

**Appendix**  
**AI Curriculum Implementation Plan (Template)**  
(To be completed by School Representatives)

**School Unit:** Davidson School of Chemical Engineering

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**Q1. Implementation of Level 1 Exposition.** What does your school unit want first-year engineering to cover in ENGR 131 and ENGR 132? Please share some concrete suggestions and rationales. Explain how these changes can make your School's AI curriculum more streamlined.

1. Responsible use and verification as core skills
  - Teach a standard workflow: ask → generate → verify → document. Require students to (i) check outputs against first principles, units, bounds, and reference sources; (ii) state limitations and assumptions; (iii) disclose AI use.
  - Rationale: without verification training, students will over-trust plausible-but-wrong outputs (a predictable failure mode). This also aligns with existing engineering-course AI guidance emphasizing understanding, transparency, and accountability for submitted work.
2. AI “tool literacy” rooted in engineering tasks (not just generic prompting)
  - In ENGR 131 (design + modeling), include small, graded “AI-assisted” micro-activities:
    - Generate alternative design concepts and stakeholder needs, then justify choices with evidence
    - Create a first draft of a simple model or spreadsheet plan, then verify with manual checks and sensitivity testing
  - In ENGR 132 (project work), require an “AI trace” appendix: prompts, outputs used, rejections, and verification steps.
  - Rationale: this makes AI usage clear and auditable, preventing later CHE courses from re-teaching basics.
3. Data management habits (cleaning, uncertainty, and plotting)
  - A basic data module: identifying bad sensors/outliers, propagating uncertainty, and presenting results with appropriate plots and tables—plus how AI can assist without replacing judgment.
  - Rationale: CHE labs later depend heavily on data quality and uncertainty; early exposure eases transitions downstream.
4. Consistent policy language across FYE
  - Adopt a college-wide “baseline” policy (similar to existing ENGR course policies): AI is permitted for brainstorming, debugging, and documentation support; students must understand the code and logic, attribute AI-assisted parts, and explain their work.

How does this simplify the CHE AI curriculum

If first-year engineering standardizes verification, disclosure, and basic data hygiene, CHE can focus Levels 2–4 on chemical-engineering-specific AI topics (process data, physical constraints, simulation/optimization) rather than re-explaining “how to use a chatbot.”

**Q2. Implementation of Level 2 Knowledge.** Discuss how your school is going to implement the Level 2 course on AI Knowledge. You can propose a new 1-credit course or mention an existing one.

If modifications are needed, please describe what modifications are. Or you may suggest any ideas you think worth exploring. Please assess feasibility and list resources that would be needed.

Proposed implementation (preferred): embed Level 2 AI Knowledge as ~1 credit-hour-equivalent module within CHE 32000 - Statistical Modeling and Quality Enhancement. This AI component has already been developed and delivered by Prof. Can Li.

Format:

- a dedicated AI unit inside CHE 32000 (roughly one credit-hour-equivalent of contact time and assessments), integrated with CHE-relevant examples.

Core topics (knowledge-level, not a full ML course):

- What “model” means in ML versus first principles; overfitting; train/validation; metrics
- Data provenance, leakage, privacy, and reproducibility
- Generative AI: capabilities and limits; hallucinations; citation discipline; prompt logging
- Constraint-aware thinking: sanity checks against conservation laws, bounds, and physical limits
- Minimal hands-on: a simple baseline fit (e.g., regression) + interpretation of errors/uncertainty

Where it fits: delivered in CHE 32000 within the existing CHE sequence, so students receive Level 2 knowledge before upper-division labs/design intensify.

Existing bridge exposure: CHE 300 – Chemical Engineering Seminar currently includes one lecture on AI delivered by Prof. Can Li. This will continue as an early orientation and will point students to the CHE 32000 AI module for Level 2 competence.

Feasibility: high, because it leverages an existing required course (CHE 32000) rather than creating a new standalone credit.

Resources needed:

- Instructional coordination for the AI module (already provided in CHE 32000 by Prof. Can Li)
- Standard computing environment (Python/Jupyter) and access to Purdue-approved AI tools. Currently this is provided by Google Colab
- A small set of CHE-authentic datasets/examples with clear licensing/privacy status

Risk to manage (explicit): prevent Level 2 from becoming “prompting tips” by requiring (i) verification artifacts (units/bounds/first-principles checks), (ii) reproducible notebooks, and (iii) disclosure of AI use.

**Q3. Implementation of Level 3 Subject.** Please fill out the following Table. We are looking for 300-level, 400-level, and 500-level courses. Please list the courses widely accessible to your students, e.g., a course that most of the juniors in your school will take. You may still list specialized courses (e.g., with a small enrollment), but our goal is to offer broad coverage.

