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I  Introduction

This handbook contains important general information for students undertaking the Undergraduate Degree program in the Department of Communications and Electronics. During the academic year 2010 / 2011, this handbook will be made available on paper and on the web.

Your degree program is subject to regulations contained in the University Student Guide. This departmental handbook interprets the regulations and your tutors may give advice, but the University Student Guide defines the regulations.

I.I  Important Dates

I.I.I  Registration:
Admission criteria are issued by the Higher Education Council, which governs all private universities (80% in the Tawjihi exam). First year students must attend the University and they will be given a full timetable for the introductory activities. Departmental and University registration must be completed at the time specified in the introductory timetable (shown below). Returning students must also register in the times specified during the introductory week.

The full time study
First year students must attend a meeting at 8.00 AM on Sunday 10th October, 2010.

I.I.II  Session Dates 2010-2011

I.I.II.1  A. FIRST TERM

- The morning study
  Begins:  Sunday 10th October  2010
  Ends:    Tuesday 1st February 2011
  The first semester includes
  - Teaching, learning, and assessment activities in communications & electronics engineering, will run for 16 weeks, from Sunday 10th October 2010 to Tuesday 1st February 2011.
  - There are 4 holidays namely on 16th - 20th November, 7th December, 25th December, 1st January.
I.I.I.II SECOND TERM

• *The studies schedule*

Begin: Sunday 20\textsuperscript{th} February 2011  
End: Sunday 12\textsuperscript{th} June 2011

The second semester includes
- Teaching, learning, and assessment activities in communications & electronics engineering will run for 16 weeks, from Sunday 20\textsuperscript{th} February to Sunday 12\textsuperscript{th} June 2011.
- *There are 2 holidays on, 1\textsuperscript{st} May and 25\textsuperscript{th} May.*

C. SUMMER TERM

• *The morning and evening studies*

Begin: Sunday 26\textsuperscript{th} June 2011  
End: Thursday 18\textsuperscript{th} August 2011

Summer semester includes teaching, learning, and assessment activities, which will run from Sunday 26\textsuperscript{th} June to Thursday 18\textsuperscript{th} August 2011.
*There is no holidays.*

• *Examination Periods*

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3. *Timetable*

The lecture timetable is published separately from this book. Whilst every attempt is made to schedule reasonable combinations of course units (modules), various constraints make some combinations and outside options impossible. If you have a timetable problem, please consult your personal tutor in the first instance.

III. Scope and Input Resources

1. *Aims and Learning Outcomes*

*Educational Aims:*

The field of communications and electronics engineering which include, mobile phone systems, data communication, digital broadcasting and microelectronics technologies, continues to be one of the fastest growing engineering fields.
All Communications systems require the design of electronic subsystems, so that, the communications and Electronics Engineering program cover aspects of both electronic and Communication systems analysis and design. Such program aim to:

- Provide students with broad communication and electronic skills that will enable their career and professional accomplishments.
- Give students strong abilities in the fundamentals of communications and electronics engineering.
- Provide the opportunity for students to apply their knowledge to systematically solve engineering problems using appropriate tools and modern technology.
- Provide student with a comprehensive training in laboratory techniques, the skills of investigation, planning and handling of experimental apparatus, project design and its practical implementation.
- Provide student with training in the communication and electronic fields in different related enterprises and to offer the opportunity to develop related skills and knowledge to a high level.
- To enable students to understand the structures and processes of communication systems and the design of their electronic subsystems and to adapt to the rapidly changing technology.
- To provide students with knowledge of modern data acquisition and data communication techniques for a variety of engineering applications.
- Make students applying the design and laboratory skills expected of practicing communication and electronic Engineers.

In addition the students will acquire and develop many valuable skills such as the ability to use different engineering tools and equipment in order to analyze, evaluate, select and design an innovative System for the purpose of problem solving. The student will acquire many practical skills through the design and implementation of different communication and electronic projects circuits and to provide an acceptable prototype for such a project.

The knowledge and skills will prepare the student for further study or employment either in communication field, in electronics field or in both of them.

**Learning Outcomes:**

Learning outcomes describe what student should know and be able to do if he makes full use of the opportunities for learning that the department provides.

**A) Knowledge and Understanding Skills:**

*Undergraduate Handbook*
You will obtain knowledge and understanding of:

A1) Mathematical tools relevant to communications and electronics systems.
A2) Fundamental technological concepts, principles, and techniques associated with electronics and communications systems.
A3) The structure of different communication and electronic systems.
A4) The way of thinking and how to design?
A5) The methods of developing the communication systems.
A6) Design and simulate different communication system and the electronic subsystems.
A7) How to build, as hardware, different communication systems.

B) Intellectual Skills:
The students will acquire and develop the thinking skills that should enable them to:
B1) Develop a strong grounding in the fundamentals and how to apply them.
B2) Develop an ability to analyze communication and electronic engineering problems and synthesize solutions.
B3) Apply appropriate techniques to the transmission systems that are currently used for data, voice and video over LAN and WAN broadband networks.
B4) Understanding, designing and developing different communication and electronic systems for processing signals and data.
B5) Analyze and identify the specifications and tools to design typical process control applications, applicable to data communications and its related electronics systems.

C) Practical Skills:
Students will acquire and develop the practical skills that should allow them to:
C1) Use appropriate numerical and mathematical skills to describe, analyze and solve a problem in electronics or/and communication system.
C2) Use various laboratory equipment as diagnostic tool to detect a faults and identify a problem in electronics or/and communication system.
C3) Analyze, design, evaluate system behavior and test electronic or/and communication system using simulation or computer-based tool (engineering software tool).
C4) Implement electronic circuits for communication system.
C5) Undertake ongoing learning in order to keep up to date in the field on electronics and communication technologies.
C6) Deal with computer hardware and use it in electronic and communication project.
D) Transferable Skills:

Students will acquire and develop the key transferable skills that will enable them to:

D1) Clarify personal values and objectives.
D2) Work with a wide variety of people.
D3) Manage tasks and solve problems.
D4) Negotiate learning contracts.
D5) Think logically and critically.
D6) Use a range of technological equipment and systems.

Main Aims of Research

The Department of Communications & Electronics endeavors to formulate strategies which encourage perusal of research in order to:

1. Enrich & inform the curriculum as appropriate.
2. Improve the research output so that it is comparable to good quality examples nationally & internationally.
3. Engage staff members in scholarly activity.
4. Enhance University investment by attracting external funds.

