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Information Manual Level Three 2009

WELCOME

I congratulate continuing students on your success in examinations last year and extend a warm welcome into Level III. A special welcome is extended to new international students joining the School, via direct entry into Level III. You must feel very satisfied to have successfully completed one more step in building the foundations for a successful career as a professional engineer. The versatility of Chemical Engineering graduates is well known and this versatility is even further enhanced by the options available for students to undertake specialisation steams within the degree program and a range of double degree programs. The School is committed to excellence in all its activities with special emphasis on student care. As usual, you will find all academic, professional and technical staff to be approachable, friendly and willing to provide assistance when required. Please do not hesitate to contact the 2007 Level III Course Adviser, A/Prof Brian O'Neill in the first instance should you require further information or assistance. In my role as Acting Head of School, I am always willing to meet with students, either individually or collectively to discuss any issues you may wish to raise. As most of you may already know, I try to make myself known to students whenever the opportunity arises. I will have already met most of you in earlier years but if I have not then I do hope that this will occur at sometime during the year. I will be teaching CHEM ENG 3017 Kinetics and Reactor Design in semester 1 so if you are enrolled in this course I will get to know you better. I offer my best wishes for a successful and enjoyable academic year.

Dr Peter Ashman
Acting Head of School

General Student Information

For further information about the Chemical Engineering School, Engineering North Building, please contact the appropriate person listed below:

Position	**Staff Member**	**Room No.**
Acting Head of School	Dr Peter Ashman	N119
Undergraduate Course Advisor	A/Prof Brian O'Neill (Chem) Dr Jingxiu Bi (Pharma)	N114 N212
Student Advisor Undergraduate Level I	Dr Peter Ashman (Chem) Dr Jingxiu Bi (Pharma)	N119 N212
Student Advisor Undergraduate Level 2	Dr Zeyad Alwahabi (Chem) Dr Jingxiu Bi (Pharma)	N113b N212
Student Advisor Undergraduate Level 3	Dr Ken Davey (Chem) Dr Hu Zhang (Pharma)	N211 N208
Student Advisor Undergraduate Level 4	Dr David Lewis	N212b
Postgraduate Coordinator	Dr David Lewis	N212b
Employment/Industry Liaison	Dr Peter Ashman	N119
Business Manager	Mrs Dianne Parish	N118
School Office Staff	Mrs Mary Barrow Mrs Elaine Minerds Mrs Sue Earle	N120
Workshop Technical Officers	Mr Jason Peak Mr Jeff Hiorns Michael Jung	Engineering Workshop
Computing Engineer	Mr Sanh Tran	N206a
School Safety Officer	Mr Andrew Wright	N115
School Health and Safety Representative	Mrs Elaine Minerds	N120
First Aid Officers	Mrs Mary Barrow Mrs Dianne Parish	N120 N118
Laser Laboratory Coordinator	Dr Zeyad Alwahabi	N212b
Laboratory Coordinator	Mr Andrew Wright	N115
Equal Opportunity	Mrs Mary Barrow Mrs Dianne Parish	N120 N118
Sexual Harassment Contact Officer	Mr Andrew Wright	N115
Equity Officer	Mr Andrew Wright	N115

Welcome to Level III Students

As the adviser to Level III students, I would like to welcome you all back for what, I hope, should be a challenging and exciting year. Please take note of the following items:

Plant Tour

In 2009, the School will once again arrange a plant tour for Level III students. Dr David Lwis will be the Plant Tour co-ordinator for 2009. This trip provides a unique opportunity to visit major chemical engineering companies within S.A., to see major processing facilities (up-close and personal) and to meet the engineers who are responsible for their safe and efficient operation.

While the exact details of this year's trip are yet to be finalised, in previous years we have visited:

▪ WMC – Olympic Dam ▪ OneSteel – Whyalla ▪ Pasminco – Pt Pirie ▪ Penrice Soda – Osborne ▪ Santos – Port Bonython ▪ Wolf Blass Winery - Nuriootpa	▪ NRG Flinders – Port Augusta ▪ F.H. Faulding – Salisbury ▪ Michells – Salisbury ▪ Penfolds – Barossa Valley ▪ National Dairies

The School will provide coach transport, supervisory staff and arrange accommodation. Students are required to meet the cost of their own accommodation and most of your meals (there is usually a BBQ on one night) typically an amount of $150-200 is sufficient. The trip will be held in vacation time, most likely in the week 20-24 July, and you will receive further information closer to the event. The plant tour is not compulsory but is highly recommended.

Chem-E-Car

This is an Australasia wide competition for undergraduate students, held annually as part of the Chemeca Conference and supported by IChemE, Engineers Australia and Royal Australian Chemical Institute. A team from each university is required to construct a model-sized car powered by a chemical energy source to nominated specifications, which includes the quickest to travel a set distance. Our school will normally sponsor one team to travel to Chemeca each year, to participate in the competition. The opportunity for participation and team selection process is integrated as part of 3003A/B, Chem Eng Projects III.

Work Experience

The professional accrediting bodies (Engineers Australia (EA) & The Institution of Chemical Engineers (IChemE)) require students to complete 12 weeks of appropriate work experience prior to graduation. It is the responsibility of students to arrange their own work experience placements. You are strongly advised to commence your efforts as soon as practicable (at least before July). A booklet is available from the Chemical Engineering Office that lists some major employers of chemical engineers in S.A. It is by no means exhaustive and you should not confine your search to companies listed in this booklet.
You should also be aware of the exact requirements for work experience. Discuss these with staff at the Faculty of Engineering Office. In some cases, it is possible to include some non-engineering work experience within the 12 weeks. Does your recent summer job qualify towards your work experience?

Also see page 9 for more details regarding Vacation work and documentation required.

Problems?

It is inevitable that minor problems will arise over the coming year. These problems are generally easy to solve provided they are addressed rapidly. Please bring any concerns to my attention, or alternatively, discuss them with one of the Level III CHEMS representatives. I am also happy to advise on problems of an individual nature.

February, 2009
Dr Ken Davey
Level III Course Co-ordinator

Assessment Procedures, 2009

The following gives the proposed method of assessment and weighting factors for 2009. Minor changes may occur throughout the year. Students will be informed of these.

NOTES:

1. C.B. = Closed book
   O.B. = Open book

2. There shall be four classifications of pass at an annual examination in any course for the degree as follows: Pass with High Distinction, Pass with Distinction, Pass with Credit, Pass.

   There shall also be a classification of Conceded Pass. A candidate may present for the degree courses for which a Conceded Pass grade has been awarded within he following limits:
   - no course may be presented at the conceded pass level with a unit value greater than 3 units.
   - for any single Bachelor of Engineering program no more that 10% of the courses presented may be at the conceded pass level with a limit of 9 units in total.
   - for all double/combined programs no more than 10% of the courses presented may be at the conceded pass level with a limit of 12 units in total. All rules pertaining to the presentation of conceded passes within the individual programs must also be complied with.
   - articulating students and students with credit transfer may present 10% of their units undertaken at Adelaide at the conceded pass level and this number will be rounded up to a multiple of 3 and will not exceed 9 units in total.

3. Supplementary examinations are held two weeks after the main examination periods:

Mid-year (Semester 1)	20 - 24 July 2009
End of year (Semester 2)	14 – 18 December 2009

   Supplementary examinations are available on academic, medical and compassionate grounds. The decision to grant a supplementary examination is the responsibility of the academic staff.

   Please note: It is strongly recommended that students sit for their exams wherever possible because there is no guarantee that a supplementary will be granted.

   Academic Grounds
   For courses taught by Engineering Schools, supplementary examinations on academic grounds are normally offered to students obtaining a mark of 40-49 (provided they meet all other requirements of the course) and to students in their final year of study who have completed all the requirements for the degree with the exception of up to four units. Precise details on assessment in each course should be provided by Schools at the beginning of lectures.
   Students do not apply for academic supplementary examinations. The maximum final grade that can be awarded for a course in which students have an Academic Supplementary is 50 Pass, except where a higher division pass (55 P1) is required to proceed to the next level of the course.

   Medical Grounds
   Applications must be lodged within five (5) working days of the illness.

