49004 Systems Engineering for Managers

Course area: UTS: Engineering
Delivery: Spring 2015; standard mode; City
Credit points: 6cp
Result type: Grade and marks

Attendance: on campus, distance

Subject coordinator
The instructor for this subject is Ravindra Bagia, a Senior Lecturer in the Faculty. His interests include areas of Systems Thinking and Engineering, Project Management, Engineering Management and complex systems. Ravindra joined the Faculty in 1998, before which he was employed as Principal Systems Engineer and Engineering Manager at Boeing Australia. He has extensive experience in development of large and complex systems in Defence Industry.

Should you have any questions relating to this subject please contact Ravindra via email.

Teaching staff
Ravindra Bagia

Building: CB11.06.216
Email: Ravindra.Bagia@uts.edu.au
Telephone: (02) 9514 2432

Please remember: ALWAYS include your Name, Student number and Subject number (49004) in any correspondence with the instructor. Send email from your UTS email account. Do NOT send email to the instructor through the UTSONline system.

Subject description
In the multidisciplinary process of problem solving in engineering, systems engineering is seen as a unifying discipline. Drawing on contemporary scholarship and best practice, the philosophy, concepts, techniques and tools of the systems engineering process are examined in the context of engineering management, and their domain of applicability explored. The subject provides extensive opportunity for individual and group encounter with the challenges of the systems approach, and is illustrated by case studies presented by guest lecturers.

Subject objectives
Upon successful completion of this subject students should be able to:

1. Demonstrate the significance of systems thinking and concepts to engineering practice and management
2. Explain systems approaches closely identified with the engineering discipline, the issues continually reshaping them under best practice imperatives, and their distinctive assumptions
3. Recognise the problem domains in which the structured goal-oriented decision-making processes of hard (vis-à-vis soft) systems engineering and life-cycle perspectives are most applicable
4. Distinguish contrasting ideas and approaches of soft systems engineering in the management of complex organisational issues, and the opportunities in engineering management to merge hard and soft approaches
5. Benchmark personal experience of systems practice and management
6. Select and apply techniques and tools for dealing with complexity and uncertainty in the creation and/or sustenance of engineering systems
7. Adapt and apply appropriate methodologies of systems engineering to the challenges of engineering management and their professional circumstances.
This subject also contributes specifically to the development of the following course intended learning outcomes:

- Identify, interpret and analyse stakeholder needs. (A.1)
- Establish priorities and goals (A.2)
- Identify constraints, uncertainties and risk of the system (social, cultural, legislative, environmental, business etc.) (A.3)
- Apply principles of sustainability to create viable systems (A.4)
- Apply systems thinking to understand complex system behaviour including interactions between components and with other systems (social, cultural, legislative, environmental, business etc.) (A.5)
- Identify and apply relevant problem solving methodologies (B.1)
- Design components, systems and/or processes to meet required specification (B.2)
- Synthesise alternative/innovative solutions, concepts and procedures (B.3)
- Apply decision-making methodologies to evaluate solutions for efficiency, effectiveness and sustainability (B.4)
- Demonstrate research skills (B.6)
- Apply abstraction, mathematics and/or discipline fundamentals to analysis, design and operation (C.1)
- Develop models using appropriate tools such as computer software, laboratory equipment and other devices (C.2)
- Manage own time and processes effectively by prioritising competing demands to achieve personal goals (Manage self) (D.1)
- Reflect on personal and professional experiences to engage in independent development beyond formal education for lifelong learning (D.2)
- Communicate effectively in ways appropriate to the discipline, audience and purpose. (E.1)
- Be able to conduct critical self-review and performance evaluation against appropriate criteria as a primary means of tracking personal development needs and achievements (F.1)
- Understand cross-cultural issues (regions or workplaces) (F.3)
- Be aware of global perspectives (needs, rules/regulations, and specifications) (F.4)

**Teaching and learning strategies**

Students have the opportunity to study the subject at their own pace throughout the semester, guided by the subject outline, the semester program, and the study guide available online. This subject is also available in Autumn and Spring semesters in standard mode. Classes in the Summer Semester, when available, are in Block mode, and the students are expected to study the subject material on their own outside of the lecture blocks.