Course	Existing AI element (if there is) / How to modify (if needed)
CHE 300	Existing: one lecture on AI (Prof. Can Li). If desired, add a lightweight follow-up activity (e.g., a short verification checklist + reflection) to connect this exposure to the CHE 32000 Level 2 module.
CHE 32000	Existing: ~1 credit-hour-equivalent AI Knowledge module (Prof. Can Li). Reinforce with an “AI-assisted computation check” assignment: students may use AI to draft a script/template (properties, parameter sweeps) but must verify with manual checks and bounds/units tests; require AI-use disclosure.
CHE 30600	Add a brief module on AI-assisted solution planning for differential and algebraic systems; require students to compare the AI-generated approach with a reference numerical method and explain any discrepancies.

CHE 34800 (Lab)	Use AI as a data assistant: for cleaning, uncertainty propagation, and plotting—but include a verification checklist plus a brief reflection on “what AI got wrong / what I corrected”. (CHE labs include 34800/37700/37800/43500.)
CHE 37700 (Lab)	Introduce the 'model + data" lab memo: AI assists in drafting code for parameter estimation; students must justify the model form and perform residual analysis.
CHE 37800 (Lab)	Add an “AI for experiment troubleshooting” exercise: students query AI for causes of anomalous data, then must rank hypotheses using evidence from instrumentation and process understanding.
CHE 42000	Incorporate AI-supported literature synthesis: students create a mini annotated bibliography on a process topic and must verify sources and extract quantitative claims with citations.
CHE 43500 (Lab)	Require a writing assistant workflow: AI may improve clarity and structure, but students must submit (i) a tracked outline, (ii) a technical accuracy checklist, and (iii) disclosure of AI use.
CHE 45000 (Capstone/Senior Design)	Add an AI “design companion” rubric: AI can propose alternatives and assist with sensitivity/optimization scripts, but final design decisions must be supported with calculations, constraints, and economics; include an “AI trace” appendix. (Senior-year sequence includes CHE 45000.)
CHE 45600	Add a case on AI-assisted process monitoring and fault diagnosis (small dataset): compare a basic baseline model with an ML model; discuss interpretability and operational risk.
CHE 54000 (500-level option)	Offer an optional AI-for-modeling add-on: AI-assisted derivation checking and symbolic/numeric support, with strict verification requirements. (CHE 54000 is highlighted as recommended preparation for graduate study.)
CHE 41100/41200/49800/49900 (research/thesis options)	Standardize “AI-in-research” expectations: literature triage, coding assistance, and writing support are permitted with disclosure; require reproducible workflows and a brief methods appendix describing AI use.

(Feel free to expand this table.)

**Q4. Implementation of Level 4 Projects.** Discuss how your existing Projects (VIP, EPICS, senior designs, etc) can include AI elements. We are specifically looking for (1) How to use AI to brainstorm ideas and collect information, (2) How to use AI as a math / data assistant; (3) How to use AI as a code assistant, and (4) How to use AI as a writing assistant.

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#### Project 1: AI-Augmented Chemical Process Design (Capstone)

Senior design

Description of Project: Team designs a chemical process (flowsheet + economics + safety/environment constraints) and delivers a final report/presentation.

Discuss how AI has been / will be used:

- Brainstorm/info: generate process alternatives, hazards checklist, regulatory considerations — then verify with textbooks and standards, citing sources.
  - Math/data assistant: conduct sensitivity studies, define uncertainty ranges, perform regression fits for property and kinetic parameters, with validation.
  - Code assistant: draft Python and MATLAB utilities for scenario analysis, ensuring unit tests and sanity checks.
  - Writing assistant: improve structure and clarity; include disclosure, a technical accuracy checklist, and an “AI trace” appendix.
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#### Project 2: AI-Enabled Lab-to-Model Mini-Project

Embedded in CHE laboratory sequence (CHE 34800/37700/37800/43500)

Description of Project: Students collect experimental data and build a simple predictive model (baseline + ML) for an observable (yield, conversion, pressure drop).

Discuss how AI has been / will be used:

- Brainstorm and gather information: suggest plausible mechanisms and sources of error for anomalies; rank hypotheses based on evidence.
  - Math and data assistant: clean data, handle outliers, propagate uncertainties, analyze residuals.
  - Code assistant: generate initial notebook and plotting routines; students must explain every section and reproduce results.
  - Writing assistant: draft a narrative of results; students must verify every quantitative statement.
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#### Project 3: AI-Supported Undergraduate Research / Honors Thesis

Research projects and thesis tracks (CHE 41100/49800/49900; 50000+ level options exist for honors pathways)

Description of Project: Faculty-mentored research

Discuss how AI has been / will be used:

- Brainstorming and information: mapping literature and identifying gaps; enforcing citation discipline and verifying sources.
- Math/data assistant: surrogate modeling, uncertainty quantification, experiment prioritization.
- Code assistant: speeding up prototyping; needs repository, reproducible environment, and documented AI usage.
- Writing assistant: improve abstracts and papers; require advisor review for technical accuracy and IP/confidentiality safeguards.