   It will be to your advantage to see a doctor on the day of the illness, so an accurate assessment of your condition can be made. Retrospective certificates are not accepted.

   The category of “unfit to sit an examination” is reserved for major illness that prevents attendance at the examinations. As a general rule, minor ailments, such as colds and mild respiratory infections, are not considered sufficient grounds for being certified unfit to sit an exam.
   There is no restriction on the maximum grade awarded for a Medical Supplementary.

   Compassionate Grounds

Supplementary examinations may be awarded where special circumstances beyond the student's control significantly affect their preparation for, or performance in, an exam. Applications must be lodged within five (5) working days of the special circumstances. There is no restriction on the maximum grade awarded for a Compassionate Supplementary.

Students who are awarded a supplementary examination on medical or compassionate grounds will not be able to count the better of the primary and supplementary exams. Sitting a supplementary exam will constitute acceptance of the offer of the supplementary exam and only the supplementary exam result will be recorded (whether it is higher or lower than the first result).

Students granted a Medical or Compassionate Supplementary Examination and also eligible for an Academic Supplementary Examination

For courses taught by Schools in the Faculty of Engineering, Computer & Mathematical Sciences, students granted a medical/compassionate supplementary examination and who are also eligible for an academic supplementary examination should consider their options and before sitting the examination, advise the ECMS Faculty Student Office (ecms_office@adelaide.edu.au) whether they wish to accept the medical/compassionate supplementary examination or whether they wish to take the academic supplementary examination. If no notification is received it will be assumed that the student wishes to take the academic supplementary examination and thus allow the possibility of retaining the primary examination mark.

4. Tutorials and class exercises held during the year may count towards the mark in any subject for each component. This value will be specified by the lecturer in charge at the commencement of the course.

5. In subjects consisting of a number of components, a minimum mark of 40 must be obtained. This requirement applies to the following subject: CHEM ENG 3003A/B Chem Eng Projects III; CHEM ENG 4025 Chemical Engineering Projects IV, CHEM ENG 4027 Chemical Engineering Research Project (N), CHEM ENG 4026 Chemical Engineering Research Project (H).CHEM ENG 4002A/B Chemical Engineering Research Elective II and CHEM ENG 4020A/B Chemical Engineering Research Elective. A fail will be recorded if the student does not submit satisfactory project work in **ALL** components as specified by the examiner or supervisor.

6. **Exemptions and Status** - In some cases students may be granted status in whole subjects because of related studies taken previously. Exemptions from part of a subject previously attempted may be granted in some cases. You **must apply** for exemption or status; it does not happen automatically. Applications should be submitted to the **School Office** on the appropriate form **no later than** the end of Week 1 (3 March 2009).

7. **Chemical Engineering Honours:** To be eligible for the award of honours a student **should be** enrolled for the complete Fourth Year with the exception of up to 4 Units (composed of electives and/or CHEM ENG 4018 Ind. Econ. Man). In exceptional circumstances this requirement may be varied by the Head of the School. Honours will be awarded for meritorious performance throughout the course. To obtain the final honours mark a weighted average for each year will be evaluated based upon the subject weights shown in a calendar (eg a 2-point subject will contribute 2/24 = 8.33%) and the mark achieved by a student at their **first attempt** (with the exception of subjects where a medical supplementary was awarded). Results from any repeating subjects are **NOT** counted towards honours marks. Weights for the individual years are: Year 2 = 20%, Year 3 = 30%; Year 4 = 50%. Class I Honours requires 75%, Class IIA 70% and Class IIB 65%. Candidates will normally be required to average at least 75% in their final year for the award of Class I Honours.

   There is a selection process to choose candidates who will be permitted to undertake the honours stream in the fourth year of the BE. Those selected for honours may enrol in a specially designated level IV honours course. This course varies from program to program and details are given in the enrolment sheets for each program. The normal minimum requirement for selection for the honours stream is a weighted average of 60% over levels 2 and 3 of the BE, where the relative weighting of the levels is 2:3 respectively.

8. Students may apply **in writing** to have supervised access to their **examination scripts** within **three (3) weeks** of the publication of the provisional examination results.

9. Students who believe they have reasonable grounds for expecting a higher mark may request, **in writing** to the Acting Head of School within **three (3) weeks** of the publication of the results, for a piece of work to be reassessed

10. **Review of Academic Progress:** Engineering implements a review of academic progress policy in accordance with University guidelines. This policy states that students who, in any one year of university study, fail 1/3 or more of their year's enrolment will be subject to review. The review in this case involves a

formal letter and an interview with a Course Adviser in the School. The outcome could include referral to academic or counselling services and restriction of the student's enrolment, such that the student is not permitted to enrol in an overload in the following year. Further failures will result further restrictions and students failing 1/3 or more of their enrolment in each of three consecutive years will have their progress reviewed by the Academic Review Committee. The outcome of this review could include a recommendation for preclusion, compulsory deferment for one semester or one year, or a further restricted enrolment.

11. **University Policy on Plagiarism**: Details are available on the CLPD website at: http://www.adelaide.edu.au/clpd/plagiarism/students

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Calculator Policy

1. **No restrictions** will be placed on the **type/brand** of calculator that may be used by students in an examination where the use of calculators is permitted.
2. Students are expected to own **either** a **graphing** calculator (similar to those used in Year 12 mathematics) or a calculator with a **solve function** (i.e. can iterate & solve non-linear equations). This is particularly useful in the later years of the course.
3. There will be **no restrictions** placed on calculator usage in **an open-book** examination or **an open-book** section of an examination.
4. Students are permitted to use a calculator in **all closed-book** examinations or **all closed-book sections** of an examination unless a **specific direction** is included on the examination cover sheet prohibiting the use of calculators
5. The use of calculators **may be prohibited in a defined part (or all) of a closed-book examination**. In this case, a separate answer book for this section **must be handed-in** before the portion of the paper in which a calculator may be used is commenced.

School Policy and Procedures for Handling Student Complaints and Feedback

The following outlines the necessary steps to make a complaint, offer suggestions or comments, or express concerns about any issue deemed relevant to the School:

1. Bring the matter to the attention of the appropriate member of staff (academic, professional or technical) concerned.
2. If the matter is not resolved by following step 1, it should be discussed with the Year Level Advisor.
3. If the matter remains unresolved after following steps 1 and 2, it should be brought to the attention of the Acting Head of School. If the member of staff concerned in step 1 is the Acting Head of School then the appropriate person in step 3 is the Executive Dean.
4. Steps 1 and/or 2 may be by-passed if the student so desires.
5. If the student wishes to make anonymous complaints, suggestions or comments, a locked Suggestions Box is available on the wall outside the School Office (Room N120, North Engineering Building).

Assessment Procedures 2009 (By Subject)

LEVEL III Subject	Part	Paper No.	Type	Durati-on (h)	Semest-er	Weight
3001 MATERIALS IIIC					1	(2.0 Units)
	1. Examination	1	C.B.	2		80%
	2. Tutorials and Assignments					20%
3003A/B CHEMICAL ENGINEERING PROJECTS III					FY	(4.0 Units)
	1. Laboratory Project Reports					70%
	2. Other Assessment Tasks					30%
3005 SEPARATION PROCESSES					2	(2.0 Units)
	1. Examination	1	{C.B.	1		70%
			{O.B.	2		
	2. Tutorials					30%
3006 TRANSPORT PHENOMENA					2	(2.0 Units)
	1. Examination	1	C.B.	2		70%
	2. Tutorials and Assignments					30%
3010 INTRODUCTION TO BIOCHEMICAL ENGINEERING					1	(2.0 Units)
	1. Examination	1	C.B.	2		80%
	2. Assignments & Practicals					20%
3014 PROCESS DESIGN AND PLANT ENGINEERING					2	(2.0 Units)
	1. Examination	1	O.B.	2		50%
	2. Design Project		.			50%
3015 PROCESS CONTROL AND INSTRUMENTATION					2	(2.0 Units)
	1. Examination	1	C.B.	2		80%
	2. Tests and Assignments					20%
3017 KINETICS AND REACTOR DESIGN					1	(3 Units)
	1. Examination	1	{C.B.	1		80%
			{O.B.	2		
	2. Tutorials and Tests					20%
3018 FLUID AND PARTICLE MECHANICS					1	(3.0 Units)
	1. Examination	1	{C.B.	1		80%
			{O.B.	2		
	2. Tutorials					20%
4024 ENVIRONMENTAL ENGINEERING					1	(2.0 Units)
	1. Examination	1	{C.B.	1		80%
			{O.B.	1		
	2. Tutorials					20%

Practical Experience

It is a student's responsibility to organise their own work experience and a booklet listing names of companies who have provided practical work experience to students in the past is available at the School Office. Engineers Australia also provides a booklet to their Student members listing a number of Chemical Engineering companies.