**Content**

Topics covered in the subject include system concepts and discipline perspectives; systems thinking; hard and soft systems practice; systems engineering as a structured life cycle process; systems characteristics, including performance, reliability, maintainability, useability, integrated logistics, life cycle cost and effectiveness; requirements management and system architectures; systems engineering techniques used in design and in management; and related system disciplines, including concurrent engineering, software engineering and contemporary systems thinking in business.

**Program**

<table>
<thead>
<tr>
<th>Week/Session</th>
<th>Dates</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31 Jul</td>
<td>Topic: 1.1 Introduction to Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading: See Study Guide Section 1</td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>Reading</td>
</tr>
<tr>
<td>-------</td>
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</tr>
<tr>
<td>7 Aug</td>
<td>1.1 System Concepts</td>
<td>Reading: See Study Guide Section 1</td>
</tr>
<tr>
<td>14 Aug</td>
<td>2.1 Soft Systems methodology</td>
<td>Reading: See Study Guide Section 2</td>
</tr>
<tr>
<td>28 Aug</td>
<td>2.2: System Dynamics - Dynamic Modelling</td>
<td>Reading: See Study Guide Section 2</td>
</tr>
<tr>
<td>4 Sept</td>
<td>Self study - no class.</td>
<td></td>
</tr>
<tr>
<td>18 Sept</td>
<td>3.2 Requirements Engineering and Functional Analysis Part A</td>
<td>Reading: See Study Guide Section 3</td>
</tr>
<tr>
<td>25 Sept</td>
<td>3.2 Requirements Engineering and Functional Analysis Part B</td>
<td>Reading: See Study Guide Section 3</td>
</tr>
<tr>
<td>Date</td>
<td>Day</td>
<td>Lecture Details</td>
</tr>
<tr>
<td>-------</td>
<td>-----</td>
<td>-----------------</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>VC Week - No Lecture</td>
</tr>
</tbody>
</table>
| 10    | 9 Oct | Topic 3.3: Specialty Engineering  
Reading: See Study Guide Section 3. |
| 11    | 16 Oct | Topic 3.4 Systems Analysis, Topic 3.5 V&V and Reviews  
Reading: See Study Guide Section 3 |
| 12    | 23 Oct | Topic 3.6: SE Management  
Reading: See Study Guide Section 3.  
**Notes:**  
Group Assignment due.  
RME 4 due. |
| 13    | 30 Oct | Topic 4.1 TSI and CMMI  
Reading: See Study Guide Section 4.  
**Notes:**  
RME 5 due. |
| 14    | 6 Nov | Subject Revision |
| 15-17 | 13 Nov | Formal Examination Period commences (students to refer to the University Exam Timetable for location and time of Final Examination) |

The subject semester program is indicative, and is subject to change. Any changes to the program will be announced in advance in class and via UTSOnline.

**Assessment**

**Assessment task 1: Final Exam**

**Objective(s):** This assessment task addresses subject learning objectives:

1, 2, 3, 4, 5, 6 and 7

This assessment task contributes to the development of the following course intended learning outcomes:

A.5, B.1, B.4, C.1, E.1 and F.1

**Type:** Examination

**Groupwork:** Individual

**Weight:** 40%
Task: The final examination will be a 3 hour open-book examination. It will cover all the topics studied in this subject. The examination will consist of a mix of questions requiring a narrative, numerical or diagrammatic response. Further information will be provided in class during the revision lecture. You may take non-programmable calculator to the exam.

Due: UTS Exam period
Refer to UTS Examination timetables for the date of the examination.