2. The Department Staff

A. Academic Staff
   a. Qualifications
      The academic staff members are divided into two categories: full-time and part-time. The number of full-time staff members is 10 (1 woman and 9 men), while the part-time staff depends on the number of students and the needs of the Department.
      The academic staff members, who are between 28 and 55 years of age, have relatively adequate experience ranging from 2 years to 25 years.

   b. Specializations
      Full-time as well as part-time teaching staff members have various specialisations that can be divided into 10 categories
      - Electrical Circuits
      - Engineering Analysis
      - Electromagnetics
      - Computer Design and Microprocessors
      - Power and Electrical machines and Automatic control.
      - Electrical measurements and devices
      - Electrical Communications (Analog & Digital)
      - Electronics (Electronic Circuits and Digital Electronics)
      - Computer and Wireless Communication systems.
      - Engineering applications.
. At present, there are seven research teams at the Department and young staff members belong to these teams.

B. Non-Academic Staff
Besides the academic staff, the Department has 4 other full time members, holding B.Sc. degrees and 2 full time members, holding Diplom in Communications and Electronics fields. Those staff members have 2 to 6 years working experience and some of them are Philadelphia University graduates. All of the non-academic staff members are qualified as laboratory tutors and assist lecturers in the laboratory hours. In addition, some of them are responsible for maintenance of Communications and Electronics devices in the laboratories and Electronics workshop.

3. Departmental Learning Resources

- **Code of Practice for Students of Communication and Electronics Administration**
  This code of practice is supplementary to University regulations concerning the use of computing equipment which you are required to accept at Registration.
  1. You must follow all rules, regulations and guidelines imposed by the Faculty of Administrative and Financial Sciences and the University in addition to the Department's Code of Practice.
  2. You must not use machines belonging to the Department for commercial purposes without the prior written permission of the Head of the Department. You must not sell the product of any work you do using Departmental facilities without the prior written permission of the Head of the Department.
  3. You must not write or knowingly store on machines belonging to the Department software that, if executed, could hinder or annoy other users, except with the prior written permission of the Head of the Department.

- **Student Bookshop**
  Photocopy facilities are available in the student Bookshop, 7th floor in the faculty of engineering. Reference copies of textbooks are available at affordable prices. Copies of previous week’s tutorial solutions are also available. Lending copies of textbooks are available in the University Library.

- **Printing**
  You can take printouts (free of charge) in any Faculty labs. Some of labs contain at least one printer for this purpose.

- **Administrative Infrastructure**
  There are 35 offices at the Faculty of Engineering used for administrative functions as follows: Dean, Assistant Dean, Dean’s Secretary, 5 Department
Heads, 3 Department Head Secretaries, 1 room for student advisory services, and 1 general meeting room.

- **Academic Infrastructure**
  It is composed of
  - 15 Department classrooms and one auditorium equipped with support facilities: computer, data show, overhead projector.
  - 5 laboratories.
  - 10 staff offices where each staff member is supplied with a PC.
  - 1 office for student guidance and the examination working groups.

- **Lecture Support Facilities**
  In the Department, there are 2 overhead projectors and 1 data show used to support modules and seminar presentations.

- **The University Computer Centre**
  This centre provides the Department with training and maintenance facilities.

- **Networking Facilities**
  - **Ethernet:** The PCs in each laboratory are connected to an Ethernet platform 10/100 Mbps.
  - **Intranet:** All computing facilities of the University are connected to a Gigabit Intranet backbone.
  - **Internet:** The University is connected to the Internet by 2 Mbps lines.

**Library Facilities** At the University level, a mixture of learning resources is available to staff and students through a fully equipped and sophisticated library. Engineering and other learning and teaching resources, up-to-date module textbooks are available in the library with five different texts for each module. Resources are updated regularly to meet current and projected module requirements. In addition, library resources are continuously monitored to assure availability and currency. The electronic library is also a part of the main University library.

**Extracurricular Activities**
The University provides recreation facilities for students to enrich their talents. This includes:
- A Deanship of Student Affairs which organises the social, cultural and sports events at the University. It also has an alumni office to keep track of graduates
- Several spaces for cultural activities e.g. celebration of festivals, etc
- Several common rooms for meetings, snacks, and cafeterias.
- Three Internet cafes each contain 11 PCs.
- One Student Club.
IV. Student Support and Guidance

1. Assistant Dean’s Office

The Assistant Dean’s Office (7th floor) is mainly for student advisory services. They deal also with all routine undergraduate enquiries. Problems which cannot be dealt with by the Assistant Dean will be referred to the Dean.

2. Academic Guidance

All new students should have academic (personal) tutors. The new students are grouped into groups of 20 – 30 students and each group is assigned to an academic staff member who is their academic tutor. The students remain with the same tutor till their graduation. The tutor deals with all routine undergraduate inquiries, advises for academic registration at the beginning of each semester, and any other outstanding problems. However, problems which cannot be dealt with by the tutor will be referred to the Head of the Department, the Dean of the Faculty, or to an appropriate member of academic staff. Academic guidance is available on specified dates in the terms, and any advisory service offered by the Assistant Dean is available daily to all students in the Engineering Faculty.

Time: 08.00 AM to 04:00 PM Sunday to Thursday during term.

The advisory service offers advice on departmental and University matters and helps with anything that concerns you, whether in your studies, in the Department, at the University or in your life outside the university. Each of the staff in these offices is available with information about the Department and university and the willingness to listen and help with whatever you bring. Note that

- All visits to the advisory service offices are strictly confidential.
- If you have difficulties with material on particular course units you should normally first approach your tutors (or lecturers/project supervisors). You may also consult with your tutors on matters that are more general but you can equally well call in at the Assistant Dean’s Office.
- If you have health problems, you are welcome to consult an advisor in the Department but you may prefer to go directly to your doctor or to the University Clinic.

Feel free to make use of these services at any time.

3. Student Affairs Deanship

Confidential, individual counseling on any matter affecting personal well-being or effectiveness is available at the Philadelphia University Student Affairs Deanship. The Deanship sees well over a hundred students a year and gives expert advice on problems such as low motivation, personal decision making, relationships, anxiety and family difficulties. People there are willing to help in finding fresh ways to cope with the emotional and personal aspects of problems and seek to do so in a collaborative, straightforward and empowering way with the individual concerned. Advice is available concerning referral to other...
services, helping others and dealing with common student problems such as exam anxiety.
The Deanship is open from 8.00 AM to 4.00 PM, from Sunday to Thursday throughout the year and appointments can be made by calling in at the Dean of Student Affairs. All inquiries will be treated confidentially.

