



**Higher Education Technical Challenges:  
ICT Securities Bachelor Programme (180 Credits)**

## Semester 1 - 4: 120 ECTS

### Compulsory Modules:

|                |  |
|----------------|--|
| ICT01B1*       | Mathematics (fundamental)*   |
| ICT02B1*       | Physics*   |
| ICT03B1*       | Computer Science*  |
| ICT04B1*       | Electronics*   |
| ICT05B1*       | Sensors*   |
| ICT06B1*       | ICT Security*  |
| ICT07B1*       | English Language*  |
| ICT08B1*       | Communication (presentation technologies, ethics)*                                   |
| ICT09B1*       | Law (Intellectual Property, working law, law dedicated to security)*                 |
| <u>ICT10B1</u> | <u>Methodological course (how to learn, how to do research, how to write papers)</u> |
| ICT11B1*       | Technological Awareness (state of technology)*                                       |

### Optional Modules:

1. Technological Awareness (e.g. short seminars with industry experts)\*
2. English language (basic, technical): country specific\*

***\* Indicates modules that are general for many curricula, they do not require special definition***



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## Semester 5: **30 ECTS**

|                |  |
|----------------|--|
| <u>ICT13B5</u> | <u>Network Security</u>                      |
| <u>ICT14B5</u> | <u>Web application security</u>              |
| <u>ICT15B5</u> | <u>Security management</u>                   |
|                | Information systems design and applications* |
| <u>ICT16B5</u> | <u>Project management</u>                    |

## Semester 6: **30 ECTS** Internship and/or Bachelor project



## Module Specification

University/Department: St. Petersburg State University (Russia), Department of Computer Science

**Module name:** Methodological module (how to learn, study, research, write paper)

**Code:** ICT10B1-4

**Programme** (Energy/ICT): ICT

**ECTS:** 6

**Type Bachelor/Msc :** Bachelor

**Scope and form:** Lecture and group exercises in connection with the lectures. Oral presentations of the plan of the research work and the text review.

**Duration** (weeks; Hours/week): 15 weeks, 4h/week

**Type of assessment:** During the semester students write a review of a text concerning a subject to study (textbook for example) and present it orally in a group. They also write a plan of their research project and present it in a group and write a paper. To grant a credit it is necessary to fulfil all the components.

**Qualified Prerequisites:** English

**General module objectives:** The objectives of the module are as follows: improving learning process with focus on active learning and communication with a teacher; research process, scientific writing with focus on logical structure and style of the document, principles of effective writing, abstract, review.

**Topics and short description:**

- How to learn and study. Principles of effective learning. Active reading, writing, speaking and listening. Communication with a teacher and other students. Asking questions.
- Research activity: learning basic ideas of the subject that you study; defining the project scope; discussion of the research proposal with the teacher; finding resources.
- Scientific writing. The format of an original paper. Abstract. Introduction. Main part. Conclusions. Acknowledgements. References.
- Abstract: brief resume of the paper that contains the set of the problem and the obtained result.
- Introduction: background; gaps and limitations; question or hypothesis to test; plan of attack; obtained results.
- Main part: obtained results and discussion.
- Logical structure of the text. Crafting better sentences and paragraphs.
- Grammar issues. Word order. Relative clauses. Gerund. Compounds. Punctuation.
- Effective writing: active voice; cutting unnecessary clutter; avoiding repetitions and reducing a paper.



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### Learning outcomes:

| Knowledge                                   | Skills   | Competences  |
|---|--|--|
| Advanced knowledge of the learning process  | Practical applications of knowledge to active learning   | Application of acquired knowledge and skills in design and implementation of research projects |
| Advanced knowledge of the research activity | Defining of the project scope and goal, finding resources, comparison the results with known results in a given area | Project work   |
| Scientific writing                          | Experience in writing and using the style of scientific papers   | Writing research papers, review  |