General

A total of twelve weeks practical experience (of which a minimum of 6 weeks should be under the supervision of a professional engineer) is required and this should be undertaken during the university vacations and normally be completed before beginning the work of Level IV of the course. It is desirable that at least half of the total number of weeks specified above be spent in an approved chemical factory or research establishment on plant operation or industrial research or development. The Faculty may grant either partial or total exemption from these requirements to a candidate who produces satisfactory evidence of practical experience obtained before their first enrolment in the Faculty; and in special cases, the Faculty may grant dispensation from the requirements. Credit will not normally be given for periods of less than three consecutive weeks. A candidate should seek a variety of practical experience appropriate to the candidate's academic level. Before beginning a period of practical experience, a candidate may ensure that it will be satisfactory to the Faculty by consulting the Acting Head of School. Upon completion of each period of practical experience (and no later than the following 31 March) each candidate is required to submit to the Faculty Office, on the prescribed form, a statement of practical experience gained, certified by the employer for approval by the Faculty of Engineering.

To help you find work experience, we have produced a booklet which contains names, addresses and phone numbers of companies you may contact for work experience. This is available from the School of Chemical Engineering Office N120.

STUDENT PLACEMENT PROGRAM AGREEMENT

Students who undertake **unpaid** work experience or a community placement program in connection with their course or approved research work will only be covered by the University's insurance program if the work is undertaken with the knowledge and consent of the University. To obtain and document this consent the student must complete a **Student Placement Program Agreement** before any work placement can take place. (This form (total of 3 pages may be found starting on the next page.)

The most important thing to remember is that if a student begins **unpaid** work placement without the approval of the Acting Head of School and the completion of the Student Placement Program Agreement, the University of Adelaide insurance program is **not** available to the student.

STUDENT PLACEMENT PROGRAM AGREEMENT

Part A - Student Details

Family Name ______________________ Given Names ____________________

Student ID # ______________________ Student Phone # _________________

Degree/Program enrolled ____

Faculty ________________________________ Campus _________________

EMERGENCY CONTACT

Name __________________________ Relationship ____________________

Phone # Work: _______________ Home: _________________________

Mobile # __________________________

School Contact

Name ______________________________ Phone # ____________________

As a student on work placement, I agree

1. To attend the workplace to which I have been assigned at the agreed times and days stated below.
2. To notify both my workplace supervisor (named below) and the School Contact above if I am unable to attend for reasons of ill health or any other reason.
3. To present myself in an appropriately dressed fashion ensuring I am wearing any protective clothing which may be required by the Host Organisation.
4. Obey all lawful directions of the workplace to which I have been assigned.
5. To work to my full capacity, with due regard for my legal responsibilities in the workplace.
6. To comply with all Occupational Health & Safety requirements required by the host organisation.
7. To inform the host workplace supervisor and the School administration office of any accident or injury in which I am injured or in which I have injured another party.
8. In the event of an emergency I will contact the School administration office.

Student's Signature:______________________________Date:____________

Part B – Host Organisation

Name: ___________________________________ Phone # _______________

Street address: ____
____
____

Contact Person: ____________________________ Phone # _______________

Email Address ______________________________ Fax# ______________

Location of placement ____
____
____

Supervisor Name ______________________________ Phone # ______________

Date of placement: (From) ______________________________ (To) ______________

Hours of work: (Start) ______________________________ (Finish) ______________

Description of task to be performed ______________________________________
____
____
____
____
____

Special Conditions (Clothing, safety equipment, parking)
____
____
____
____
____

Part C – Conditions

We agree to accept the named student on work placement and to plan an appropriate program for their placement.

All reasonable precautions will be taken in the workplace to ensure the occupational health safety and welfare of the student in a non-discriminatory and harassment free working environment. The School administration office will be notified by our organisation in the case of a student's illness, injury or unexplained absence. The student will not receive any form of reward or stipend for work performed during and placement and will not be used to replace paid workers or be used during any form of industrial dispute. The student is not to be required to undertake any task prohibited by the University, Legislation or insurance requirements.

It is understood by all parties that the University, the host organization or the student may without notice cancel the work placement.

The host organization agrees that they have Occupational Health & Safety procedures in place and the student will receive a safety and workplace induction that will prepare them to safely undertake the tasks and duties of the work placement.

Part D – Insurance

The University maintains a Public Liability insurance policy that will indemnify the host organisation for any negligence act, error or omissions by the student during the period of the work placement. A Certificate of Insurances for Public Liability is enclosed with this Placement Agreement Form.

The host organization agrees to indemnity the University and the student for any injury, loss or damage to student or to University property being used by agreement with the host organisation, resulting from any negligent act or omission by its employees, agents or contractors.

The host organisation agrees to provide 'proof of insurance' for the period of the work placement to the School administration office. The student is not to commence the work placement until the proof of insurance has been sighted.

Host Organisation Authorising Officer Name: ____

Signature ____ Date ______________

Part E - Authorisation

I grant permission for the above named student to undertake a work placement with the above named host organisation in accordance with the conditions and guidelines above:

Acting Head of School

Signature ____ Date ______________

Distribution

1. School administration office
2. Host organisation
3. Student

Adelaide University Undergraduate Scholarships

A list of potential scholarships is available on the web at the following URL:

http://www.adelaide.edu.au/scholarships/undergrad/

Each year students who achieve a weighted average of over 80% will receive a Dean's Merit Award.

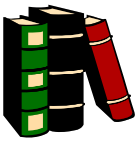
Exchange Opportunities for Engineering Students

Adelaide University has established student exchange programs with around fifty overseas universities, which enable Adelaide students to study overseas for a semester or year and count the work completed towards their Adelaide degree.

Under an exchange program students remain enrolled at the Adelaide University while they are overseas which means they are still liable for HECS and Student Union fees. As students are still studying towards their Adelaide degree they may still be eligible for AUSTUDY while on exchange if they already receive it. Exchange students do not pay tuition fees to the host university, but must fund their own travel, accommodation and living expenses during the exchange.

There are two types of exchange program - university wide programs in which students from all Faculties may participate, and discipline/Faculty based programs which have been established by a particular School or Faculty for its own students. Some programs are available to both undergraduate and postgraduates, and some to undergraduates only.

Course Notes and Syllabus Requirements for B.E. (Chem.) and combined degrees.