4. Tutoring Arrangements
Some of your course units will have tutorials, where you can discuss topics on a course unit and run through exercises. Usually, the lecturer of the course unit runs the tutorial. There will be an opportunity for you to ask questions on matters you do not understand.
As you have a personal tutor from the beginning of your University life, your tutor is there to help you on your way through University life. He/she will watch your progress and offer help and advice whenever necessary. If you get into difficulties, you should contact your personal tutor or visit the Assistant Dean at the earliest possible opportunity. Do not let things slide until it is difficult to rectify the situation, especially if you are getting behind with your work. Your personal tutor will also advise on your choice of course units, on departmental or University procedures and will provide references for jobs and other purposes.

Course lecturers are always available to discuss questions or problems with the course unit material. Each lecturer fixes at least six office hours on his timetable, which is posted on his office door. You can call in at these hours. For any reason, if these lecturers could not see you at these office hours, they may arrange an appointment at another time. It is important that any matter that affects your ability to study be reported to the Department - through your personal tutor, through the Assistant Dean or otherwise. The following are examples of matters that may affect your study: illness, personal or family difficulties (including illness in the family) or financial problems. In assessing your performance, the Department has a policy of trying to help you overcome difficulties you have encountered whilst studying. We can do this only if we are aware of the difficulties and have some idea of their extent.

5. Student Progress
Work and Attendance. The University regulations governing the Work and Attendance of students are outlined in the Student Guide 2010/2011. Full attendance is required at all lectures, laboratories, and any tutorials, which may be scheduled. Completed laboratory work should be handed in on time. Attendance at laboratories and at many lectures is monitored and attendance registers kept. Please note that students are required to undertake approximately thirty-six hours per week of study i.e. an average of two hours of private study will be required for every scheduled hour of lectures or laboratories. Some students may require much more time than this. Being a student is a full time occupation! Absence for holidays is not permitted in term-time. The experience of the Department confirms that lack of attendance leads to study problems and any student with problems
should consult his/her subject tutors or personal tutor. In addition, failure to attend can result ultimately in the University barring the student from sitting for the degree examinations. The duty of the lecturer is to keep continuous review of the work and attendance of the students with whom he is concerned. If the rate of student absences, in a course unit, is greater than 15% (or 20% for student representing the University in sports or cultural activities) of the total module hours and the student has no acceptable justification, then this student is withdrawn from that module. If the Dean of the Faculty accepts the justification of absences, then this student is considered **withdrawn** without refunding the course fees. A formal process is defined to tackle the problem of any student whose work and attendance appear unsatisfactory. Direct approaches by lecturers to solve the problem are as follows: He may choose to issue an "informal" warning, on a special form which may rectify the situation. If this doesn’t work, a "formal" warning is issued. This is again done on another special form. Failure to remedy the situation at this stage leads to dropping the student from the module. A copy of these documents is kept in the student's file.

6. ** Interruption of the Degree Program**
   Any interruption (for a maximum of 2 years) of your degree program requires special permission from the Faculty. Regulations state that a B.A. degree is a continuous 5-year period of study. Permission will only be granted if satisfactory reasons are given. A written request with supporting evidence must be presented to the Faculty. Reasons might include prolonged illness. Consult your tutor for advice.

7. **Transfer between Departments**
   - If you are contemplating any change of Faculty or Department, consult your primary tutor as soon as possible.
   - You can change your Department by filling a special form at the beginning of the semester. The Tawjihi average required in the new Faculty or Department must be less than or equal to your Tawjihi average. A special committee will determine which courses will be accredited from your current Department.

8. **Withdrawal from Modules**
   If you are contemplating withdrawing from a module, please discuss the situation with your personal tutor at the earliest opportunity.
   - You can withdraw from a module up to the thirteenth week of the first or second term, and up to the seventh week of the summer term.
   - The minimum number of credit hours (which is 9) required in each term should be followed.
V. Organization of Teaching

An individual course of lectures is known as a "course unit" or sometimes as a "module".

The curriculum contains modules that are University Requirements (Univ. Reqts.), Faculty Requirements (Facu. Reqts.), and Department Requirements (Dept. Reqts.). Each module has 3 hours per week. However, some modules are supported by tutorials and some continuous assessment, such as seminars or laboratory work, usually amounting to 1 hour per week. When you register for course units, you should follow the academic guidance plan that the Department arranges for you. In fact, you can register any module only if you have taken its prerequisite(s) with the exception that you can register the module and its prerequisite only if you are in the graduation semester.

In each semester, you can register a minimum of 12 credit hours and a maximum of 18 credit hours, except for the semester in which you are expected to graduate when you can register 21 hours. The complete five-years academic guidance plan is listed in Appendix A of this report. For more information about module numbering and full module descriptions, see Appendix B of this report.

In the First Year, you are encouraged to take 18 credit hours each semester (first and second, the summer term is optional). The fourth digit of each course unit code (see Appendix B) tells you the year in which the course is offered. During the first 16-week semester, students will normally complete 5 modules. Thus, each teaching week contains 15 hours or more of scheduled work, while the students normally finish 6 modules in the other 16 week semester. In addition, each scheduled hour typically requires two extra hours of unscheduled work (e.g. writing up lecture notes, preparing for a tutorial, finishing of a laboratory exercise etc.). The selection of a University elective module (one module) depends on your choice. Five of the first year 11 modules are compulsory University requirements; five are Faculty requirements and one elective University requirement module.

In the Second Year, the number and size of modules is approximately similar to that of the first year. Tows of the 12 modules of the second year are University requirements, six modules are Faculty requirements, and four modules are compulsory Department requirements.

In the Third Year, you take seven modules per semester all of them are compulsory Department requirements. Four of these modules are engineering labs, in each semester there are two of them.

In the Fourth Year, the number and size of the modules is approximately similar to that of the third year. There are fifteen compulsory Department requirements modules. One of the compulsory modules is the Graduation Project.
In the **Fifth Year**, there are thirty credit hours remaining, divided as follows: One Faculty requirement module, eleven Department requirements modules; seven of them are compulsory; while the others are elective.

