UNIVERSITY OF PRETORIA
DEPARTMENT OF CHEMICAL ENGINEERING
SPECIALISATION CSS420, CSS 421, CSS 422 and CSS 423 (16 credits each) (2024)

Fourth year students in the Department of Chemical Engineering who **comply** with the necessary **prerequisite**, namely **CPJ 421#, i.e. simultaneous registration for CPJ421**, may register for **CSS420, CSS 421, CSS 422 OR CSS 423** Specialisation. Students must select **one** of the elective options.

You register for CSS420, CSS 421, CSS 422 or CSS 423 in the normal manner with Admin. (or have already registered). Note that, once you are registered for one of these modules, you must get access to the relevant it via **ClickUP**.

CSS 420: **Analytical Techniques** (Coordinator: Prof W Focke) assisted by Dr I vd Westhuizen with contributions by guest lecturers
CSS 421: **Environmental Engineering** (Coordinator: Prof E Chirwa) assisted by Dr Tichapondwa & Dr D Brink
CSS 422: **Polymer Processing** (Coordinator: Prof W Focke) with contributions by guest lecturers
CSS 423: **Sustainable Chemical Engineering Practices** (Coordinator: Prof MO Daramola) assisted by Dr Samuel Iwarere with contributions from other guest lecturers

Students must consult the undergraduate timetable for the second semester for lecture periods and meetings with the responsible lecturer. Each lecturer will make his/her own arrangements with those students taking the relevant elective module with respect to utilisation of these lecture periods, as well as with regard to the venue where these meetings will take place. Students have to confirm the relevant arrangements with the respective coordinator. It is also necessary to ensure that students gain access to study guides and study material via ClickUP.

Note that the information in this document will also be made available on the Departmental Website at: http://www.up.ac.za/chemeng.

The information in the table below gives more detail with respect to the elective modules available in 2020. (The Department reserves the right to assign students to the other electives, in the case of one of the elective options not being available:

ELECTIVE	CONTENT
CSS 420 **Analytical Techniques** (Coordinator: Prof W Focke) Availability in 2024 will be communicated in SEM 2 , 2024	Understand the different types of analytical techniques. Distinguish between numerous analytical techniques and their applications. Apply the theory to real analytical data. Techniques covered are: – Imaging (SEM, TEM, EDX/WDX, EELS, EBSD and FIB, confocal microscopy, optical microscopy, AFM) – Spectroscopy (FTIR, UV-Vis, Raman, etc.) – Chromatography (LC, GC, ICP, and the corresponding hyphenated techniques) – Thermal analysis (TG, DSC, DTA, DMA, Thermomat, etc.) – XRD, XRF, etc. – Miscellaneous (Particle size, density, porosity and BET surface area, rheology, etc.)
CSS 421 **Environmental Engineering** (Coordinator: Prof E Chirwa)	Environmental Systems, Drinking Water Treatment, Wastewater Treatment, Water Quality Parameters, Activated Sludge Process, Anaerobic Digestion, System Optimisation, Global Warming Mechanisms, GHG Emission Reduction The study objectives of this module are to: – provide information on the principles of Environmental Engineering/Management – provide an update of the legal framework for environmental systems – facilitate application of life cycle assessment principles – the “cradle to grave” approach – in human enterprises. – provide an overview of technologies for water and effluent treatment – introduce the student to the design of unit operation and unit process in environmental engineering, and – evaluate effect of pollution on receiving water bodies, and the effects in air and land.
CSS 422 **Polymer Processing** (Coordinator: Prof W Focke) Availability in 2024 will be communicated in SEM 2 , 2024	Unit processes in polymer processing. Analysis of complex processes: Description in terms of elementary processing steps. Transport phenomena: Transport equations, rheology and mixing processes. Elementary process steps: Particle technology, melting, pumping, pressure elevation, mixing, modelling of processes. Forming: Extrusion, calendering, injection moulding, and film blowing. Reactive processing: Thermo set materials, reaction kinetics.
CSS 423 **Sustainable Chemical Engineering Practices** (Coordinator: Prof MO Daramola)	Chemical engineering contributes to various aspects of human life, ranging from the production of food and energy and the provision of water, sanitation and shelter to the provision of health care using chemical processes. Sadly, as a result of unsustainable chemical engineering practices, unintended by-products of these processes have caused significant damage to human lives and the ecosystem. However, efforts have been directed at eliminating or minimising the negative ecological footprints of unsustainable chemical engineering activities by closing the material cycles and creating value-added commodities from the waste products of these processes. The purpose of this course is to introduce chemical engineering students to the concepts of sustainable chemical

	engineering practices and their roles in circular economy and sustainable development. Topics to explore include: ▪ Introduction to sustainable chemical engineering and circular economy ▪ Nanotechnology and its applications in sustainable energy and environment ▪ Advanced and applied materials in sustainable energy and environment ▪ Biotechnology and its role in sustainable development ▪ Waste treatment and valorisation into value-added commodities ▪ 4^{th} industrial revolution and its role in sustainable chemical engineering practices ▪ Modelling and simulation as a tool in sustainable chemical engineering practices ▪ Sustainable development, EIA, DfE, MIfCA ▪ Safety process engineering and loss prevention and control in industry ▪ Hydrogen economy