### Module recommended literature:

- Lynne Truss. Eats, Shoots, and Leaves: The Zero Tolerance Approach to Punctuation, London 2003.
- J. Trzeciak. Writing mathematical papers in English. Gdansk Teachers' Press.1998.
- Chicago Manual of Style (CMS) <http://www.chicagomanualofstyle.org/home.html>
- Writing in the Sciences. <http://www.coursera.org>
- D. Mcginnes. Language Development and Learning to Read – The Scientific Study of how Language Development Affects Reading Skill. ISBN 9780262134521; 2005
- Strunk & White. The Elements of Style.  
<http://www.faculty.washington.edu/heagerty/Courses/b572/public/StrunkWhite.pdf>
- How to Study and Learn: <http://www.criticalthinking.org/pages/>
- How to Study and Learn Effectively: <http://www.discoverbusiness.us/>
- How to Study Effectively Free online course  
<http://www.volunteerministers.org/training/study/overview.html>
- How to Study Guide - Tools & Guides to Study at Home  
<http://www.howtoguides365.com/>
- <http://www.fusionschools.com/files/documents/site1/section307/%20Study%20Skills%20Curriculum.pdf>
- [http://www.ehow.com/how\\_2053926\\_do-research.html](http://www.ehow.com/how_2053926_do-research.html)

### Remarks:

**Special Considerations:** Generically none for this module but should be commented on by the institution delivering the module.



## Module Specification

**Module name:** Network Security – ICT13B5

**Programme** (Energy/ICT): ICT

**ECTS:** 6

Type Bachelor/Msc : Bachelor

**Course / Module name:** Network Security

**Scope and form:** Compulsory, full attendance, course + labs

**Duration** (weeks; Hours/week):

15 weeks; 2 hours lecturers and 2 hours labs/week

**Type of assessment:** Continuous assessment during labs, project and final exam

**Qualified Prerequisites:** Computer Networks

General course objectives: The course focuses on the main aspects regarding the network security policies and the identification of problems about system security, data privacy, cryptology, online censorship and other contemporary threats. The students will learn how to deal with these problems and find appropriate solutions by theoretical and practical experience.

**Topics and short description:**

1. Introduction: Fundamental concepts, Vulnerabilities of networks, Security mechanism, Challenges and trends
2. Cryptography: Symmetric and public key encryptions, Cryptographic functions, Digital signatures
3. Physical Security: Physical protection and attacks, Authentication technologies, Physical intrusion detection
4. Authentication and key establishment: Overview on authentication systems, Authentication of people
5. Malware: Trojan, Viruses, Worms, Spyware, Spam, Phishing, Botnets, Distributed Denial of Service Attacks
6. Firewalls and web security: Design principles, Firewall configuration, Packet filtering, Application level gateways, Encrypted tunnels, Cookies, Web security problems
7. Intrusion detection: detection of attacks HIDS/NIDS (host and network intrusion detection systems)
8. Real-time Communication Security: Introduction to TCP/IP protocol stack, Implementation layers for security protocols and implications, IPsec: AH and ESP, IPsec: IKE, SSL/TLS
9. Electronic Mail Security: Distribution lists, Establishing keys, Privacy, Source authentication, Message integrity, Proof of submission, Proof of delivery, Message flow confidentiality, Anonymity
10. Wireless security: Trends, Threats, Attacks and countermeasures.



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**Learning outcomes:**

| Knowledge                                      | Skills   | Competences  |
|--|--|--|
| The fundamentals of network security           | Ability to understand the basic concepts, principles and practice of network security  | Analyze and identify the vulnerabilities of networks   |
| Fundamentals in cryptography and data security | Ability to understand the basic concepts and principles of cryptography, encryption methods and the theory behind the security of different cryptographic algorithms | Application of adequate methods data verification in a real communication or computer network; identify measures for data security |
| Malware network security and web security      | Ability to analyze the threats for information security in the communication and computer networks and find solutions for web security problems                      | Detect the problems and identify solutions   |
| Communication security                         | Ability to understand different types of protocols   | Implement various network layers   |
| Wireless security                              | Ability to understand and analyze the specific security problems in wireless networks  | Detect the possible threats and find countermeasures   |

**Course recommended literature:**

1. Charlie Kaufman, Radia Perlman, and Mike Speciner - Network Security: Private Communication in a Public World, Prentice Hall, 2002
2. Niels Ferguson, Bruce Schneier, Tadayoshi Kohno – Cryptography Engineering: Design Principles and Practical Applications, Wiley, 2010
3. Michael T. Goodrich and Roberto Tamassia - Introduction to Computer Security, Pearson Education, 2014
4. William Stallings - Cryptography and Network Security: Principles and Practice, 4th edition, Prentice Hall, 2005
5. Kok-Keong Lee and Beng-Hui Ong -Building Resilient IP Networks, 1st edition, Cisco Press, 2012