### VI. Course Unit Choices

You may choose a course unit (module) if you have already taken all its prerequisite modules with the approval of your personal tutor. **Figure (C-1) in Appendix C** depicts the prerequisite relationships between the modules.

An initial choice is made before or at Departmental Registration. After that, changes can be made as follows:

- The deadline for changing modules in each semester is one week after lectures start (three days for the summer term). Normally, no changes of modules will be permitted after these dates except for the withdrawal mentioned in point (8) of the previous section.

- In the first instance, you should discuss any plan to change modules with your personal tutor. You must check that the new module you wish to take is a valid option for your degree program and creates no schedule conflict. If there is conflict, the change is not permitted.

### VII. Assessment and Examinations

1. **Criteria for Assessing Examination Work**

   **First class (90 – 100 marks).** First class answers demonstrate depth of knowledge or problem solving skills, which is beyond that expected from a careful and conscientious understanding of the lecture material. Answers will show that the student
   1. has a comprehensive knowledge of a topic (often beyond that covered directly in the program) with an absence of misunderstandings;
   2. is able to apply critical analysis and evaluation;
   3. can solve unfamiliar problems not drawn directly from lecture material and can adjust problem solving procedures as appropriate to the problem;
   4. can set out reasoning and explanation in a logical, incisive and literate style.

   **Upper Second class (80 – 89 marks).** Upper second class answers provide a clear impression of competence and show that the student
   1. has a good knowledge base and understanding of all the principal subject matter in the program;
   2. can solve familiar problems with ease and can make progress towards the solution of unfamiliar problems;
3. can set out reasoning and explanation in a clear and coherent manner.

Lower Second class (70 – 79 marks). Lower second class answers will address a reasonable part of the question with reasonable competence but may be partially incomplete or incorrect. The answer will provide evidence that the student:

- has a satisfactory knowledge and understanding of the principal subject matter of the program but limited to lecture material and with some errors and omissions;
- can solve familiar problems through application of standard procedures;
- can set out reasoning and explanation which, whilst lacking in directness and clarity of presentation can nevertheless be followed and readily understood.

Third Class (60 – 69 marks). Third class answers will demonstrate some relevant knowledge but may fail to answer the question directly and/or contain significant omissions or incorrect material. Nevertheless, the answer will provide evidence that the student:

- has some basic knowledge and a limited understanding of the key aspects of the lecture material;
- can attempt to solve familiar problems albeit inefficiently and with limited success.

Pass (50 – 59 marks). Answers in this category represent the very minimum acceptable standard. Such answers will contain very little appropriate material, major omissions and will be poorly presented lacking in any coherent argument or understanding. However the answer will suggest that the student:

- has some familiarity with the general subject area;
- whilst unable to solve problems can at least formulate a problem from information given in a sensible manner.

2. Assessment Regulations

In general, every module is assessed as follows: 50% is given for two 1-hour midterm exams, coursework and/or seminars, projects, or essays, and 50% for the final exam that may be a written exam only or a written exam plus a final laboratory exam (if applicable), final small project, or seminar presentation. The 50% for the final exam is stipulated in the University regulations. The minimum pass mark is 50% for any module, whereas the minimum passing cumulative average in each semester is 60%. Students are placed on academic probation if their cumulative average drops below 60%. In this case, students are encouraged to repeat those modules with low marks in order to increase their cumulative average. However, students will be dismissed from the University if this average is not achieved in the third attempt.

On the other hand, a committee of three staff members, including the supervisor of the project, assesses the graduation project module. The project's assessment
will include the supervisor mark (35%) and the discussion committee mark (65% given as follows: 20% for project presentation, 25% for report writing, and 20% for project discussion).

3. Role of Internal and External Examiners
   If many lecturers teach the same module, the main coordinator of such a module plays the role of the internal examiner of that module. All lecturers of this module propose exam questions (for the first, second and final exams). The main coordinator will collect these questions from lecturers and select some of them to include in the exam paper.

   On the other hand, external examiners validate the standard of the degree program. The external examiners are expected to look at the question papers, inspect a selection of scripts and project reports (particularly the borderline ones). They supply an assessment report to the Department.

4. Appeal Procedures
   If you have good reason to question a mark you have been given (in midterm exams or in coursework), you should in the first instance approach the module lecturer. If the problem is not solved, you must submit it to your primary tutor. He will find the appropriate solution within administrative structures.

   Problems with final examinations are resolved by submitting complaints or appeals in writing (within three days of the announcement of examination results) to the Examination Committee of the Department. The examination committee will consider these cases and check if there is any mistake in the summation of the marks and so on.

5. Unfair Practices
   The University treats attempting to cheat in examinations severely. The penalty is usually more severe than a zero in the paper concerned. More than one student of this Department was dismissed from the University because of this. Plagiarism, or copying of course or lab work, is also a serious academic offense as explained in the University guidelines.

6. Department Guidelines on Plagiarism
   1. Coursework, laboratory exercises, reports and essays submitted for assessment must be your own work, except in the case of group projects where a joint effort is expected and is indicated as such.

   2. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.

   3. Use of quotations or data from the work of others is entirely acceptable, and is often very valuable provided that the source of the quotation or data is given.
Failure to provide a source or put quotation marks around material that is quoted gives the appearance that the comments are ostensibly your own. When quoting word-for-word from the work of another person, quotation marks or indenting (setting the quotation in from the margin) must be used and the source of the quoted material must be acknowledged.

4. Paraphrasing, when the original concept is still identifiable and has no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

5. Direct quotations from an earlier piece of your own work, if not attributed, suggest that your work is original, when in fact it is not. The direct copying of one's own writings qualifies as plagiarism if the fact that the work has been or is to be presented elsewhere is not acknowledged.

6. Sources of quotations used should be listed in full in a bibliography at the end of your piece of work.

7. Plagiarism is a serious offence and will always result in imposition of a penalty. In deciding upon the penalty the Department will take into account factors such as the year of study, the extent and proportion of the work that has been plagiarized and the apparent intent of the student. The penalties that can be imposed range from a minimum of a zero mark for the work (without allowing resubmission) through warning to disciplinary measures (such as suspension or expulsion).

VIII. Teaching Quality Assurance Committee

The Departmental Teaching Quality Assurance and Enhancement Committee is responsible for the quality of teaching in the Department, including the analysis of Course Evaluation Questionnaire responses.