The degree course with Honours in BE (Chem.) shall occupy four years of full-time study. Details of BE courses can be found at the following site.

http://www.ecms.adelaide.edu.au/enrol/guides/

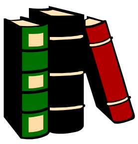
B.E. Chem (Energy and Environment)
B.E. Chem (Process and Product Engineering)
B.E. Chem (Food, Wine and Bio-molecular)
B.E. in Sustainable Energy Engineering (Chemical)
B.E. in Pharmaceutical Engineering

Double and Combined Programmes
It is possible for students to enhance their engineering qualifications by combining studies in Engineering with studies in other faculties. Information can also be found at: **http://www.ecms.adelaide.edu.au/enrol/guides/**

The complete Academic Program Rules governing the award of combined degrees is available online as a pdf file from the University's website. The URL is:
www.adelaide.edu.au/calendar/ug/eng

B.E. (Chem.)/B.Sc
B.E. (Chem)/B.Ma&Comp.Sc. (Computer Science focus)
B.E. (Chem)/B.Ma&Comp.Sc. (Mathematics focus)
B.E. (Chem)/B.A.
Arts Studies Combined with the B.E.(Chem)
B.E. (Chem.)/B.Ec.
B.E.(Chem.)/B.Fin..
B.E. (Chem.)/B.Sc (Biotech)
B.E. (Petroleum.)/B.E. (Chemical)

The Bachelor of Engineering degree in the specialisations listed above may be awarded in the Pass or Honours grade. The award of the Honours grade shall be made for meritorious performance in the course with greatest weight given to performance in the later years. The Honours grade may be awarded in one of the following classifications: First Class, Second Class Division A, Second Class Division B. (There is no Third Class for the Bachelor of Engineering degree). To qualify for the degree a candidate shall regularly attend lectures and do written, laboratory, and other practical work (where such is required), and pass examinations in the subjects prescribed in the Specific Course Rules for one of the specialisations listed above. Before being admitted to the degree a candidate shall also submit satisfactory evidence of completion of a period of practical experience in work approved by the Faculty of Engineering as appropriate to the course which the candidate has followed. Candidates are required to complete satisfactorily subjects to the value of 24 Units at each of Levels I, II, III and IV.



SUMMARY OF AIMS, OUTCOMES ASSESSMENT AND SYLLABUS FOR LEVEL III CHEMICAL ENGINEERING SUBJECTS

CHEM ENG 3001: MATERIALS III (CH)

Units:	*2*
Duration:	*Semester 1*
Lecturer:	*Dr Yung Ngothai*
When:	*Refer Timetable under Current Students in MyUni*

Aims:

To introduce students to a range of electrochemical and high temperature materials-related issues that are relevant to chemical engineering practice.

Outcomes:

At the end of the course the student should be able to:

1. Select appropriate materials for corrosion resistance. Select relevant corrosion protection schemes.
2. Understand the basic engineering principles of electrochemical engineering processes such as power generation, power storage and production of chemicals.
3. Understand the basic issues of high temperature material properties
4. Select advanced materials on the basis of physical properties.
5. Analyze failures using correct methodology and adopt suitable prevention measures.

Syllabus:

Introduction

- The importance and limitations of materials in our industrial society.
- Brief introduction of the choice of materials, strength, corrosion resistance, temperature resistance
- Introduction to corrosion and electrochemical theory.
- Outline of the course

Electrochemistry

- Electrochemistry as "The Other Chemistry". The nature of electrochemistry and its relationship to other sciences. The role of energy in electrochemistry.
- Present electrochemical industry and near future leads in the electrochemical industry.
- Biomedical applications
- The electro-deposition of materials from high-temperature melts
  - Mineral processing
  - Electrocatalysis
- Material conservation
- Electro-organic chemistry
- High-temperature electrolytes
- Electrochemistry of cleaner environments
- Electrochemistry for a better world
- Borderline phenomena

Corrosion and Corrosion Prevention

- Introduction: Costs, design implications etc., wet corrosion, dry corrosion

- Electrochemical Theory
- Thermodynamics of corrosion reactions
  - Directions and signs
  - Potential distance plots
  - Galvanic series
- Kinetics of corrosion reactions
  - Polarization
  - Diffusion processes and the double layer
  - Mixed potential theory
- Various forms of corrosion, electrochemical corrosion and corrosion prevention
- Corrosion in specialized environments
  - Mechanism & prevention
- Design from the viewpoint of corrosion

Electrochemical Energy Storage
- Introduction, primary & secondary batteries

Electrochemical Energy Conversion
- Introduction, thermodynamic and kinetic aspects. Electrocatalysis, Fuel cells
- Electrochemical synthesis

High Temperature Materials
- Metals for high temperature applications. Effect of atmosphere on durability, creep,
- Ceramic materials for high temperature applications, resistance to chemical attack, effect of thermal shock
- Lightweight high temperature materials

Assessment:

Closed Book examination

Final 2 hour examination	80%
Tutorials and assignment	20%

Resources:

K.R. Tretheway and J. Chamberlain; *Corrosion for Science and Engineering*, 2nd Ed, Longman

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Understanding the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development.
- Understanding of professional and ethical responsibilities and commitment to them; and expectation of the need to undertake lifelong learning, and capacity to do so.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3010: INTRODUCTION TO BIOCHEMICAL ENGINEERING

Units:	*2.0*
Duration:	*Semester 1*
Lecturer:	*Dr Jingxiu Bi*
When:	*Refer Timetable under Current Students in MyUni*

Aims

1. provide an understanding of basic microbiology, its methods and limitations and terminology

2. apply this together with established chemical engineering principles, to design and analysis of bio-processes and the potentialities for exploitation of microbiological systems
3. by stressing underlying common fundamentals, and a wide range of applications, provide a broad treatment of the link between microbiology and chemical engineering.

Outcomes

At the end of the course, students should be able to:

1. Explain the role of microbes - with particular emphasis on bacteria - in the food and fermentation industries
2. Grow and maintain bacteria and identify different morphological types
3. Understand basic cell anatomy and physiology
4. Use methods of enumeration of viable cells
5. Explain the adhesion and interaction of bacteria in the environment
6. Construct and describe : Michaelis Menten kinetics, Lineweaver-Burk plot; Eadie-Hofstee plot
7. Explain the conceptual view of the different approximations and representations that are useful for the cellular phase populations and classify populations systems according to components used in cellular representation: structured, unstructured, segregated, unsegregated
8. Describe in detail the typical bacterial growth curve and derive kinetic models for ideal reactors: batch, CSTR, plug flow
9. Derive and apply Monod growth kinetics in enzyme systems: and
10. Illustrate experimental data for vegetative cell and spore death over a range of temperatures and calculate sterility requirements for continuous sterilisation reactors both analytically and using the generalised sterilisation chart
11. Explain protein precipitation and product expression and recovery within vegetative cells

Assessment

Examination	80% (2hr Closed Book)
Assignment and Practicals	20%

Texts

Brock T D & Madigan M T *Biology of Micro organisms* 10 Ed 2002 (Prentice-Hall International)
Shuler, M.L. and Kargi,F. *Bioprocess Engineering: Basic Concepts*, 2nd Ed 2002 (Prentice-Hall Ptr)

Recommended Reference Books: (these text are useful but do not need to be purchased by the student)

Aiba S, Humphrey A E & Millis N F *Biochemical Engineering* 2nd Edition (University of Tokyo)
Fryer P J , Pyle D L & Reilly C D *Chemical Engineering or the Food Industry* (Blackie London)
Perry R H & Green D W *Perry's Chemical Engineer's Handbook* 6th Edition (McGraw-Hill)
Lee J M *Biochemical Engineering* (Prentice-Hall)
Webb F C *Biochemical Engineering* (Van Nostrand)
Stanier R Y, Doudoroff M & Adelberg E A *General Microbiology* 4th Edition (Mcmillan).

Syllabus

1. *Introduction to Microbiology*: basic microbiology; aseptic technique; general growth curve; aerobic/anaerobic metabolism; mutation; isolation and identification; epidemics; enumeration (8L, 9P).
2. Enzymes: enzyme catalysed reactions; what/how; Michaelis-Menten kinetics; Lineweaver-Burk plot; Eadie-Hofstee plot; enzyme inhibition; immobilised enzymes; applications (2L, 1T).
3. Kinetics of growth, substrate utilisation product formation biomass production and death in cell cultures: structured and unstructured models; ideal batch and CSTR (chemostat) reactors; balanced growth; Monod kinetics; modification to Monod model (endogenous and maintenance metabolism); environmental factors (T, pH, a_W); mathematical models; transient kinetics; growth and non-growth associated formation kinetics; thermal death kinetics of cells and spores; experimental determination; design criterion in sterilisation; deviation from kinetic models; environmental factors (T, pH) (8L, 2T).
4. Design and analysis of biological reactors: fed-batch reactors; enzyme-catalysed reactions in CSTR; ideal plug flow tubular reactor; batch and continuous sterilisation reactors; HTST; RTD (4L, 2T) .
5. Protein product and recovery: protein production by fermentation, forms of protein, recovery schemes; downstream processing equipment - functionality and cost; process integration (6L, 3T).
6. Bio process economics: planning stage
7. Mixed microbial population: planning stage
8. Particular processes considered are: fermentation, sterilisation, waste-water treatment.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Ability to utilise a systems approach to design and operational performance.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3003A/B CHEMICAL ENGINEERING PROJECTS III
CHEM ENG 3020A/B: PHARMACEUTICAL PROJECTS IIIA

Units:	*2*
Duration:	*Semester 1 and 2*
Academic:	*Dr Jingxiu Bi*
When:	*Refer Timetable under Current Students in MyUni*

Aims:
1. To foster practical skills as an adjunct to lecture-based teaching.
2. To teach communication skills (verbal, formal written, informal written).
3. To teach teamwork and leadership skills.
4. To provide an introduction to electrical systems.

