering (S.T.), Chemical Engineering

Universitas Riau | August 2021 – September 2026

- **GPA:** 3.46 / 4.00
- **Relevant Coursework:** Process Control, Process Design, Heat Transfer, Mass Transfer, Chemical Reaction Engineering, Process Modeling & Simulation, Utilities System, Process Safety.
- **Languages:** Indonesian (Native), English (Professional Working Proficiency)

CORE COMPETENCIES

- **Process Design & Simulation:** Process simulation, material and energy balances, equipment sizing, reactor design, utility system design, and process optimization.
- **Process Control & Dynamic Simulation:** First-principles dynamic modeling, PID design and tuning (QDR, TLC, ALC, Direct Synthesis), control block diagrams, closed-loop simulation, HMI development, and temperature/level/flow loop performance evaluation.
- **Utility & Energy Systems:** Utility requirement calculation, water balance analysis, heat integration and pinch analysis, utility optimization, and energy efficiency evaluation.
- **Utility & Building Equipment Knowledge:** Cooling tower utility analysis, pump power and electrical demand calculations, wastewater treatment, multi-effect evaporation water treatment, and plant utility demand assessment.
- **Data Analysis & Performance Evaluation:** Engineering data analysis, model validation, automated data processing, dashboards, and real-time process visualization.
- **Process Economics & Feasibility:** ROI, IRR, Payback Period, BEP, DCF, and sensitivity analysis.
- **Environmental & Process Safety Awareness:** Environmental impact, wastewater, emission, and waste stream assessment; hazard awareness for high-temperature, high-pressure, flammable, and hazardous process systems.

TECHNICAL SKILLS

- **Engineering Simulation Software:** Aspen HYSYS (Steady-State & Dynamics), Aspen Plus, Aspen Energy Analyzer (AEA), Aspen Exchanger Design & Rating (EDR), Aspen Process Economic Analyzer (APEA), MATLAB, Simulink.
- **Programming & Data:** Python (NumPy, SciPy, Pandas, Matplotlib), object-oriented programming, Git, GitHub.
- **Microsoft Office:** Excel (engineering calculations, PivotTable, XLOOKUP, Solver), PowerPoint, Word.
- **Technical Documentation:** Markdown, LaTeX, technical report writing, process flow diagrams (PFD), piping and instrumentation diagrams (P&ID).

ENGINEERING EXPERIENCE

Process Engineering Intern

PT Kilang Pertamina Internasional RU II Dumai (Engineering & Development Division) | November 2025 – December 2025

- Evaluated the thermal-hydraulic performance of a 4-shell, seawater-cooled CDU overhead condenser train using Kern's method, Aspen HYSYS, and Aspen EDR; diagnosed fouling at 6× the design limit and verified that internal cleaning increased the overall heat transfer coefficient by 147%, reduced fouling resistance by 82%, and raised condenser duty by 52%, with pressure drops within allowable limits.
- Identified up to 51.6 ton/day of recoverable LPG in Platformer off-gas currently routed to fuel gas, using 3 months of composition data and an Aspen HYSYS component-splitter model; sized a 2.12 kW LPG pump and estimated a cooling-water demand of 214 ton/day.
- Studied the 170 MBSD RU II refinery configuration across its Hydroskimming, Hydrocracker, and Heavy Oil complexes, reviewing design bases, PFDs, and P&IDs of 7 process units (CDU, HVU, Platforming, NHDT, DHDT, HCU, DCU) with process engineers; completed refinery safety induction and complied with HSE requirements.

Teaching Assistant – Process Control

Chemical Engineering Department, Universitas Riau | Agustus 2025 – Present

- Develop Python-based learning modules covering dynamic modeling, transfer functions, PID control, valve and sensor-transmitter modeling, tuning, and closed-loop simulation.
- Mentor 25+ undergraduates per semester across 2 semesters through tutorials and substitute lectures based on Stephanopoulos' *Process Control*.

- Design assignments, quizzes, and assessments, integrating Python simulations into course instruction.

Final Project: Preliminary Design of an Acrolein Plant via Dehydration of Crude Glycerol

Universitas Riau | January 2026

- Designed a 66,132 ton/year acrolein plant via crude glycerol dehydration, simulated in Aspen Plus and verified with analytical material and energy balances.
- Sized the dehydration reactor (R-102) using analytical calculations, Aspen Plus, and Python-based computational modeling.
- Conducted heat integration and designed a 37-unit heat exchanger network (Aspen Energy Analyzer), recovering 142.1 MW of process heat and reducing hot and cold utility demand by 35.8%, plus utility requirement calculations and wastewater treatment system design.
- Assessed process economics using APEA and Microsoft Excel (ROI 26.60%, IRR 23.35%, payback 2.48 years); prepared equipment specifications, PFDs, and engineering calculations.

Research Project: Dynamic Modeling, Simulation, and Control System Development for Biodiesel Reactor Processes

Universitas Riau | August 2024 – August 2026

- Formulated a first-principles dynamic model of a biodiesel reactor process to support process analysis and control system design.
- Tuned 5 PID-based temperature, level, and flow control loops, mapping control block diagrams in MATLAB/Simulink.
- Engineered an HMI-based process control simulator in Python and ran servo and regulatory closed-loop scenarios using Python, MATLAB/Simulink, and Aspen HYSYS Dynamics.
- Validated simulation accuracy against Aspen HYSYS Dynamics: MAPE 0.017–0.070%, PBIAS -0.006% to +0.058%, MAE 0.010–0.040 %TO, RMSE 0.023–0.141 %TO.

Website Developer

Chemical Engineering Department, Universitas Riau | August 2026 – Present

- Build a Final Project Administration System and departmental landing page using Django, SQLite, Tailwind CSS, and HTMX.
- Implement role-based workflows for four user roles, with authentication, email notifications, PDF generation with QR code verification, approvals, seminar registration, and progress tracking.
- Digitalize manual administration processes for 400+ students and create dashboards, improving traceability and accreditation readiness.

LEADERSHIP & INVOLVEMENT

Chairperson – 19th Chemical Engineering Student Congress & Election

Chemical Engineering Department, Universitas Riau | September 2023 – November 2023

- Spearheaded a 70+ member committee to organize the annual student congress and leadership election over a five-week period with ~50 representatives, leaders, and alumni.
- Directed planning, budgeting, permits, and scheduling; facilitated stakeholder coordination and conflict resolution, delivering on schedule without major issues.

Finalist – Impact-Driven Start-Up & UMKM Business Pitch Competition

Fortia Strategic Partner | October 2023

- Selected as one of 10 finalists for a waste-to-energy concept converting Pangasius (catfish) processing waste into crude biodiesel, presenting its technical, environmental, and economic potential.

Chairperson – 23rd UKMI Student Congress

Unit Kerja Mahasiswa Islam (UKMI) – Engineering Faculty, Universitas Riau | October 2022

- Headed a 10-member committee for a three-day congress with 20+ representatives, managing agendas, budgeting, logistics, and leadership transition.

Member, Funding & Entrepreneurship Division

Unit Kerja Mahasiswa Islam (UKMI) – Engineering Faculty, Universitas Riau | October 2021 – October 2023

- Raised funds for organizational programs through sponsorship, product sales, and bazaar events.