IX. Student Feedback and Representation

1. Staff Student Consultative Committee
   Student representatives are elected onto the departmental staff student committees at the start of each term. All simultaneous sections of a module have a staff student committee. Each committee meets at least three times each semester and may discuss any matter of concern with the module. The staff members of each committee are the lecturers of the concerned sections.

2. Departmental and Deanship Meetings
The meetings held by the Head of the Department and the Dean of the Faculty during term time, mainly have an advisory role, where students may raise their problems that need some concern from these authorized persons. Separate meetings are held for students of each year.

3. Module Evaluation Questionnaires
The Department attaches great importance to the opinion of students on the quality of the teaching provided, and every student is asked to complete a Module Evaluation Questionnaire for each module. The questionnaires are anonymous.

X. Communications

1. Official Notices
Official notices are posted on the notice boards at the Department and at the Faculty. Electronic mail is also used extensively for communication with the Department and University. Each lecturer provides the students with his/her e-mail at the beginning of the term. Most official information including copies of this handbook, the undergraduate syllabus and timetables are available on the University Web pages www.philad.edu.jo. This includes directories of staff and students for internal use, complete with photographs.

2. Electronic Mail
Electronic mail is used widely for administrative purposes within the Department. It is frequently useful for communicating between individuals and small groups (e.g. between a tutor and his/her tutorial group), and occasionally for broadcasting important messages to wider groups. It is important that you know how to use e-mail. It will be covered in the introductory laboratory sessions. The code of practice for computer usage covers electronic mail, Please note the points below:

3. Obscene or Offensive Mail
DO NOT SEND OBSCENE OR OFFENSIVE MAIL. If you receive mail, which you regard as offensive or obscene, you may wish to complain to a staff member so that appropriate disciplinary action can be taken against the offender.

4. Group Mailing
You are strongly discouraged from sending e-mail to groups of people. The newsgroups should be used for this purpose.

5. Miscellaneous Hints
   • Be brief in your communications.
   • Compose your message as if ALL of your recipients were physically present.
   • Limit the distribution of messages to the people who are likely to be interested.
• Keep a copy of the mail you send out, for future reference. Learn to use folders to keep useful messages.
• Read all your incoming mail before replying to any of it. There may be other relevant messages for you to read.
• Be careful when replying to messages. You probably want your reply to go only to original message sender - not to the whole of the distribution list.
• When you reply to a message, it is frequently helpful to include some of the original message to help your recipients to remember and understand the context of the reply.

XI. Curriculum Design, Content and Organization

1. Curriculum Design and Content
The programme is offered to students from the scientific branch that passed their Tawjihi exam with a minimum average of 80%. The programme is normally completed in five years, where the typical American credit hour system is applied. The Department awards the degree upon completion of 160 credit hours. The study is organised into five consecutive levels. Each level is split into two consecutive semesters (first and second) and an optional summer term. All students complete 47 modules 3-credit-hours each, 4 two-credit-hours modules and 14 modules in one-credit-hour.

• The 3-credit-hours modules are organised as follows:
  24 modules Department compulsory 51.06 %
  4 modules Department electives   8.51 %
  10 modules Faculty requirements 21.27 %
  7 modules University compulsory 21.27 %
  1 module University elective    2.13 %

• The 2-credit-hours modules are organised as a compulsory Department requirements.

• The 1-credit-hour modules are organised as follows:
  12 modules Department compulsory 85.71 %
  2 modules Faculty requirements 14.29 %

Module credit is awarded upon successful completion of the module with a minimum 50% grade. Progression from one level of study to another requires the student to complete all prerequisites of the following year modules, and the cumulative average of grades obtained in the modules studied (whether successful or not) should be at least 60%.
2. Curriculum Organisation

Table (1) Areas of Specialization and Number of Modules

<table>
<thead>
<tr>
<th>Area</th>
<th>Compulsory Modules (CH)</th>
<th>Elective Modules (CH)</th>
<th>Faculty Requirements (CH)</th>
<th>Total No. of Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (No. /92) %</td>
<td>No. (No. /12) %</td>
<td>No. (No. /32) %</td>
<td></td>
</tr>
<tr>
<td>1. Electric circuits</td>
<td>6 6.52</td>
<td>0 0</td>
<td>0 0</td>
<td>2</td>
</tr>
<tr>
<td>2. Engineering Analysis</td>
<td>12 13.04</td>
<td>0 0</td>
<td>6 18.75</td>
<td>6</td>
</tr>
<tr>
<td>3. Electromagnetic</td>
<td>9 9.78</td>
<td>3 0.25</td>
<td>0 0</td>
<td>4</td>
</tr>
<tr>
<td>4. Computer design and microprocessors</td>
<td>6 6.52</td>
<td>0 0</td>
<td>3 9.375</td>
<td>3</td>
</tr>
<tr>
<td>5. Electrical machines and power</td>
<td>5 5.43</td>
<td>0 0</td>
<td>0 0</td>
<td>2</td>
</tr>
<tr>
<td>6. Measurements</td>
<td>6 6.52</td>
<td>0 0</td>
<td>0 0</td>
<td>2</td>
</tr>
<tr>
<td>7. Communications</td>
<td>10 10.87</td>
<td>0 0</td>
<td>0 0</td>
<td>5</td>
</tr>
<tr>
<td>8. Electronics</td>
<td>12 13.04</td>
<td>3 0.25</td>
<td>0 0</td>
<td>5</td>
</tr>
<tr>
<td>9. Data transmission, communication networks an computer networks</td>
<td>5 5.43</td>
<td>0 0</td>
<td>0 0</td>
<td>2</td>
</tr>
<tr>
<td>10. Engineering applications</td>
<td>9 9.78</td>
<td>30 2.5</td>
<td>0 0</td>
<td>15</td>
</tr>
</tbody>
</table>

4. Curriculum Characteristics

- **Objectives of the Main University-Required Modules.** These requirements are to broaden the students’ basic skills: languages, computing, and culture.

- **Objectives of the Main Faculty-Required Modules.** These requirements are to consolidate mainly the students’ background in the basics of the Communications and Electronics, such as mathematics, physics and computing applications.

- **Objectives of the Main Management Modules in the Curriculum.** The curriculum is designed so that the basic foundations of Engineering are given in the first two years of study, whereas modules of the next two years allow students to acquire the essential modules.