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6. \*\*\* Network Security Courses, University of Illinois, 2013,  
<http://web.engr.illinois.edu/~caesar/courses/CS598.S13/syllabus.html>
7. \*\*\* - NIST Computer Security Resource Center, <http://csrc.nist.gov>

**Special Considerations:** Generically none for this module but should be commented on by the institution delivering the module.



## Module Specification

**Module name:** Web Applications Development / Web application security

**Programme** (Energy/ICT): Information and Communication Technology

**ECTS:** 6

**Type:** Bachelor

**Module name:** ICT14B5 – Information systems design and application

**Scope and form:** Compulsory; face to face

**Duration** (weeks; Hours/week): 15 weeks, 2h lectures/week and 2 h lab/week; 4 weeks exam period

**Type of assessment:** Continuous assessment, Laboratory assessment and final written / practical exam

**Qualified Prerequisites:** The subject is based on the knowledge acquired by the students from previous classes: HTML/PHP/CSS/JS/SQL/Security - Programming, Object oriented programming, Data bases, Software engineering, Software Security.

**General module objectives:** Training skills to design a Web application, recognition of technical elements in existing Web applications.

**Topics and short description:**

**Knowledge and understanding** (knowledge and appropriate use of specific notions of the discipline)

- Principles in Web programming;
- Knowledge of the main techniques used on the client side and server side;
- Advanced techniques in Web applications, notions that appear in Semantic Web terminology;

**Explanation and interpretation** (explanation and interpretation of ideas, projects, processes, and theoretical and practical contents of the subject)

- The acquisition of skills necessary to achieve Web applications and interactive websites;
- Recognition of existing techniques and their use in existing Web applications

**Instrumental - applied** (design, management and evaluation of practical activities specific; the use of methods, techniques and tools of investigation and enforcement)

- Ability to write and develop web applications
- Handling tools for editing and testing for Web applications

**Attitudinal** (manifestation of a positive attitude and responsible to the scientific / cultivating a scientific environment centered on values and democratic relations / promotion of a system of cultural values, moral and civic / optimal exploitation of their potential in creative and scientific activities / involvement in institutional development and in promoting scientific innovations / engaging in partnerships with others - institutions with similar responsibilities / participation in their own professional development)





- Recognition of problems and shortcomings in meeting applications
- To explore ways of improving the application shortcomings

**Learning outcomes:**

| Knowledge  | Skills   | Competences   |
|--|--|---|
| Web application design   | To concept and design the application functionality  |   |
| Data grid in Web applications  | Ability to design data grid and web app integration  | Design and implement data grid in web app                           |
| Web Services, XML Web services connection and PHP SOAP<br>WSDL (Web Services Description Language)<br>SOAP (Simple Object Access Protocol)           | Ability to use the protocols and scripts using XML, WSDL, SOAP   | Developing web app using protocols and scripts with XML, WSDL, SOAP |
| Implementation of transactions in MySQL databases with PHP   | Ability to analyze the database structure and the data consistency   | Develop and implement MySQL databases with PHP in web apps          |
| Fundamental tools for help in building and testing Web applications, add-ons from Mozilla (Firebug etc) facilities installation and operating manual | Ability to use specific tools for applying a benchmark to an web application.<br>Ability to use proper software to develop secure web apps | Develop using various operating systems and development software.   |
| Web application security   | Ability to concept, apply and analyze the web application security   | Apply and analyze and act in case of cyber-attack incidents         |

