Course Brief and Outline: 2015

Course Lecturer:

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1 Course Background and Purpose

Teletraffic engineering, based on teletraffic theory, provides the means to analyse, design and monitor networks to ensure that the networks carry end user and signalling information to the satisfaction of end users. Teletraffic started early in the history of telephony with a Danish Schoolmaster wondering about the capacity of the village telephone exchange. As switched circuits grew in complexity, a large body of theory and practice emerged for engineering telephone networks to carry voice traffic with acceptable quality of service using measures such as the probability of an attempt to make a call failing because all equipment is busy. With the emergence of packet switched networks the subject expanded. Approaches to engineering packet switched networks to carry user packets have much in common with switched circuit networks but required extensions. Engineering of packet networks for traffic also has its own nuances.

Teletraffic theory is rooted in probability. Ideally, the student should be well versed in probability concepts. However, as this is often not the case, the course is structure with the opportunity to learn or refresh key concepts in probablity and to reinforce this learning through computer exercises.

2 Course Outcomes

By the end of the course the student will demonstrate ability to:

1. Apply key concepts in probability to describe teletraffic;
2. Perform key calculations in switched circuit networks;
3. Apply the principle concepts of queueing theory to traffic modelling;
4. Formulate models for teletraffic problem situations.

3 Course Content

- Teletraffic: definition, teletraffic engineering process
- Classical teletraffic: modelling simple traffic sources, modelling switched circuit traffic problems, congestion: call and time.
- Loss systems: Erlang B distribution and blocking probability.
- Delay systems: Erlang C distribution and performance metrics.
- Queueing Theory: Kendall notation, Little's formula, Markov models, birth-death systems, selected queue type: $M/M/1$, $M/M/n$, $M/D/m$, etc.
- Packet switching: modelling switches, routers and links, modelling networks, effect of additive delays and delay elements in parallel.
- Applications of teletraffic theory: selected applications of teletraffic modelling to situations existing in networks and other systems.

4 Prior Knowledge Assumed

A working knowledge of PSTN, mobile network, packet switched and Internet architecture is assumed. A number of concepts in probability are essential.

5 Assessment

5.1 Components of the Assessment

The assessment contains two components:

- Project (Weight 40%): Each student is expected to do one problem from a range of problems covering the subject matter of the course and requiring the application of telecommunications standards for solution. The report must be properly structured and use acceptable style and language. Standards documents required for each problem will be identified and made available.
- Examination (Weight 60%): The first section, lasting not more than one hour is a Closed Book Examination consisting of short questions. The second section is an Open Book Examination concentrating on the solution of problems using the theory, concepts and information in the course text. The course text must be brought to the examination by every student. No other material may be used. Students are required to be present in the examination room unless permitted to leave by the invigilator.

5.2 Assessment Criteria

Satisfactory performance is characterised by a combination of the following performances appropriate to each particular task:

- Display Literacy by producing a majority of correct answers in multiple choice and short answer questions on concepts and principles of probability and teletraffic.
- Apply teletraffic theory to situations occuring in networks.
- Formulate models for traffic behavious of network elements and situations.
- Use computer aids to visualisation and problem solving .

5.3 Satisfactory Performance Requirements

The course occupies the time on days listed below consisting of a mixture of lectures, work sessions and evaluations. All students are required to be present during the times listed above.

5.4 Calculators in examinations

Students will have access to Octave in examinations.

6 Teaching and Learning Process

6.1 Teaching and Learning Approach

The knowledge base for the course is contained in the course notes. Problems will be set from day to day.

6.2 Arrangements

Dates TBA.

Times TBA.

Venues Room CM 3, Chamber of Mines Engineering Building, Wits West Campus.

Consultation Communicate via email to arrange an appointment.

7 Information to Support the Course

7.1 Web References

There is no prescribed textbook for this course. Prescribed reading material comprises handouts, www links and library references which will be posted on the course home page or announced in class.

7.2 Course Homepage

Further information and announcements regarding the course is posted on the course home page `http://dept.ee.wits.ac.za/~cheng/`. All students are expected to consult the course home page at regular intervals.

8 Other Information

8.1 Administrative details

Further information and announcements regarding the course will be communicated either via the web page, verbal announcements or printed material distributed during lectures. Handouts for the tutorials and the project will be issued during the course.

Although a Personal Computer is not a requirement for any Electrical, Information or Biomedical Engineering course, it is strongly recommended as a useful tool from the second year of study onwards.

All students are expected to regularly consult the course home page.