- **Objectives of the Training, Special Topics and Graduation Project Modules.** The objectives of these modules are to allow students to gain practice in problem analysis, design & implementation, report writing, and making presentations.

- **Identification of Key Stages of Progression in the Curriculum.** Students are directed to take the 24 hours of university requirement modules and the 21 hours faculty requirement modules in the first two years of study. Students can also choose some modules from the list of electives.
Table (2) shows the distribution of compulsory and elective modules in each specialization area of the curriculum.

Table (2) Compulsory and Elective Modules

<table>
<thead>
<tr>
<th>I.I.I</th>
<th>A – The Compulsory Specialisation Modules</th>
<th>I.I.III</th>
<th>C-Faculty Requirements</th>
<th>I.I.IV</th>
<th>C- The Elective Specialisation Modules</th>
</tr>
</thead>
</table>
| 1. Electric circuits | 610211 Electric circuit I  
610212 Electric circuit II | | | | |
| 2. Engineering Analysis | 650304 Advanced Engineering Analysis  
650302 Probability and Random Variables  
650331 Signal Analysis and Processing  
650534 Digital Signal Processing | 2. Engineering Analysis | 650201 Engineering Analysis I  
630202 Engineering Analysis II | | |
| 3. Electromagnetic | 650241 Electromagnetic I  
650341 Electromagnetic II  
650541 Antennas and wave propagation  
650542 Microwave propagation | | | 3. Electromagnetic | 650541 Antennas and wave propagation |
| 4. Computer design and microprocessors | 650261 Logic Design  
630371 Microprocessor | 4. Computer design and microprocessors | | 630203 Programming Language |
| 5. Electrical machines and power | 610381 Electrical Machines  
610485 Power System Analysis | | | | |
| 6. Measurements | 650351 Electronics Instructions and Measurements  
650451 automatic Control systems | | | | |
| 7. Communications | 650431 Communications I  
650432 Communications II  
650533 Digital Communications  
650535 Optical Communications  
650539 Mobile Communications | | | | |
| 8. Electronics | 650221 Electronics I  
650321 Electronics II  
650421 Digital Electronics | | | 8. Electronics | 650521 Microelectronics |
| 9. Data transmission, communication networks an computer networks | 650536 Communications Networks  
650463 Computer Networks | | | | |
| 10. Engineering Applications | 650325 Engineering Project  
650592 Graduation Project I  
650590 Graduation Project II  
650307 Reversal Engineering | | | 10. Engineering Applications | 650532 Communications Transmission Systems  
650541 Antennas and wave propagations  
650544 Radar Engineering  
650545 satellite Engineering  
650424 Biomedical Electronic Instrumentation  
650593 special topics in Communication end Electronics |
4. Innovation in the Curriculum
The curriculum is constantly evolving to cope with new technologies and rapidly developing topics. The curriculum has been revised in 2000, 2003, 2007, 2008, and 2009. For example, internal processes, industrial feedback, various benchmarks, and information from other institutions have led to many improvements in the curriculum.

The evaluation of the module is also performed through workshops in curriculum design, typically attended by representatives from Industry and some ex-students. The Department is particularly mindful of the fast technological development and its likely effect on curriculum development. In addition, the Department policies and operations ensure that the staff appraisals are used to identify strengths and weaknesses so that appropriate action can be taken.

XII. Health and Safety at the University

The University has a Health & Safety Committee, which comprises representatives of all services within the University. It is the responsibility of this committee to investigate complaints and potential hazards, to examine the cause of all accidents and to carry out periodic inspections of all areas of the Department. At registration, you will be required to assent to the departmental code of behavior, which relates to health and safety.

1. Buildings
The Department comprises two kinds of buildings: the Rooms Building and the Computer Laboratories.
The buildings are generally open between 08.00 and 19.30 (Sunday – Thursday). In accordance with University policy, smoking is prohibited throughout all buildings.

2. Emergency Evacuation
It is the responsibility of every individual to familiarize himself with the Department's buildings and be aware of the fire exits.

- After evacuation of any building, please assemble well away from the building, and do not block any exits.
- Do not return to any building until the safety supervisor declares the emergency is over and the buildings are safe.
3. **Fire Action**
   Fire Action notices are located at, or adjacent to, fire alarm actuation points. All staff and students should be acquainted with this routine.

4. **Operating the Fire Alarm**
   The manual fire alarm system can be activated by breaking the glass in the red contact boxes sited at strategic points throughout the premises.

5. **Use of Fire Appliances**
   Fire appliances are sited at strategic points throughout the Department to deal with fires. Fires should only be tackled provided there is no personal danger and after the alarm has been set off.

6. **Action when the Alarm Rings**
   On hearing the intermittent alarm, you should prepare yourself to evacuate the building promptly.
   On hearing the continuous alarm, you should evacuate the building immediately by the nearest exit.

7. **Personal Difficulties**
   Please inform the Department's counselors or your tutor of any difficulties with which the Department can be of assistance.
XIII. Course outlines of the Specialized Courses

PHILADELPHIA UNIVERSITY
FACULTY OF ENGINEERING

Communication & Electronics Engineering Department

Course Description
(English & Arabic)

2010-2011
جامعة فیلادلفیا
كلية الهندسة
قسم هندسة الاتصالات والالكترونيات
وصف المواد
(عبري و انجلزي)

650201 Engineering Analysis (1)

Pre-request: Mathematics for engineering students 210206

تحليل هندسي (1) (650201)
المعادلات التفاضلية والممذجة، حل المعادلات التفاضلية الخطية وغير الخطية، نماذج النظم الميكانيكية والكهربائية، حل لابلاس، حل المعادلات التفاضلية باستخدام المتاللات، حل المعادلات التفاضلية ذات القيم الإبتدائية، مقدمة إلى المعادلات التفاضلية الجزئية.