Criteria linkages:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight (%)</th>
<th>SLOs</th>
<th>CILOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctness/relevance of solutions</td>
<td>100</td>
<td>1, 2, 3, 4, 5, 6, 7</td>
<td>A.5, B.1, B.4, C.1, E.1, F.1</td>
</tr>
</tbody>
</table>

SLOs: subject learning objectives
CILOs: course intended learning outcomes

Assessment task 2: Individual Assignment 1

Objective(s): This assessment task addresses subject learning objectives:

1, 2, 4, 5, 6 and 7

This assessment task contributes to the development of the following course intended learning outcomes:

A.1, A.3, A.4, A.5, B.3, B.6, C.1, C.2, D.1, E.1, F.3 and F.4

Type: Report

Groupwork: Individual

Weight: 20%

Task: Details of the assignments will be provided separately via UTS Online. This assignment is to done individually. It provides you with an opportunity to apply the concepts of systems thinking considered in class to a relatively complex situation. The situation considered may not be a purely technical or engineering one.

Length: Your report should not be longer than 4 pages plus any diagrams. Reference list and coversheets are not included in this count. The assignment should have no appendix.

Due: Friday 11 September 2015

Criteria linkages:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight (%)</th>
<th>SLOs</th>
<th>CILOs</th>
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</thead>
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<tr>
<td>Evidence of research beyond course materials</td>
<td>33</td>
<td>1, 2, 4</td>
<td>A.5, B.3, B.6, D.1</td>
</tr>
<tr>
<td>Evidence of systems thinking application</td>
<td>33</td>
<td>4, 5</td>
<td>A.1, A.3, A.4, A.5, C.1, F.3, F.4</td>
</tr>
<tr>
<td>Correctness of diagramming and notation</td>
<td>34</td>
<td>6, 7</td>
<td>C.2, E.1</td>
</tr>
</tbody>
</table>

SLOs: subject learning objectives
CILOs: course intended learning outcomes
Further information: The Assessment Tasks will be completed and submitted on or before the due date nominated. Any deviations from this will be penalised at the rate of 10% per day late for a maximum delay of 2 days. Unless prior approval in writing has been given by the subject coordinator, assignments more than 2 days late will not be accepted. Extensions of time will only be granted under exceptional circumstances. Work or travel pressures are not normally valid grounds for extension. Requests for extensions of time must be submitted in writing to the Lecturer prior to the due date of the relevant assessment task. The supporting evidence such as a Doctor’s Certificate or Statutory Declaration should be attached to the submitted Assessment Task. The Lecturer reserves the right to apply a penalty or reject the late submission.

All written assignments must be typed and should meet the following format and guidelines:

- Times New Roman 12 point font for the main text – use individual judgment for headings.
- Use a double or 1.5 line spacing for assignment text to allow room for comments.
- Use the 49004 cover sheet, appropriately signed, for each assignment (available via UTSOnline).
- Submit the marking sheet (if supplied) with the assignment with your details included.
- **Ensure that your name and student number is on each page.**
- All sources must be adequately and accurately referenced using the Harvard UTS referencing style.
- **Please do not** place your work in a plastic sleeve, folder or binder. Staple in the upper left corner only.

Assignment Submission and Due dates
Hard copies of the assignments are to be submitted to the lecturer within the first 15 minutes of the lecture in the week that they are due. Prior arrangements need to be made with the subject coordinator if you are unable to submit them at the commencement of the lecture.

A soft copy of the Individual and Group assignments is also to be submitted online to the ‘Turnitin’ anti-plagiarism system. See the section on Turnitin later in these instructions for more information. There is no requirement to submit RME responses into Turnitin. Dates on which the assignments are set and due are available in the Semester Program in this outline. Soft copies of assignments may also be required for submission (other than for Turnitin). This will be advised in the specific assignment instructions if appropriate.

It is strongly recommended that students keep copies of all their submissions. Although great care is taken, submitted work may be lost in the process of marking and it is the student’s responsibility to provide an additional copy, should this happen. Under no circumstance should assessments be faxed to the University.

Turnitin Instructions
Turnitin is an electronic assignment submission and plagiarism detection system.

Students will be required to use Turnitin to submit their Group and Individual assignments in electronic format. Access to Turnitin is via the UTSOnline Assignment Folder. Submission of assignments into Turnitin is required on or before the respective assignment due date.

You will see folders for “Individual Assignment” and “Group Assignment” within the Assessment Folder. Select the relevant Assignment area. To submit your work, click on the link and follow the on-screen instructions. Ensure that you click the “submit” icon.

