3rd/4th YEAR ELECTIVE COURSE

NUCLEAR CHEMICAL ENGINEERING

1. COURSE OBJECTIVES

Nuclear power is a major UK industry, accounting for around 20% of electrical power in the country, and chemical engineers have traditionally had a major role in it. This course is aimed at presenting information on chemical and chemical engineering aspects of nuclear power, including fuel manufacture, radiation chemistry, reactor coolant chemistry, fuel reprocessing and waste disposal. This course will be available as a “stand-alone” elective to third and fourth year students in the Departments of Chemical Engineering, Mechanical Engineering and Materials and will also be one of the five constituent courses to be taken by students pursuing the degree courses in Chemical and Nuclear Engineering, Mechanical and Nuclear Engineering and Materials and Nuclear Engineering. Those pursuing these degree courses would take the Nuclear Chemical Engineering course in the Spring Term of their third year.

The College lecturers will be:

- Prof. Kang Li (Liquid-liquid extraction)
- Prof. M. Streat (Ion exchange & Nuclear Chemical Engineering)
- Prof. G.F. Hewitt (Thermal aspects)

In addition, there will be a number of speakers from outside College as follows:

- Dr. Howard E. Sims, NNL (Radiation Chemistry)
- Eur. Ing. Bruce Hanson, NNL (Nuclear Chemical Processing)
- Mr Andrew Worrall, NNL (Fuel fabrication and construction)
- Dr. I. W. Cumming (Consultant) (Fuel production)
- Lecturer C (Water reactor coolant chemistry)
- Lecturer D (Gas cooled reactor coolant chemistry)

The following texts are recommended for the course:

2. PROPOSED TIMETABLE

Friday, January 16th, 2009: Introduction and Liquid-Liquid extraction
3.00 Prof. K. Li  Liquid-liquid extraction I: Principles of liquid-liquid extraction.
4.00 Prof. K. Li  Liquid-liquid extraction II: Design of liquid-liquid extraction plant.

Friday, January 23rd, 2009: Ion exchange
2.00 Professor M. Streat  Principles of ion exchange.
3.00 Professor M. Streat  Applications of ion exchange in nuclear systems.

Friday, January 30th, 2009: Radiation chemistry
2.00 Dr. Howard E. Sims  Radiation Chemistry: Basic principles, dosimetry and experimental methods.
3.00 Dr. Howard E. Sims  Radiation Chemistry in the Nuclear Fuel Cycle: Examples from power generation and reprocessing through to repository.

Friday, February 6th, 2009: Fuel production A
3.00 Dr I W Cumming  Principles of isotope separation.
4.00 Dr I W Cumming  Uranium enrichment.

Friday, February 13th, 2009: Fuel production B
2.00 Professor M. Streat  Introduction to uranium production technology.
3.00 Professor M. Streat  Uranium hydrometallurgy

Friday, February 20th, 2009: Fuel reprocessing
2.00 Mr Andrew Worrall, NNL  Fuel fabrication and construction.
3.00 Professor M. Streat  Fuel reprocessing systems.

Friday, February 27th, 2009: Waste processing
2.00 Professor B. Hanson  Design principles of reprocessing plan
            Criticality in reprocessing. THORP plant etc
3.10 Professor B. Hanson  Options for dealing with spent fuel

Friday, March 6th, 2009: Waste management
2.00 Professor B. Hanson  Introduction to nuclear waste management
3.10 Professor B. Hanson  UK strategies for waste management
4.00 Professor B. Hanson  Decommissioning
Friday, March 13th, 2009

2.00  Lecturer C  Water reactor coolant chemistry
3.00  Lecturer D  Gas cooled reactor coolant chemistry
4.00  Profs. Li & Streat  Closing tutorial. Scope of examination.

G.F. Hewitt. 06.01.09