**Module recommended literature:**

1. ANGHEL T. Dezvoltarea aplicatiilor web folosind XHTML, PHP si MySQL. Ed. Polirom, Iasi, 2005
2. HOLOTESCU C, NAAJI A. Tehnologii Web.“Vasile Goldis“ University Press, Arad, 2007
3. BOIAN F.M. BOIAN R.F. Tehnologii fundamentale Java pentru aplicatii Web. Ed. Alabastra, Microinformatica, Cluj, 2004
4. BURAGA S. Tehnologii web. Ed. Matrix Rom, Bucuresti, 2001
5. BURAGA S. Proiectarea siturilor web. Ed. Polirom, Iasi, 2002
6. BURAGA S. et al. Programare web in BASH si PERL. Polirom, 2002.
7. CASTRO E. HTML for the World Wide Web with XHTML and CSS. , 5'th ed. Ed. Visual QuickStart Guide, 2004
8. HALL M. BROWN L. Core web programming. Sec. Ed. Prentice Hall, 2001
9. NEGRINO T. SMITH D. JavaScript for the World Wide Web. Ed. Visual QuickStart Guide, 200



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10. VARLAN C. Macromedia FLASH; concepte, exemple, studii de caz. Ed Polirom, Iasi, 2004

11. <http://www.w3schools.com/default.asp>

**Special Considerations:** Generically none for this module but should be commented on by the institution delivering the module.



## Module Specification

**Course/Module name: ICT15B5**

Programme (Energy/ICT): ICT\_Security management

ECTS: 6

Type Bachelor/Msc : Bachelor

Course / Module name: **Security Management**

Scope and form: Classical course + labs in French (available for classical full-time students and also for part-time students), classical course + lab in English (+ academic project, optional in both languages), academic project

Duration (weeks; Hours/week): 1 semester,

- On a 15-week basis, 3 contact-hours/week for the course,
- 3 day per semester lab (one lab duration is 6 hour),
- Academic project is around one day per week of autonomous work (some meetings with the teacher) during 15 weeks

**Type of assessment:** Reports about labs, final exam, report + defense for the academic project

**Qualified Prerequisites:** Mainly networking (intermediate or advanced level), industrial computing

**General course objectives:** transmission systems – network administration – securisation of network architectures – Points to take into account to set a security policy

**Topics and short description:** This course deals with the management of security. The mechanisms (technical, organizational, methodological) needed to design, implement, operate and maintain a network infrastructure are taught and practiced through the labs and the academic project. Concerning the academic project: the students will have to design a network with security aspects and a wireless extension, to implement it, and be audited by another group of students. Some meetings with the teachers will be organised to validate the advancements of works.

**Lectures syllabus:**

1. Introduction to dependability, principles of security (physical, exploitation, logical, application, telecommunications...)
2. Strategies of attacks and organisms for security
3. Strategies and policies for security
4. Technologies for security, firewall
5. Cryptographic issues
6. Security Protocols
7. Virus
8. Intrusion detection systems
10. Security thanks to networks administration and management

**Learning outcomes:**

| Knowledge        | Skills              | Competences                |
|------------------|---------------------|----------------------------|
| Errors detection | Configuration of an | Designing, maintaining and |



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|  | operating system<br>(Windows, W. Server,<br>Linux)               | auditing a secure network<br>architecture in its<br>environment |
| symmetric and asymmetric<br>cryptography | configuration of a firewall                                      | contributing in the setting of<br>a security policy             |
| security protocols                       | configuration of a router<br>(and wireless router) and<br>client | <i>Academic project:</i><br>Teamwork                            |
| Standards                                | <i>Academic project :</i><br>communication                       | <i>Academic project:</i> project<br>management                  |
|  | <i>Academic project:</i><br>organizational skills                | <i>Academic project:</i><br>multicultural environment           |

**Course recommended literature:**

- G. Avoine, P. Junod, P. Oechslin – Sécurité informatique, exercices corrigés – Vuibert, Paris, 2006
- Security for industrial communication systems, Dacfey Dzung, Martin Naedele, Thomas P. Von Hoff, Mario Crevatin, pp. 1152-1177, Proceedings of the IEEE, Vol. 93, n° 6 "Industrial Communication Systems", June 2005
- La sécurité des réseaux-First steps, Tom Thomas, Cisco Press, 2005
- Les réseaux, édition 2005, G. Pujolle, Eyrolles 2004
- G. Avoine, P. Junod, P. Oechslin – Sécurité informatique, exercices corrigés – Vuibert, Paris, 2006
- SSL VPN, Understanding, evaluating and planning secure, web-based remote access – J. Steinberg & T. Speed, 2005.
- S. Ghernaouti-Helie – *Sécurité informatique et réseaux* – Dunod, 2005
- F. Halsall – Computer networking and the internet – Addison Welseley, 2005 + additional student support at [www.pearsoned.co.uk/halsall](http://www.pearsoned.co.uk/halsall)
- E. Cole, R. Krutz, JW Conley - *Network security bible* – Wiley, 2005

**Special Considerations:** Generically none for this module but should be commented on by the institution delivering the module.