Outcomes:
At the end of the course, students should be able to:
1. Demonstrate skills in the safe operation of laboratory equipment.
2. Communicate work through formal written reports of high quality, and effectively communicate with other team members.
3. Analyse experimental data.
4. Work as part of a team in a mature and professional manner.
5. Recognise the components of industrial electrical supply systems and appreciate the economic and technical factors in their selection.

Content:
A laboratory program in semesters 1 and 2 illustrating principles of transport theory, fluid and particle mechanics, separation processes, heat transfer, process dynamics and control, and kinetics and reactor design. Lectures & tutorials dealing with laboratory safety, introductory error analysis and introductory report writing will also be held. A short lecture series on industrial electrical systems is included.

Assessment:

Laboratory Project:			85%
(Comprising of	- Major Project report	75%	
	- Laboratory Performance reports	20%	
	- Class Exercise	5%)	
Electrical Systems Quiz			15%

Schedule:

Briefing Lecture: Monday, 2 March 2009, 1-2 pm, Engineering Annex A314
- Introduction
- Safety Briefing

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Ability to function effectively as an individual and in multi-disciplinary and multicultural teams; with the capacity to be a leader or manager as well as an effective team manager.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3004: ENGINEERING COMMUNICATIONS - ESL (H)

Units: *2*
Duration: *Semester I*
Lecturer:
When: *Refer Timetable under Current Students in MyUni*

Outcomes

The subject provides language development in English as a second language for the purposes of oral and written communication in the context of the study of Engineering at third year level. It introduces linguistic principles as tools to assist communication in English as a second language and in cross-cultural settings. Class work is designed to develop the capacity of students for communication (in speaking, listening, writing and reading) relevant to their current studies and intended careers in the fields of engineering and computing. Language development tasks will be project-based and require students to take themes chosen from the disciplines in which they are enrolled. Task assignments will focus on technical writing, preparing reports, reading, informal technical discussion and formal oral presentation.

Assessment

3 written assignments	60%
Informal and formal oral presentations	30%
Tutorial participation and regular weekly language work	10%

GRADUATE ATTRIBUTES:

- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Understanding the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Understanding of professional and ethical responsibilities and commitment to them; and expectation of the need to undertake lifelong learning, and capacity to do so.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3005: SEPARATION PROCESSES

Units: *2.0*
Duration: *Semester 2*
Lecturer: *Dr Ken Davey*
When: *Refer Timetable under Current Students in MyUni*

Aims

To introduce students to the principles and applications of diffusional separation processes involving gas-liquid, liquid-liquid and solid-liquid systems in equilibrium-stage and continuous-contact operations.

Outcomes

At the end of the course, students should be able to:

1. Determine the number of stages required for a multiple-stage separation operation such as distillation, liquid extraction, leaching and gas absorption.
2. Determine the height of continuous contact separators such as packed towers used for gas absorption/desorption and distillation.
3. Perform analysis calculations (simulation) for stagewise and continuous-contact operations.

Emphasis throughout is placed on problem solving and illustrative worked examples.

Assessment

Tutorial and assignments	30%
Final examination	70%

Recommend Texts and References

A.S. Foust, et al., *Principles of Unit Operations*, 2nd edition (Wiley)
R.E. Treybal, *Mass-Transfer Operations*, 3rd edition (McGraw-Hill)
W.L. McCabe, J.C. Smith and P. Harriot *Unit Operations of Chemical Engineering* 4th Edn (McGraw-Hill)
J.D. Seader and E.J. Henley, *Separation Process Principles* 3rd Edn (John Wiley)

Syllabus

1. Introduction to Separation Processes (1L)
2. Phase Equilibria (2L, 1T)
3. Stage Operations
   Equilibrium Stage Calculations
   - single stage (2 L, 2 T)
   - counter-current multistage operations with and without reflux (3 L, 2 T)
4. Simplified methods (2 L, 1T)
5. Continuous Contact Operations
   - Introduction (1 Lecture)
   - Mass Transfer Theory (3 L, 1 T)
   - Height of Packing - Development of design equations (2 L, 1 T)
   - Transfer units: Concept and calculations (2 L, 2 T)
   - Simplified methods (2 L, 2 T)

   Separation operations considered include:
   - Distillation (binary),
   - Liquid-liquid extraction, leaching, gas absorption (scrubbing)
   - Desorption (stripping).

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Understanding the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development.
- Ability to utilise a systems approach to design and operational performance.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3006: TRANSPORT PHENOMENA

Units: *2.0*
Duration: *Semester 2*
Lecturer: *Dr Zeyad Alwahabi*

When: *Refer Timetable under Current Students in MyUni*

Aim

- To introduce to students to the transport phenomena approach in the study of fluid dynamics (momentum transfer) and heat and mass transfer. The emphasis is more on understanding basic physical principles than on the blind use of empiricism.
- To develop skills in applying basic principles of mass, momentum and energy transport to analysing and solving chemical engineering problems.

Outcomes

At the end of the course, students should be able to:

1. Understand the basic principles and mechanisms of transport phenomena, the transfer of momentum, energy and mass.
2. Demonstrate the applicability of transport analysis to solving engineering problems.
3. Apply the shell balance technique and conservation equations to set up and solve momentum, heat and mass transfer problems.
4. Recognise and exploit the unified approach in analysing momentum, heat and mass transfer processes.
5. Apply the first principles to solve problems of different complexity in fluid flow, heat and mass transfer applications.

Assessment

Tutorials and Test (30%)
Final examination (70%).

Text book

Bird, R.B. Stewart, W.E. and Lightfoot, E.N., *Transport Phenomena* 2nd edition, Wiley. New York 2002

Syllabus

Introduction

Momentum Transport

1. Mechanism of Momentum Transport
2. Shell Momentum Balances
3. Equations of Change for Isothermal Systems)
4. Momentum Transport with more than one independent variable.
5. Turbulent momentum transport

Energy Transport)

6. Mechanisms of energy transport
7. Shell energy balances
8. Equations of change for non-isothermal systems
9. Energy Transport with more than one independent variable

Mass Transport

10. Mechanisms of mass transport
11. Shell mass balances
12. Equations of change for multicomponent systems.

GRADUATE ATTRIBUTES:

- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.

CHEM ENG 3010: INTRODUCTION TO BIOCHEMICAL ENGINEERING

Units: *2.0*
Duration: *Semester 1*
Lecturer: *Dr Jingxiu Bi*
When: *Refer Timetable under Current Students in MyUni*

Aims

1. provide an understanding of basic microbiology, its methods and limitations and terminology
2. apply this together with established chemical engineering principles, to design and analysis of bio-processes and the potentialities for exploitation of microbiological systems
3. by stressing underlying common fundamentals, and a wide range of applications, provide a broad treatment of the link between microbiology and chemical engineering.