Required name format for assignment submission:
You need to type in the Submission title for your paper. Use the following format:

**Individual Assignment:**
**Last name_ firstname_student number.**

Some points to remember when submitting to Turnitin:

- Remove the standard assignment cover sheet prior to submission.
- Only submit the "core" of your assignment.
- Only submit 49004 assignments to the 49004 site.
Assessment task 3: Group Assignment

Objective(s): This assessment task addresses subject learning objectives:

1, 2, 3, 6 and 7

This assessment task contributes to the development of the following course intended learning outcomes:

A.1, A.2, A.3, A.5, B.1, B.2, B.4, B.6 and C.2

Type: Report

Groupwork: Group, group assessed

Weight: 30%

Task: The group assignment gives you the opportunity to collaborate on a partial design of a system using the ideas, tools and techniques presented in class.

Length: It is expected that your group report shall be less than 20 pages, though this will vary depending upon your approach to the problem and issues.

Due: Friday 23 October 2015

Criteria linkages:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight (%)</th>
<th>SLOs</th>
<th>CILOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctness of diagramming and notation</td>
<td>25</td>
<td>6, 7</td>
<td>B.1, B.4, B.6</td>
</tr>
<tr>
<td>Consistency and coherency of design</td>
<td>25</td>
<td>7</td>
<td>A.5, B.2, B.4, C.2</td>
</tr>
<tr>
<td>Correct requirement management</td>
<td>25</td>
<td>1, 3</td>
<td>A.1, A.2, A.3</td>
</tr>
<tr>
<td>Evidence of systems approaches to design</td>
<td>25</td>
<td>2, 7</td>
<td>A.5</td>
</tr>
</tbody>
</table>

SLOs: subject learning objectives
CILOs: course intended learning outcomes

Further information:

Assignment formatting and submission instructions as for Assessment Item 2.

Turnitin Instructions

General Turnitin instructions as for Assessment Item 2.

Specific Group Assignment Instructions:

For the group submissions, only ONE member of the group should submit to Turnitin – use the following submission title format:

Semester_Group number (example Aut_26)

Your group number will be assigned by the lecturer. This number will remain your group number for the duration of the group project.
Areas have been established for all the submission titles in this subject except for RME, which does not require submission to Turnitin.
Some points to remember when submitting to Turnitin:

- Remove the standard assignment cover sheet prior to submission.
- Only submit the "core" of your assignment.
Only submit 49004 assignments to the 49004 site.

**Group Management**

You are to self-select which group you belong to (subject to the maximum group size). The group members are expected to manage the project within your groups as well as identifying the appropriate mechanisms to ensure that the group functions effectively to accomplish the required tasks. The group needs to ensure that each member contributes to the group effort in a fair manner. You are advised to document the group decisions and any issues that may arise, as well as the resolution of the issues. You may use all the facilities available on the UTSOnline Group pages to help you communicate within your groups. There will be time for group meetings etc. after each class.

**Assessment task 4: Class Participation**

**Objective(s):** This assessment task addresses subject learning objectives:

1, 2, 3, 4, 5 and 6

This assessment task contributes to the development of the following course intended learning outcomes:

A.5, B.1, B.6, C.1, C.2, D.1, D.2, E.1 and F.4

**Type:** Exercises

**Groupwork:** Individual

**Weight:** 10%

**Task:** Class participation will be assessed via problem based class discussions and UTS Online submissions. They are chosen to help you with your study in this subject. The instructions for these exercises are available via UTSOnline in the Assessment Folder. The Reading Material Exercises subfolder within the Assessment Folder contains the relevant instructions. Up to three students will be selected at random to discuss their RME responses in class during the week that a particular RME is due. The rest of the class will be expected to contribute to this discussion so that the concepts involved may be explored collaboratively.

**Length:** Except for questions requiring numerical solutions, you are to restrict your responses to a maximum of 2 pages for each RME. For example, if an RME has multiple parts (a, b, c etc.) then your TOTAL response to the whole RME must fit within the 2 pages limit.

