Manufacturing sector, and especially metal casting industry, are critical for employment and economic development. These parts are needed for automobile, construction, energy, defence, farming, mining, machinery, pumps & valves, and many other industries.

Casting is a multi-physics process with coupled fluid flow, heat transfer, and stresses in a complex geometry. Producing high quality castings at low cost is a major challenge.

New technologies such as 3D printing, CAD, simulation, Cloud computing and process data analytics have created a wave of new opportunities for research, development and industrial applications in this field. There is however, a shortage of relevant resources and trained teachers, till now.

E-Foundry provides high-quality self-learning content that can be accessed even on mobile phones over Internet. This helps enhance the interest and employability of engineering and polytechnic students in the manufacturing sector. Local teachers are trained to use the resources in their classes, labs, research and industry projects.

Learning Resources

- **Lesson videos**: 45+ short lectures related to casting science, engineering and technology.
- **Cloud-based simulation lab**, which takes a 3D CAD model and generates solidification images.
- **Reference material**: animations, books and papers, case studies, defects museum, slides, web links.
- **Self evaluation**: tutorial exercises and quizzes with scores and answers for comparison.
- **Research network**: links to casting researchers and ideas for new research projects.
- **Discussion hub**: community for posting technical questions and getting answers.

Google: E-Foundry

Teachers: Deliver interesting lectures, engage students better
Students: Understand casting process, explore industry projects
Industry: Gain access to manpower, ensure quality and yield.
Casting Design and Simulation

Classroom

Short lesson videos with speaker, audience and lecture slides

Simulation Lab

Online library of casting models of various complexity

Online interface for casting solidification simulation

Content developed at E-Foundry Lab, IIT Bombay
Training and Research Network

Library, Tutorial, Projects

Library

Selected and sorted reference material to view or download after log in:
- E-Foundry Labs, IT Bombay
- Textbooks (List)
- Technical Papers (published from E-Foundry Lab)
- Journals (technical papers published worldwide)

Library

Different types of casting defects in various metals:
- Solidification defects
  - shrinkage
  - porosity
  - hot tear
  - cold shut
- Volume defects
  - flash
  - blow hole
  - voids
  - cold shuts
- Shape defects
  - flash
  - misrun
  - case (layer) void
  - chills

Flash is an irregular fin around the part, at the parting line, caused by excess metal escaping at the joint of mold halves due to poor contact between them as well as high-metallurgical pressure.

Tutorial

- Exercises

- Feeder Neck Design
  - Solidification temperature: 760°C
  - Liquidus temperature: 600°C
  - Freezing range: 700°C
  - Density (solid): 7000 kg/m³
  - Density (liquid): 7200 kg/m³

People and Projects

- Project Ideas
  - Description of projects and new ideas to explore:
  - Ahmed A. Nune, Nagpur
  - Doroth J. J. J. J., Indiana
  - Goutam Sarkar, Kolkata
  - Elizabeth Jacob, Thiruvananthapuram
  - Nishith Shinde, Shree (Rajgurunagar)
  - E. John, Mumbai
  - Rahul Dhariwal, Bangalore

Supported by National Knowledge Network Mission
Inspired by ‘Make in India’, ‘Digital India’, ‘Skill India’ and ‘Startup India’ initiatives of Government, several leading researchers and industry experts have come together to reinvent casting process by leveraging the latest disruptive technologies.

SMART – Sustainable Metalcasting by Advanced Research and Technology – will have the following key technology elements:

Intelligent Design: Part models will be created using 3D CAD or 3D Scanning, and converted into tooling models. Then methods design (feeding and gating) will be created and verified by process simulation.

Automated Manufacture: Plastic patterns will be fabricated by low-cost 3D Printer, and used to create chemically-bonded no-bake sand molds. Cast metal will be melted and directly poured into the molds inserted under the furnace (without ladling).

Process Data Analytics: Sensors embedded in casting equipment will continuously measure temperature, pressure, weight, vibration and other parameters. These will be streamed to the Cloud, to visualize, analyse and optimize on mobile phones/tablets.

System Specifications: The facility is designed for educational institutes and SME entrepreneurs. It can be set up in a small room, for rapidly manufacturing small parts in 1-100 order quantity, at a fraction of the cost of metal 3D printing.

Part size: up to 100 mm
Casting alloys: Al, Cu, Zn
CAD to first part: 24 hours
System size: Tabletop units

Interested in collaborating or setting up a SMART Foundry?
Please get in touch with us today!
Write to: efoundry.iitb@gmail.com