Outcomes

At the end of the course, students should be able to:

1. Explain the role of microbes - with particular emphasis on bacteria - in the food and fermentation industries
2. Grow and maintain bacteria and identify different morphological types
3. Understand basic cell anatomy and physiology
4. Use methods of enumeration of viable cells
5. Explain the adhesion and interaction of bacteria in the environment
6. Construct and describe : Michaelis Menten kinetics, Lineweaver-Burk plot; Eadie-Hofstee plot
7. Explain the conceptual view of the different approximations and representations that are useful for the cellular phase populations and classify populations systems according to components used in cellular representation: structured, unstructured, segregated, unsegregated
8. Describe in detail the typical bacterial growth curve and derive kinetic models for ideal reactors: batch, CSTR, plug flow
9. Derive and apply Monod growth kinetics in enzyme systems: and
10. Illustrate experimental data for vegetative cell and spore death over a range of temperatures and calculate sterility requirements for continuous sterilisation reactors both analytically and using the generalised sterilisation chart
11. Explain protein precipitation and product expression and recovery within vegetative cells

Assessment

Examination	80% (2hr Closed Book)
Assignment and Practicals	20%

Texts

Brock T D & Madigan M T *Biology of Micro organisms* 10 Ed 2002 (Prentice-Hall International)
Shuler, M.L. and Kargi,F. *Bioprocess Engineering: Basic Concepts*, 2nd Ed 2002 (Prentice-Hall Ptr)

Recommended Reference Books: (these text are useful but do not need to be purchased by the student)
Aiba S, Humphrey A E & Millis N F *Biochemical Engineering* 2nd Edition (University of Tokyo)
Fryer P J , Pyle D L & Reilly C D *Chemical Engineering or the Food Industry* (Blackie London)
Perry R H & Green D W *Perry's Chemical Engineer's Handbook* 6th Edition (McGraw-Hill)
Lee J M *Biochemical Engineering* (Prentice-Hall)
Webb F C *Biochemical Engineering* (Van Nostrand)
Stanier R Y, Doudoroff M & Adelberg E A *General Microbiology* 4th Edition (Mcmillan).

Syllabus

1. *Introduction to Microbiology*: basic microbiology; aseptic technique; general growth curve; aerobic/anaerobic metabolism; mutation; isolation and identification; epidemics; enumeration (8L, 9P).
2. Enzymes: enzyme catalysed reactions; what/how; Michaelis-Menten kinetics; Lineweaver-Burk plot; Eadie-Hofstee plot; enzyme inhibition; immobilised enzymes; applications (2L, 1T).
3. Kinetics of growth, substrate utilisation product formation biomass production and death in cell cultures: structured and unstructured models; ideal batch and CSTR (chemostat) reactors; balanced growth; Monod kinetics; modification to Monod model (endogenous and maintenance metabolism); environmental factors (T, pH, a_w); mathematical models; transient kinetics; growth and non-growth associated formation kinetics; thermal death kinetics of cells and spores; experimental determination; design criterion in sterilisation; deviation from kinetic models; environmental factors (T, pH) (8L, 2T).
4. Design and analysis of biological reactors: fed-batch reactors; enzyme-catalysed reactions in CSTR; ideal plug flow tubular reactor; batch and continuous sterilisation reactors; HTST; RTD (4L, 2T) .
5. Protein product and recovery: protein production by fermentation, forms of protein, recovery schemes; downstream processing equipment - functionality and cost; process integration (6L, 3T).
6. Bio process economics: planning stage

7. Mixed microbial population: planning stage
8. Particular processes considered are: fermentation, sterilisation, waste-water treatment.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Ability to utilise a systems approach to design and operational performance.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3014: PROCESS DESIGN AND PLANT ENGINEERING

Units: *2*
Duration: *Semester 2*
Lecturer:
When: *Refer Timetable under Current Students in MyUni*

Aims:

1) To introduce students to the basic concepts and principles of process design including simple economic analysis:
   a) Familiarise students with the use of computer simulation packages (eg PROCESS™, ASPEN or HYSYS) in process design.
   b) Educate students in fundamental design principles.
   c) Allow students to apply knowledge learned to design and cost a basic industrial process.
2) To familiarise students with the basic features and the terminology of industrial electrical power supplies and the essential characteristics of major electrical plant types.

Outcomes:

At the end of the course, students should be able to:

1. Understand basic concepts and principles of process design.
2. Integrate knowledge learned in other chemical engineering subjects and apply knowledge in process design projects.
3. Draw process flow sheets of a process and establish starting points for subsequent computer analysis.
4. Know how to use a computer simulation package to solve process design problems.
5. Perform simple economic analyses of a process design.
6. Recognise the components of the electrical supply system to an industrial plant and understand their function.
7. Appreciate the technical and economic factors involved in the choice of the major electrical plant types such as motors and transformers.

Assessment:

Examination (2 hr open book)	(50%)
Major Design project	(50%)

Syllabus

1. Economic analysis of process designs
2. Introduction to process design
   - What is process design?
   - How to prepare or select a process diagram?
   - Comparison of alternative processes
   - Conceiving a new scheme
   - Using computer simulation packages for process design
3. Introduction to computer simulation packages
4. Design of major process components using a computer simulation package

- Reactors
- Separation units
- Distillation
- Recycles
- Heat exchangers

5. Major process design project (26 hrs of practical work)
6. The major components and typical layouts of three-phase and single-phase electricity supply systems
7. The performance of transformers and major electric motor types. Principles of motor selection
8. Economic aspects of electric power supply including power factor correction

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Ability to function effectively as an individual and in multi-disciplinary and multicultural teams; with the capacity to be a leader or manager as well as an effective team manager.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3015: PROCESS CONTROL AND INSTRUMENTATION

Units: *2.0*
Duration: *Semester 2*
Lecturer: *Dr Brian O'Neill*
When: *Refer Timetable under Current Students in MyUni*

Aims
To introduce students to:
1. The concepts and principles of feedback control applied to continuous process systems.
2. The characteristics, principles and application of important process measuring units.

Outcomes
At the end of the course, students should be able to:
1. Interpret and draw P&I diagrams.
2. Derive transfer functions for simple lumped-parameter systems.
3. Explain the main features of control system response (for P, P+I, P+I+D control)
4. Determine time responses and stability characteristics for simple dynamic systems.
5. Specify appropriate measuring elements for some applications.
6. Specify a control valve, for a particular service.

Assessment
A combination of tests and assignments (20%) and examination (80%).

Text Book
Stephanopoulos, G., *Chemical Process Control* (Prentice-Hall)
Johnson, C. D., *Process Control Instrumentation Technology* (Prentice-Hall)

Syllabus
1. Control (14 L, 7T)
   What is control? Automatic control; feedback; control loop; P+I diagrams. Components of a feedback control loop; regular and servo systems; design
   Transfer functions; Laplace transformation; inversion; use of tables; initial and final value theorems. Process dynamics; derivation of dynamic mass and energy balances for simple systems; deviation

variables; first and second-order systems; self-regulating and non-self-regulating systems; local linearisation; dead time; degrees of freedom.
Controllers: P, I, D; P+I+D; settings. Valve and measuring element dynamics.
Block diagram algebra; block reduction.
Responses to system inputs; impulse, step, ramp, sinusoid; pulse; general deterministic; poles and zeroes.
Stability; Argand diagram; Routh method.
Transient responses of first- and second-order systems (to step and other inputs); response characteristics (quantitative). Control loop responses to step input; offset and its elimination; simple analytical solutions.

2. Instrumentation (8 L; 4 T)
Characteristics of measurement system elements; range, sensitivity, hysteresis, response, accuracy.
Temperature measurement - thermocouple and resistance thermometry, radiation pyrometers; thermowells, gauges and transmitters. Temperature sensor dynamics - responses, cold junction compensation, installation applications.
Pressure measurement - theory, calibration, pressure gauges and transmitters: Bourdon tubes, GP & DP cells, remote sensing.
Level measurement - theory, calibration for liquid densities. Level gauges, transmitters and switches - float, displacement, capacitance, ratio attenuation, ultrasonic, extended diaphragm transmitters.
Control valves - sizing formulae and characteristics (installed, inherent; linear, equi-percentages).
Control valve types, actuators, positioners, installations.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3017 KINETICS AND REACTOR DESIGN

Units:	*3*
Duration:	*Semester 1*
Lecturer:	*Dr Ken Davey*
When:	*Refer Timetable under Current Students in MyUni*

Aims:

To introduce students to:

1. The concepts of principles of chemical engineering kinetics, reaction engineering and reactor design.
2. The application of these principles to the solution of reactor design problems.