650221 Electronics (1)

Pre-request: Electrical Circuit (1) 610211

الكترونيات (1) (650221)
تحليل دوائر الالكترونيات
Pn تحويل دوائر البينائي
خواصه ونامذجه، دوائر الالفيز، دوائر التزام خصائص دوائر التكبير.
BJT، دوائر التزام ودائم (MOSFET) ودوائر الالفيز (FET)
BJT، دوائر التزام ودائم ودوائر الالفيز (FET)
دوائر التكبير، دوائر التكبير (FET) ودائم
مكعبات نموذج (OP-Amp) وتطبيق
الهندسة الكهربائية (1) 612112
650222 Electronics Engineering
Semiconductor Diode Circuit Analysis, Bipolar Junction Transistors (BJT), Design of Bipolar Junction transistor Amplifier (CE, CC, and CB), Field Effect Transistors (FET): Field Effect Transistor (FET) Amplifier, Operational Amplifier and its applications

Pre-request: Mechatronics Dept.

650302 Probability & Random Variables

Pre-request: Signal Analysis & Processing 650331

650304 Advanced Engineering Analysis
Complex Functions, Mapping, Integration in the Complex Plane, Taylor and Laurent Expansion, Singularities and the Residue Theorem, Eigenvalues and Eigenvectors.

Pre-request: Engineering Analysis (2) 630202

650321 Electronics (2)
Multistage Amplifier Analysis, Power Amplifiers Classes (A, B, AB, C), Darlington Pair, Amplifier Frequency Response (Low & High Frequency Responses), Ideal Operational Amplifier, Differential Amplifiers, Operational Amplifier as Integrated Circuits, Practical Operational Amplifier, Feedback and Oscillators.

Pre-request: Electronics (1) 650221

650331 Signal Analysis & Processing

Pre-request: Engineering Analysis (1) 650201
تحليل ومعالجة إشارات (650331)

الإشارات الزمنية المتصلة والمنقطة، الالتقاء، الأنظمة الخطية، خصائص الأنظمة، المعادلات التفاضلية والفرقي، متسلسلة قياسي، تحليل تلامل، تحليل قياسي، خصائص تحليل قياسي ولا بالأس.

المتطلب السابق: تحليل ديناميكي (1) 650201

650341 Electromagnetics(2)
Pre-request: Electromagnetics(1) 650241

كهرومغناطيسية (2) (650341)
الموجات وتطبيقاتها. معادلات ماكسويل، انتشار الموجات الكهرومغناطيسية، محاسبات الطاقة والإشارة، انعكس الموجات المستوية على الحادث الطبيعي. خطوط القليل، نقاط الموجة، أساسيات الهوائي، المتطلب السابق: كهرومغناطيسية (1) 650241

650421 Digital Electronics
Digital signals and systems, semiconductor diodes and transistors, logic technologies and families, Interfacing, memory elements and types, programmable logic devices, A/D converter and D/A converter, visual displays.
Pre-request: Logic Circuits Design & Electronics(1) 650261&650221

الإلكترونيات الرقمية (650421)
anظمة والإشارات الرقمية. الثنائيات أتصف النواقل والترانزستورات، العوامل والتطبيقات المنطقية. الزائد والملازمة. أعداد وعناصر الذاكرة. الأدوات المنطقية المبرمجة. المحولات التشابهية - الرقمية والرقمية، التشابهية، المعرفات الوراثية، المتطلب السابق: تصميم نوافذ منطقية و الإلكترونيات (1) 650241 و 650221

650431 Analog Communications
Pre-request: Probability and Random Variables 650302

اتصالات تشبهية (650431)
عملية الترميز، التعقيد المستمر للموجة (التشغيل السعوي، التعقيد التردي والتعقيد الطوري)، الصيغة في مستقبلات الترميز، نظرية أخذ العينات، التعقيد النبضي، المتطلب السابق: احتمالات و متغيرات عشوائية 650302

650565 Computer Networking systems
Pre-request: Digital Communications 650533

نظم شبكات الحاسوب (650565)
مبادئ شبكات الحاسوب، مكونات شبكة الحاسوب، ترابط الأنظمة المقدمة. إكتشاف وتصحيح الأخطاء، أسباب المعلومات الرقمية، وسائل الاتصالات، وروتوكلات الحدود المحددة، الشبكات المنطقية المحلية، المتطلب السابق: النظم الرقمية 650533
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Course Description</th>
</tr>
</thead>
</table>

Pre-request : Digital Electronics 650421 |

| 650528      | Television Engineering | Physical foundations of TV. Television Image Pickup and Display Devices, Generation of the TV Signal, Scanning and Deflection Stages, Synchronization of scanning, transmitting and received TV Tubes, Color Television, Broadcast color television systems, Fundamentals of digital television.  

Pre-request: Analog Communications 650431 |


Pre-request: Analog Communications and Electronics (2) (650431)& (650321) |


Pre-request: Digital Communication 650533 |


Pre-request: Analog Communications 650431 |
Undergraduate Handbook  

Electrical Engineering & Waves Propagation  


t-antenna arrays, reflector antenna, antenna synthesis, 
physics principles of radiation, antenna parameters, dipole, monopole, and loop antennas.

**Antenna Engineering & Waves Propagation**

- Pre-requisite: Digital Communication 650533

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>650541</td>
<td>Antenna Engineering &amp; Waves Propagation</td>
</tr>
<tr>
<td>650539</td>
<td>Mobile Communications</td>
</tr>
<tr>
<td>650536</td>
<td>Communication Networks</td>
</tr>
<tr>
<td>650427</td>
<td>Optical Communications</td>
</tr>
<tr>
<td>650444</td>
<td>Digital Signal Processing</td>
</tr>
<tr>
<td>650445</td>
<td>Advanced Electromagnetics &amp; Design Analysis</td>
</tr>
</tbody>
</table>

- Pre-requisite: Electromagnetics 650444, Digital Electronic Lab 650446
- Pre-requisite: Modulation and Application of Fiber Optic Systems, Optical Waveguide Design.
650542 Microwave Engineering
Pre-request: Electromagnetic(2) 650341

650544 Radar Engineering
Pre-request: Electromagnetic(2) 650341

650320 Electronics (for mechanics)
Pre-request : Electrical Circuits (1) 610211

Electrical Circuits (1) (610211)
Definitions and units, basic concepts(Charge, Current, Voltage, &Power Energy), circuit elements (independent and dependent voltage and current sources ), KVL and KCL, mesh and nodal circuit analysis, network theorem, transient analysis of RL, RC, and RLC circuits, introduction to AC circuits.
Pre-request: Applied Physics 211004

Electrical Circuits (2) (610212)
Periodic waveforms, AC response of RL, RC, and RLC circuits, phasor analysis, impedance concept, resonance, steady-state analysis of AC circuits, coupled circuits, three phase-circuits, Fourier analysis, Laplace analysis, two-port networks, and circuit analysis using computers.
Electrical Circuits Lab 610216
DC circuits, KVL and KCL, mesh and nodal circuit analysis, network theorems, transient analysis of RL, RC, and RLC circuits, and AC circuit analysis.