**Due:** As indicated in the semester program in this Subject Outline. Any modifications to the due dates will be indicated via UTSOnline. Reading Material Exercises (RME) submissions are due strictly by 5pm of the due date via UTSOnline. Any submissions after this will not be accepted, and a mark of zero (0) will be recorded for that particular submission. Email submissions of RME responses will not be accepted.

**Criteria linkages:**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight (%)</th>
<th>SLOs</th>
<th>CILOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence of critical engagement with class material</td>
<td>25</td>
<td>1, 2, 3, 4</td>
<td>A.5, B.6, D.1, D.2, E.1</td>
</tr>
<tr>
<td>Evidence of recognition of life cycle issues and approaches</td>
<td>25</td>
<td>4, 5</td>
<td>B.6, F.4</td>
</tr>
<tr>
<td>Evidence of application of appropriate techniques</td>
<td>25</td>
<td>5, 6</td>
<td>B.6, C.1, C.2</td>
</tr>
</tbody>
</table>
Use of plagiarism detection software
This subject will use the Turnitin plagiarism detection software. Specific instructions on its use are provided elsewhere in this outline.

Examination material or equipment
You will be permitted to take the following material into the final exam:

- A non-programmable calculator.
- The examination will be open book.

Minimum requirements
In order to pass this subject you must pass the final examination, as well as obtain an overall mark of 50% in the subject. If you obtain a mark $\geq 50\%$ for the subject, but have failed in the compulsory item, you will be awarded a Fail (X) grade for the subject.

Required texts
Title: Systems Engineering and Analysis
Authors: Benjamin Blanchard and Wolter Fabrycky
Publisher: Pearson Prentice Hall
Edition: 5th

Students may obtain the textbook from the Co-op Bookshop at 3 Broadway, City Campus. The bookshop is open 7 days a week: Monday to Thursday 9am to 6pm, Friday 9.30am to 5pm, Saturday and Sunday 11am to 4pm.

The Co-op will also mail you the book: order through www.coop-bookshop.com.au phone (02) 9212 3078 or fax (02) 9212 6303. Please have ready your credit card details, your student ID number and Co-op number if you are a member. They will charge you the cost of the book as well as postage by express post.

The Learning Resource Material (LRM)
The LRM contains a number of Readings to supplement the set text, and guidance for your study of the material. The readings serve to amplify points in the text, illustrate a different emphasis or cover material not covered adequately by the text. They are made up of copies of journal papers or portions of key books and are written by acknowledged experts in the field. These readings are important to obtain a rounded understanding of the subject. Students can obtain the readings via the link to the library’s e-readings. This link is available within the UTS Online Learning Resource Material folder. You should let the LRM guide your study and reading in this subject. The Study Guide available in the Learning Resource Material folder in UTS Online provides this guidance.

The Lecture Support Notes (LSN)
The lecture support notes are provided as a resource additional to the Text and the LRM, and consist of copies of the overhead slides used in the lectures. They will be available via UTS Online. The LSN should not be used as the main focus of your learning.

References
For a list of useful references please refer to the UTS Online References folder.

Other resources
UTS Administrative Information: www.uts.edu.au/students
Engineering postgraduate information: www.eng.uts.edu.au/Current_Students/postgraduate
UTS Online: http://online.uts.edu.au/webapps/login

UTSONline is a web-based learning tool used in many UTS subjects. It can be accessed from inside and outside UTS via most web-browsers.

This subject makes use of UTSONline as a means of communication between teaching staff and students. You should be registered automatically if you have enrolled correctly. If you do not want to receive emails at your default UTS
email account then you should forward emails to your preferred email address.

Students need to familiarise themselves with UTSOnline. Announcements will be made using this facility. Students are expected to regularly check the announcements page for information.

Having problems logging on? Service Desk is the first point of contact for staff, students, and the general community in relation to Student Centre inquiries, the IT Support Centre and Audio Visual Services: [https://servicedesk.uts.edu.au](https://servicedesk.uts.edu.au)

Note, use the login button if you are an existing student or staff member; use your student or staff number with your UTS Access (email) password to login. Guest login is for all other customers. Service Desk is unavailable from 2–3am weekdays and 2–6am Sunday for backups and scheduled maintenance.