## Module Specification

**Module name:** Project Management

**Code:** ICT16B5

**Programme** (Energy/ICT): ICT

**ECTS:** 6

**Type Bachelor/Msc :** Bachelor

**Module name:** Project Management

**Scope and form:** Lecture , 2h/week, course work 2h/week

**Duration** (weeks; Hours/week): 15 weeks

**Type of assessment:** No formative assessment is foreseen. Summative assessment is based on a coursework (weighting 40%), and written examination (weighting 60%) with a duration 3 hours. A qualifying mark is required for both assessed components. Students must achieve a 60% pass mark in both the coursework and the examination to achieve a pass at this module. If a mark of below 60% is obtained in one or both of these assessments, students must resit the assessed components they have failed.

**Qualified Prerequisites:** no

**General course objectives:**

The course will cover project management, including techniques to evaluate, organise, plan and monitor projects and in addition will provide the soft skills required in team building and team management.

The general objectives are:

- (1) To introduce students to the role and function of project management
- (2) To explain the stages of the project life cycle
- (3) To understand the various mechanisms for planning, managing, monitoring and controlling a technology project, also by use of software tools, for example, Microsoft Project
- (4) To examine various techniques for managing a software development or engineering team
- (5) To understand the need and techniques for gathering user requirements

**Topics and short description:**

This module considers the whole life cycle of projects, from initiation and/or acquisition, through to planning, scheduling, execution, handover and review. The principles and processes are contextualised through reference to case studies from a variety of technological settings as well as articles and journal papers, and based on the review and evaluation of relevant frameworks and standards. The associated topics of stakeholders, finance, risks, project



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administration and quality are discussed in the context of the duties of the project manager. Tools and techniques for project management are explained and elaborated, to facilitate choosing appropriate techniques and applying them in the professional practice giving stable

- Project management characteristics, variables
- Project life cycle
- Project proposals, project acquisition, selection and evaluation
- Responsibilities and attributes of the project manager
- Project organisation, team and people management
- Project planning, work breakdown structure, work packages, Gantt chart, PERT techniques master plan
- Project estimation and budgeting
- Project monitoring and control: milestones analysis, status reporting, risk and change management

**Learning outcomes:**

On completion of this module, students are expected to be able to:

| Knowledge   | Skills  | Competences  |
|---|---|--|
| Understand the major processes of the project/product management, and special management techniques   | Apply appropriate tools and techniques in the management of a software development or engineering project | Application of change control and management techniques                                    |
| Describe and critically assess methodologies/techniques for selecting, planning and controlling projects as well as for developing and successfully introducing new and enhanced products | Apply tools and techniques to analyse project cost, quality and time objectives                           | Integration and balance of overall project functions                                       |
| Initiate and plan projects by developing project charters, project scope statements, work breakdown structures and organisational breakdown structures                                    | Create cost effective projects  | Engaging stakeholders and understanding the role of self in relation to managing a project |
| Identify project cycles and critically conduct an economic analysis of a project based on life cycle costs as well as   | Evaluate and control project scope, project cost and schedule   | Identification of the project success factors  |



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|  |   |   |
|--|---|---|
| determine the most profitable project              |   |   |
| Understand the importance of standards in projects | Calculate critical paths and use PERT techniques to determine the probability of completing a project within the time scheduled | Analysis of case studies of project failure and 'lessons learnt'                |
|  | Effectively contribute to the achievement of the project objectives individually and in the group/team                          | Analysis of political and ethical context that can influence project management |

**Course recommended literature:**

Morris et al. 2011. The Oxford Handbook of Project Management  
ISO 9000 [http://www.iso.org/iso/iso\\_9000](http://www.iso.org/iso/iso_9000)

**Remarks:**

**Special Considerations:** Generically none for this module but should be commented on by the institution delivering the module.