Open book examination in TBMT02 **Medical Images**

The exam is available for download **not earlier than** 08.00 o’clock the 21\(^{\text{th}}\) of June from the course web page (‘course documents’) in LISAM or course web page at IMT. **Return no later than** 08.00 o’clock the 28\(^{\text{th}}\) of June by submission via LISAM.

The exam consists of three (3) cases. They are similar to those you have practiced at the tutorial sessions. Sometimes they are a little bit more specific. Remember to use the experience and workflow from the tutorial session when you are solving these three tasks.

You are allowed to use all material you collected throughout the course.
If you are discussing or brainstorming together with another student, write down his/hers personnel identification on the home exam. It is allowed to do the brainstorming in a tutorial group but thereafter should all learning goals and analysis be made individually.

**Reports are written individually.**

Plagiarism is presenting someone else’s ideas or words as your own.
Do not copy; instead use the sampled information to create your own knowledge.
If you are to make quotations, do not forget to put it within brackets and only short quotations. Paraphrasing without giving credit, or changing only a few words (i.e. paraphrasing too closely) even if you give credit are also examples of plagiarism. All ideas and facts that are obtained from other sources must be properly cited, unless they qualify as common knowledge. (If in doubt about whether something is common knowledge, provide a citation.) All exams will be automatically submitted to Urkund from LISAM to check for plagiarism.

The submission is blind, that is the examiner cannot see which student the exam belongs to until the grade has been set. (Please make sure all meta-information is removed in the document submitted.)

The exam consists of 3 cases. To every case you are expected to formulate 3 questions. If the questions are relevant to the case and the learning outcomes of the course you will gain 1 p. The three questions should be answered as good as possible and will be evaluated according to the SOLO taxonomy consisting of 5 levels. (See [http://www.uq.edu.au/teach/assessment/docs/biggs-SOLO.pdf](http://www.uq.edu.au/teach/assessment/docs/biggs-SOLO.pdf) and [http://www.cuhk.edu.hk/policy/assessment/SOLO-description.pdf](http://www.cuhk.edu.hk/policy/assessment/SOLO-description.pdf)) The lowest level will give 0 p and levels 2-5 will generate increasing number of points. For every case, you will get a maximum of 10 p. A minima of 4 p for each case is required in order to pass the exam.

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<th>Grading:</th>
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Results are available 14 working days after the exam.

Good luck!!!
Göran Salerud
28 67 55
For each of the situations below identify different aspects of the problems and define 3-4 different questions (learning outcomes) in accordance to both the description of the situation and the aims of the course (course learning outcomes). It is welcomed that these questions are answered including a background, analysis, applicability and a validation. You will be assessed both on basis of the delivered answers but also on basis of the questions chosen. Do not forget to motivate your answers. Maximum number of pages for the exam is limited to 15.

1) During the last 5-10 years the use of computerized tomography has increased a lot. A couple of years ago the number of CT (computed tomography) examinations was about 20% of the total number of X-ray examinations, while the CT examinations induced 60% of the total radiation dose to people. Therefore, before buying a new modern CT (multi-slice-spiral-CT) you are invited by the politicians at the County Council to tell them how the CT technique has been developed in order to avoid a further increase, or even better, to lower the collective dose to the people. The new equipment should also be used in mammography screening to detect very small malignancies and the listeners were asking if the new CT would have less good image quality compared to the older methods with lower total radiation doses. Since politicians are not radiologists, you even have to explain how the radiation doses for different examinations are measured and one of the journalists is suspicious and wonder if the radiation from modern CT is unnecessary and dangerous. Other listeners asked you to tell them more basically how the CT works and how to ensure that the children get as low dose as possible and also if there are alternatives regarding examination technique.

2) The County Council has come to a new agreement with a cleaning company about cleaning the MRI department twice a week. A contract has been signed with the company but no investigation was done if they had experience from this type of work before and they do not have this. The cleaners have become alarmed when they see the introductory video and how an entire scrubbing-machine flew into the magnet.

As manager of the MRI unit, your task is to show them around in the examination room, describe to them how an MRI camera is built, the use of high magnetic fields and how carefully they have to be with what they are wearing and what machines they use.

It turns out that the cleaners are BME master students at the university earning some extra money. They are very interested in the MRI technology and like to have answers about image generation, how contrast occurs, misdiagnosing by artefacts and if not the large magnetic field is dangerous. This will be a challenge for you.
3) A newly started ultrasonic company makes their own probes and equipment’s. Together with clinical researchers at the women’s clinic they have started a lot of interesting projects, one is where they would like to investigate foetus hearts as early as possible in the pregnancy in order to make interventional surgery possible. Therefore, they need to recruit new personnel for these projects. You have just finished your BME thesis work and the company announcement looks interesting and therefore you apply for the job. You are selected for an interview where they ask you to look at different probe types. One circular with a crystal about the size of a 5-cent coin, a second probe put together of 32 rectangular piezoelectric crystals forming an array and finally a 1.5 dimensional probe type with 16 elements in each row. They ask you to give your viewpoint about the possibility to use the probes for foetus investigations and if there are differences between the probes concerning the use and the diagnostic value. Can you get the same quality and diagnostics with the probes etc.? The questions are falling like raindrops at you and you do not know where to start. Occasionally the research director comes in and asks if you think it could be used for investigating the foetus brain also since there has been large interest in detection of aneurysms in pre-born. You feel the tension and now it is time to demonstrate what you knew and learned at the BME educational program at the university.