Pre-request: Electrical Circuits (2) 610212

Instrumentation and Measurements 610351
Deals with measurements and errors, units and standards, analog meters, potentiometers, DC and AC bridge instruments, transformers, electronics measuring instruments, oscilloscope, frequency and phase measurements and transducers.

Pre-request: Electronics(2) 650321

Automatic Control 610451
Introduction to feed back systems, review of system equations, block diagrams and signal flow graphs, system time response and closed loop performance, Routh's stability criterion, the root locus method, frequency methods, compensation techniques, and introduction to sampled control systems.

Pre-request: Instrumentation and Measurements 610351

Power System Analysis 610480
System representation, per-unit power system components, generators(sequence networks, transient performance, operating limits), constants, design, insulation, steady-state and transient operational problems, crona discharge, symmetrical and asymmetrical fault analysis, principles of power system protection, and computer applications (load flow).

Pre-request: Micro Machines610383

Power and electrical machines lab 610487
Transformers, DC motors and generators, single and three-phase induction motors, single and three-phase synchronous generators and motors, AC series motors, transmission line performance, load
Communications & Electronics Department

Undergraduate Handbook

characteristics, power system protection and relays, balanced and unbalanced faults, and stability of power systems.

Pre-request: Power system analysis 610480

**Logic circuits 630261**

Deals with number systems (binary, octal, decimal, hexadecimal), Boolean variables and algebra minimization of Boolean functions, combinational circuits with MSI components, sequential circuits analysis and design, MSI counters and registers, memories, and introduction to computers.

Pre-request: Programming language 630203

**Logic circuits lab 630266**

Basic logic circuits (familiarization with AND, OR, NOT, NOR, and NAND gates), de Morgan's theorems, combinational circuits, MSI components, RS, JK, D and T flip-flops, sequential circuits, registers and counters.

Pre-request: Logic circuits 630261

**Microprocessors 630371**

Introduction to microprocessor architecture, addressing modes, data movement instruction, arithmetic logic instructions, program control instructions, microprocessor programming, introduction to microprocessor interfacing.

Pre-request: Logic circuits 630261

**Engineering drawing 620121**

Instruments and their use, graphic geometry, lettering, orthographic and isometric drawing and sketching, sectional views, introduction to descriptive geometry, surface intersections and developments, and computer (ACAD).

Pre-request: Logic circuits 630261

Dozens of pump, Atlas electrical 610480

Introduction to microprocessor architecture, addressing modes, data movement instruction, arithmetic logic instructions, program control instructions, microprocessor programming, introduction to microprocessor interfacing.
**Microprocessor lab 630376**
Familiarization with microprocessor lab, microprocessor instruction set and Assembly language fundamentals, writing, debugging and executing various Assembly language programs, memory (RAM) interfacing and microprocessor interfacing.

Pre-request: Microprocessor 630371

**Mechanics Engineering 620215**
Statics of particles, rigid bodies, equilibrium of rigid bodies, distributed forces, moment of inertia, rigid body kinematics, Newton's second law, work and energy for rigid bodies, impulse and momentum for rigid bodies, and oscillators.

Pre-request: Applied Physics 211104

**Engineering Analysis (3) 610304**
Complex functions, integration in the complex plane, Taylor and Lagrange expansions, singularities and the residue theorem, conformal mapping Gaussian elimination, vector spaces, least square projections, eigenvalues and eigenvectors.

Pre-request: Engineering Analysis (2) 630202

**Electromagnetics (1) 650241**
Vector analysis and vector calculus, coordinate systems and transformation, electric field due to point, line surface, volume charge, electric flux density, Gauss law and divergence theorem, boundary conditions, capacitor, energy capacitance and electric stored energy, electrostatic boundary value problem, steady electric current, conductivity and magnetic stored energy, Ohm's law, KCL, Biot-Savant law and magneto static fields, magnetic flux density, Ampair's law and Stock's theorem, magnetic vector potential, inductance and energy, ferromagnetic material and the magnetic circuits, introduction to time varying fields.

Pre-request: Engineering Analysis (1) 650201

**Electronics (1) Lab 650228**
Diode characteristics, half and full wave rectifiers, diode appl. Circuits, voltage doubler, clamper (zener diodes appl.), transistor characteristics, BJT and FET, small signal analysis of CB, CC and CD amplifiers.

Pre-request: Electronics (1) 650221
Electronics (2) Lab 650328
Frequency response of EC, CB, CC, CS, and CD amplifiers, RC-coupled amplifiers, multi-stage amplifiers, differential amplifiers, operational amplifiers and oscillators.
Pre-request: Electronics (1) Lab 650228

Digital Electronics Lab 650426
Transistors as switching devices, RTL, CMOS logic circuits, TTL and CMOS characteristics, monostable and astable multivibrators, timing circuits, waveform shaping circuits, and A/D and D/A circuits.
Pre-request: Digital Electronics 650421

Communication Lab 650437
Signal analysis, filters, AM and FM modulators and demodulators, oscillators, amplifiers, demodulators and filter circuits, signal analysis and modulated waves, and analysis using Fourier transform.
Pre-request: Analog Communication 650431

Measurements and Control lab 650457
Sensitivity of Wheatstone bridge, Wien bridge, capacitance measurement, FM-instrumentation for capacitive and inductive transducers, strain-gage, thermistors, platinum thermometers, temperature control, photodiodes, photovoltaic cells, and spectral and polar responses of phototransducers.
Pre-request: Automatic Control 610451

Digital Communication Lab 650537
To emphasizes experiments in digital communication: baseband and pulse slopping, ASK, FSK, PSK, and QPSK.
Pre-request: Digital Communication 650533
Antenna and Microwave Engineering Lab 650547
Basic antenna directives, antenna wavelength and frequency measurement of microwave power and voltage, standing wave ratio, waveguide attenuation and detector characteristics, microwave tuners and measurement of impedance, directional couplers, series and shunt tees, horn antenna measurements, propagation f microwave, and reflection loss within waveguides.

Pre-request: Antenna and Microwave Engineering 650542