Outcomes:

At the end of the course, students should be able to:

3. Interpret and analyse chemical kinetics data.
4. Apply chemical kinetics principles in chemical engineering.
5. Identify and formulate problems in chemical reaction engineering and find appropriate solutions.
6. Specify and size the most common industrial chemical reactors to achieve production goals for processes involving homogeneous or heterogenous reaction systems.

Assessment:

Final Examination	(80%)
Tutorials, Assignments & Tests	(20%)

Text Book:

H.S. Fogler, *Elements of Chemical Reaction Engineering*, 4th Edition (Prentice Hall), 2005.

Syllabus

Design Fundamentals

Process design of reactors: relationship between laboratory data, pilot-plant data and commercial plant. Classification of reactors: method of operation, shape, and phases in the reaction mixture. Terminology: rate, conversion, yield, point selectivity, overall selectivity. Mole balances, rate laws and stoichiometry.

Batch reactors

Derivation of the design equation. Calculation of reactor size for known kinetics and a required production rate. Semi-batch operation and non-steady flow.

Tubular plug-flow reactors (PFR)

Derivation of the design equation for steady-state plug flow. Comparison with batch reactors. Space velocity, space time, mean residence time. Series and parallel operation of reactors.

Continuous stirred-tank reactors (CSTR)

Derivation of the design equation for steady-state well-mixed flow. Stirred-flow reactors in series: solution for first-order reactions and equal-volume reactors. Graphical solution for higher-order reactions and reactors of unequal size. Series and parallel operation of reactors. Comparison of tubular flow reactors and stirred-tank reactors.

Collection and analysis of laboratory kinetic data

Batch reactor, tubular flow reactor, continuous stirred-tank reactor.

Reactor design for complex reaction systems

Concurrent reactions, consecutive reactions, reversible reactions. Elimination of time as an independent variable. Relationship between conversion and selectivity. Optimum product distribution; control of concentration during the course of reaction; contacting patterns. Selection of reactor type for complex kinetics.

Non-isothermal reactor design

Factors affecting choice of reactor temperature level and range. Means of keeping a reaction mixture at designed temperature levels. Reactor operation: isothermal; adiabatic; non-adiabatic. The non-isothermal CSTR: heat generation and heat removal for different reaction types; autothermal operation – “ignition” and “extinction”; relationship between conversion and temperature; energy-balance and mass-balance combination. The non-isothermal batch reactor: calculation of conversion by graphical and integration methods. The non-isothermal PFR: conversion as a function of temperature and reactor length for simple and complex reactions.

Catalysis and catalytic reactors

Catalysts. Steps in a catalytic reaction. Synthesising a rate law, mechanism and rate-limiting step. Catalyst poisoning. Design of reactors for gas-solid reactions. Heterogeneous data analysis for reactor design. Chemical vapour deposition. Porous and nonporous catalysts: internal and external diffusion effects on heterogeneous reactions. Heterogeneous reactor design: packed bed and fluidized bed reactors.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- Ability to function effectively as an individual and in multi-disciplinary and multicultural teams; with the capacity to be a leader or manager as well as an effective team manager.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3018 FLUID AND PARTICLE MECHANICS

Units:	*3.0*
Duration:	*Semester 1.*
Lecturer:	
When:	*Refer Timetable under Current Students in MyUni*

Aims:

1. To introduce students to the fundamentals of fluid and particle mechanics as applied to the handling, processing and transport of multiphase systems.
2. To develop skills for solving problems and design of operations and equipment involving fluid and particle systems.

Outcomes:

At the end of this course students should be able to:

1. Characterise and describe fluid-particle systems in terms of their basic physical properties.
2. Predict the velocity of particles moving in a fluid as a function of particle characteristics (size, shape, deformability and concentrations) and fluid properties.
3. Perform design calculations for the following operations (and industrial equipment):
   a. Sedimentation (thickeners, clarifiers, centrifuges);
   b. Single- and two-phase flows through porous media (packed columns);
   c. Fluidisation (fluidised beds);
   d. Filtration (batch and continuous filters);
   e. Solid-fluid transport (pneumatic and hydraulic transport of solids by pipeline).

Syllabus:

1. Particulate systems (4 lectures + 2 tutorials)
   Description, characterisation and classification
2. Mechanics of particles in a fluid (4 lectures + 3 tutorials)
   Rigid particles
   Deformable particles (bubbles and drops)
   Multi particle systems
3. Flow through porous media (3 lectures + 3 tutorials)
   Single-phase flow
   Two-phase flows (co-current and counter-current)
4. Fluidisation (3 lectures + 3 tutorials)

5. Sedimentation (4 lectures + 4 tutorials)
   Batch sedimentation
   Continuous sedimentation
   Thickener analysis and design
6. Filtration (3 lectures + 3 tutorials)
   Theory
   Batch filtration operations
   Continuous filtration
7. Solid-fluid transport (3 lectures + 3 tutorials)
   Pneumatic transport
   Hydraulic transport

Assessment:

Tutorials and assignments:	20%
Final examination:	80%

References:

Coulson, J.M. and J.F. Richardson, Chemical Engineering, V.2, 4th ed., Butterworth-Heinemann, Oxford.
Foust, A.S. et al, Principles of Unit Operations, 2nd ed., Wiley and Sons, New York.
Perry, R.H. and D.W. Green, Perry's Chemical Engineers' Handbook, 6th ed., McGraw-Hill, New York.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 3021: ADVANCED PHARMACEUTICAL UNIT OPERATIONS

Units:	*3.0*
Duration:	*Semester 1.*
Lecturer:	
When:	*Refer Timetable under Current Students in MyUni*

Aims:

Outcomes:
At the end of this course students should be able to:

Syllabus:

Assessment:

References:.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- In-depth technical competence in at least one engineering discipline.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Ability to utilise a systems approach to design and operational performance.

- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

CHEM ENG 4024: ENVIRONMENTAL ENGINEERING

Units value:	*2*
Duration:	*Semester 1*
Lecturer:	*Dr Peter Ashman*
	Dr David Lewis
When:	*Refer Timetable under Current Students in MyUni*

Aims

1. To introduce students to the key elements of air & water pollution problems.
2. To familiarize students with the key technologies to improve effluent quality.
3. To introduce students to effective waste elimination & recycling strategies.

Outcomes

At the end of the course, students should be able to:

1. Model the dispersion of pollutants in the air & assess the associated hazard.
2. Understand the measurement of key variables to characterize air & water quality (e.g. BOD, alkalinity, dissolved solids, etc.).
3. Understand the function and elementary design of key equipment used for improving water quality (primary, secondary & tertiary systems).
4. Understand strategies for minimization of effluent generation (i.e. devise cleaner production technology).

Assessment

A combination of tutorial assignments & design exercises (20%) and a final examination (80%).

Textbook

nil

Syllabus {24 lectures/ 12 tutorials}

SECTION 1: AIR POLLUTION

1.&2. Plume Dispersion: Gaussian solution, Continuous source, 'puff' solution, hazards
3. Removal of Particles from a Gas Stream: collection efficiency, settling chambers,cyclone separators, wet collectors - venturi spray chambers
4. Electrostatic Precipitators: overall design, Andersen-Deutsch equation, corona generation, particle charging, diffusion charging
5. Filtration of Particles from Gas Stream: mechanisms- inception & diffusion, flow field, efficiency, fabric filters, granular beds.