You will need to log in to UTSOnline each time you use it.

Your user name is your student number. If you are a new user, your password is the first two letters of your family name (IN CAPITALS) followed by your student number. You can change this password at any time.


**Graduate attribute development**
For full details about the Faculty's graduate attributes, see: [www.uts.edu.au/about/faculty-engineering-and-information-technology/who-we-are/welcome/what-makes-us-unique-0](www.uts.edu.au/about/faculty-engineering-and-information-technology/who-we-are/welcome/what-makes-us-unique-0)

**Assessment: faculty procedures and advice**

**Special consideration**
Information on special consideration and special needs can be found at:


Special consideration requests are submitted and resolved through the UTS Special Consideration Process.

**Special needs**
Students should email the subject coordinator as soon as possible (and prior to the assessment deadline) to indicate how their ability to meet an assessment component or requirement is impacted, and that they are seeking assistance through UTS Special Needs as detailed in Section 5.1.3 of Procedures for the Assessment of Coursework Subjects.

**Academic integrity**
Students should refer to the [Advice to Students on Good Academic Practice](www.gsu.uts.edu.au/policies/academicpractice.html) policy at:


If your tutor, assessor or lecturer suspects that you have plagiarised and/or cheated in any assessment task, they have no choice under UTS rule 16.6 but to refer the matter to the Responsible Academic Officer (usually the Director of Undergraduate or Postgraduate Programs, or the Associate Dean Teaching and Learning).

**Academic liaison officer**
Academic Liaison Officers (ALOs) are academic staff in each faculty who assist three groups of students: students with disabilities or ongoing illness; students who have difficulties in their studies because of their family commitments (e.g. being a primary carer for small children or a family member with a disability); and students who gained entry through the UTS Educational Access Scheme or Special Admissions.

ALOs are responsible for determining alternative assessment arrangements for students with disabilities. Students who are requesting adjustments to assessment arrangements because of their disability or illness are requested to see a Disability Services Officer in the Special Needs Service before they see their ALO.

The ALO for Engineering students is:

Dr Bruce Moulton
telephone +61 2 9514 2681
email Bruce.Moulton@uts.edu.au

The ALO for IT students is:
Support

Improve your academic and English language skills: HELPS (Higher Education Language and Presentation Support) Service provides assistance with English language proficiency and academic language. Students who need to develop their written and/or spoken English should make use of the free services offered by HELPS, including academic language workshops, vacation intensive courses, drop-in consultations, individual appointments and Conversations@UTS (www.uts.edu.au/current-students/support/helps/about-helps).

HELPS is located in Student Services, on level 3 building 1. Phone 9514 9733.

Statement about assessment procedures and advice

This subject outline must be read in conjunction with the policy and procedures for the assessment for coursework subjects, available at:


Querying marks/grades and final results

If a student disagrees with a mark or a final result awarded by a marker:

- where a student wishes to query a mark, the deadline for a query during teaching weeks is 10 working days from the date of the return of the task to the student
- where a student wishes to query an examination result, the deadline is 10 working days from the official release of the final subject result.

More information can be found at:

https://my.feit.uts.edu.au/pages/course/student_policies_rules

Retention of student work

The University reserves the right to retain the original or one copy of any work executed and/or submitted by a student as part of the course including, but not limited to, drawings, models, designs, plans and specifications, essays, programs, reports and theses, for any of the purposes designated in Rule 3.9.2 (www.gsu.uts.edu.au/rules/student/section-3.html#r3.9). Such retention is not to affect any copyright or other intellectual property right that may exist in such student work. Copies of student work may be retained for a period of up to five years for course accreditation purposes. Students are advised to contact their subject coordinator if they do not consent to the University retaining a copy of their work.

Statement on UTS email account

Email from the University to a student will only be sent to the student's UTS email address. Email sent from a student to the University must be sent from the student's UTS email address. University staff will not respond to email from any other email accounts for currently enrolled students.

Disclaimer

This outline serves as a supplement to the Faculty of Engineering and Information Technology Student Guide. On all matters not specifically covered in this outline, the requirements specified in the Student Guide apply.