Expert Lecture: “Role of Chemical Engineer in the Pharmaceutical Industry”

An expert lecture by **Mr. Chirag Patel, Assistant General Manager at Torrent Pharmaceuticals Ltd.** (Gold Medalist – Chemical Engineering, Lean Six Sigma Green Belt, PMP Certified) was arranged in Chemical Engineering Department for the **BE final year and ME students on 26th September, 2025**. The lecture was organised by Dr. Milap Nayak and Dr. A. D. Baldaniya and coordinated by Dr. R. R. Patel and Dr. T. S. Rajaraman. Mr. Patel provided valuable insights into the diverse and evolving role of chemical engineers in the pharmaceutical sector. Drawing from his **25 years of experience in pharmaceutical research and development**, Mr. Patel highlighted the critical interface between chemical engineering principles and drug manufacturing.

Overview of the Pharmaceutical Industry

Mr. Patel began by outlining the pharmaceutical industry’s global importance in improving life expectancy and quality of life. He emphasized that pharmaceutical manufacturing relies heavily on chemical engineering principles such as mass and heat transfer, reaction engineering, and unit operations (filtration, crystallization, drying).

Key Roles of a Chemical Engineer

Chemical engineers act as a bridge between laboratory chemistry and large-scale production. They design, scale up, and optimize processes for Active Pharmaceutical Ingredients (APIs) and formulations, ensure safety and environmental compliance, and introduce process control and automation systems. Other responsibilities include solvent recovery, waste treatment, and sustainability initiatives, along with risk assessment and troubleshooting to improve yields and compliance.

Technical Focus Areas Discussed

- **Crystallization & Particle Engineering** – Techniques to control particle size, shape, and polymorphism to improve drug bioavailability and stability.
- **Polymorphism in APIs** – Its impact on solubility, stability, and manufacturing reproducibility.
- **Reaction Engineering & Scale-up** – Transitioning from gram- to kilogram-scale production with attention to heat/mass transfer and safety.
- **Modelling & Simulation** – Using statistical and mechanistic models (software such as Dynochem) to optimize and predict process outcomes.

- **Artificial Intelligence & Machine Learning** – Reducing experimental burden, enabling predictive modelling, and self-optimizing reactions in crystallization and synthesis.

- **New Trends in API Development** – Continuous manufacturing, flow chemistry, digital twins, and Process Analytical Technology (PAT) tools for real-time monitoring and control.

Key Takeaways

The lecture emphasized that a successful chemical engineer in the pharmaceutical field must blend core engineering principles with modern tools such as AI/ML and PAT. Knowledge of scale-up, process safety, sustainability, and regulatory requirements is essential. Mr. Patel concluded with practical tips for students seeking entry-level positions, encouraging them to build skills in modelling, simulation, and process understanding.