SECTION 2: WASTE WATER MANAGEMENT

1. Introduction: the water of life; groundwater; rivers, lakes and oceans; aquatic life, liquid and solid waste management; proscribed wastes
2. Characteristics of Waste-water: introduction; chemical equilibria; solubility product and precipitation; ionization, treatment of metallic wastes and cyanides; organic molecules - proteins, carbohydrates, lipids; standards.
3. Measurement of Dissolved Oxygen: effect on oxygen resources; determination of dissolved oxygen, definition of BOD; kinetics of carbonaceous BOD, nitrification; COD and TOC tests; re-aeration; oxygen demand and replacement; Streeter-Phelps model, other factors affecting DO.
4. Primary Treatment methods: physical processes; screening and sedimentation - settling basins, filtration, aeration, flotation, coagulation and flocculation; disinfection.
5. Microbiology of Waste-Water: types of organisms; growth and nutrients; human pathology and hygiene; information and material resources; species identification.
6. Secondary treatment processes: chemical and biological treatments; batch biochemical reactors; biofiltration; continuous reactors; lagoons.
7. Secondary treatment processes: design parameters materials of construction, appurtenances, control, aeration, heat generation and transfer;, mass loading rate.
8. Secondary treatment : applications, BOD reduction, nutrient removal, inorganic conversion, resource recovery.
9. Tertiary Treatment: adsorption, ion exchange, chemical oxidation and reduction, aeration and stripping.
10. Product Disposal and Toxic Waste: typical industries - petrochemicals, iron and steel and mining, alkali and plastics.

GRADUATE ATTRIBUTES:

- The ability to apply knowledge of basic science and engineering fundamentals.
- Ability to communicate effectively, not only with engineers but also with the community at large.
- In-depth technical competence in at least one engineering discipline.
- Ability to utilise a systems approach to design and operational performance.
- Understanding the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development.
- Understanding of professional and ethical responsibilities and commitment to them; and expectation of the need to undertake lifelong learning, and capacity to do so.
- Ability to focus on the integration of process safety considerations with environmental concerns, waste minimisation and control system specifications.
- Confidence to tackle real-world problems and issues central to engineering and to work as individuals and cooperatively in multidisciplinary and multicultural teams.
- Enthusiasm and interest for undertaking life-long learning and the continual updating of their engineering skills.

Instructions to Undergraduate Students Working in Undergraduate Laboratories

General

The University of Adelaide recognises its obligation to take all reasonable precautions to safeguard the health, safety and welfare of its employees and students while they are at work. The University of Adelaide also believes that students leaving this University must take with them an attitude that accepts good health and safety practice as normal. To this end, University Laboratory Conduct Procedures have been developed and where practical must be adhered to by all that work in School laboratories. It is strongly recommended that new students and research workers familiarise themselves with the University Laboratory conduct procedures and view the film entitled "Safety in Laboratories" available from the Occupational Health & Safety Unit.

Persons who fail to comply with these procedures may be prohibited from working in laboratories.

The University procedures should be read in conjunction with the Australian Standard 2243, "Safety in Laboratories", Parts 1 to 10 inclusive. Australian Standards can be accessed via a link through the Barr Smith Library.

The School acknowledges the University Laboratory Conduct Procedures and recognises the specific requirements of chemical engineering laboratories. With this in mind the School has formulated specific laboratory regulations which reflect the particular nature of its laboratories. Laboratory users are reminded that these School procedures are in addition to the Universities requirements.

Engineering North Emergency Procedures

R.A.C.E

*** Remove**

*** Alert**

*** Contain**

*** Evacuate**

Immediately upon discovering a fire or other emergency

1. Remove Others.

Do not put yourself or others at risk.

2. Alert Others

Sound the Alarm.

Break glass type alarm points are situated in the corridors.

Telephone for Help. *RING 35444*

Explain location and extent of fire or emergency.

AFTER HOURS An emergency telephone is located on the ground floor of the north engineering building near the main southern entrance. (Marked X on the evacuation map.)

3. Contain the Emergency

Fight the fire ONLY if safe to do so. Do not put yourself or others at risk.

4. Evacuate

The evacuation alarm will sound firstly as a "**Beep-Beep"** sound. This is the alert phase. You should prepare to evacuate by making your area safe. This means switching of equipment and collecting your personal belongings. The alert phase will then change to the evacuate phase which is a "**Woop- Whoop"** sound. This will be accompanied by a verbal instruction.

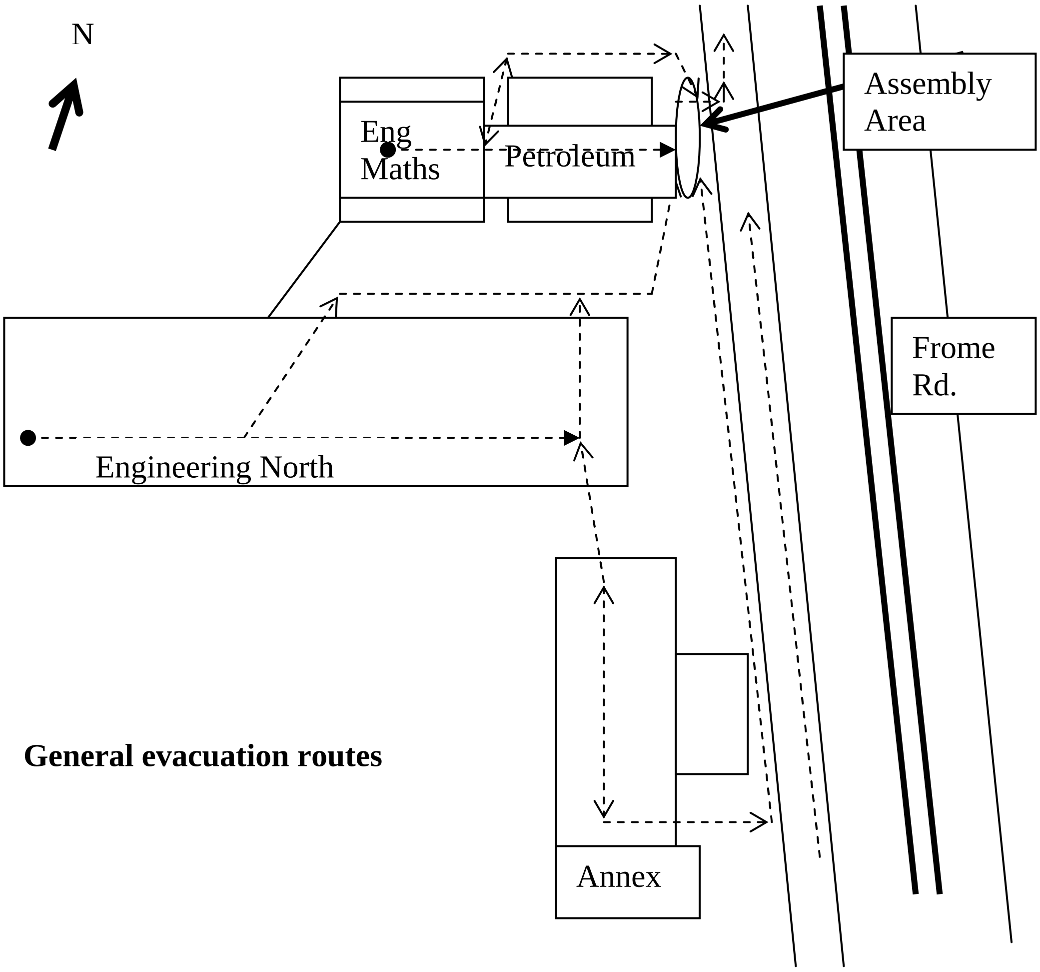
This means ALL occupants MUST EVACUATE.

Proceed via the safest route to the assembly area. Take your personal effects, keys, bags, etc. with you as you may not be able to re enter the building. Follow Exit Signs or the directions of wardens in red hats.

DO NOT RE-ENTER THE BUILDING until permitted to do so by authorised persons.

Assembly Area

*All occupants **must** assemble on the School of Petroleum Engineering gardens with overflow onto Frome Road footpath under instructions from wardens*



General evacuation routes

BOMB THREAT PROCEDURE
(Endorsed by University Council April 1995)

NOTIFY security on 35444 and the supervisor of the area.

FOLLOW the instructions of the wardens in red hats.

SCHOOL EQUITY POLICY

The School of Chemical Engineering has an Equity, Diversity and Sexual Harassment Policy. The policy is a statement of the School's commitment to providing a workplace for all staff, students and visitors that is free from harassment and bullying, deals with all people in a fair and equitable way and respects the diversity of peoples who engage with the School.
The School has a Equity Officer who is trained in equity, diversity and anti-harassment matters and who may be consulted at any time to confidentially assist in matters of concern.

The School equity officer is Andrew Wright, Room N115