The syllabus of the discipline

Wireless sensor networks

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Field name	Detailed content, comments
Name of the faculty	Faculty of Infocommunications
Level of higher education	Second (master's)
Code and name of the specialty	172 Telecommunications and radio engineering
Type and name of educational program	EPP "Information and Network Engineering"
Name of the discipline	Wireless sensor networks
Number of ECTS credits	4
Discipline structure (distribution by types and hours of study)	24 hours - 12 lectures, 16 hours - 4 laboratory classes, 8 hours - 4 consultations, 72 hours - home work, **type of control**: credit
Schedule (terms) of studying the discipline	1st year, I semester
Prerequisites for studying the discipline	Basic concepts of: - Fundamentals of information and communication technologies; - Information systems and Internet technologies; - Local communication networks; - Multiservice communication networks; - Converged service platforms of next generation networks.
Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process	The discipline is used to form the following competencies: FC-7. Ability to demonstrate and use fundamental knowledge of the principles of construction of modern information communication networks, systems for conversion and storage of information, promising areas of their development. FC-11. Ability to use standard and develop their own software products, focused on solving problems of design, calculation and ensuring the efficient operation of information networks and components of their infrastructure. FC-12. Ability to analyze, develop and improve scientific, design, technological, metrological and organizational and management documentation. FC-14. Ability to assess problem situations and shortcomings in the design, installation, configuration, operation and operation of information networks, to formulate proposals for solving

	problems and eliminating shortcomings. FC-15. Ability to evaluate design and technological, engineering and scientific and technical solutions in terms of compliance with safety conditions, energy efficiency and environmental friendliness.
The quality of the educational process	Educational-methodical and material-technical resource provision of the educational program, within the framework of which the discipline is studied, meets the licensing requirements and accreditation conditions of the educational activity of the university. Annual monitoring and revision of the curriculum of the discipline in accordance with the requirements and recommendations of the Ministry of Education and Science, state certification of acquired competencies of graduates, standards of cooperation with employers to ensure a competitive level of training. Adherence to the principles of academic integrity (http://lib.nure.ua/plagiat). Contains public information on the requirements, competencies, level of education within the current educational program.

Description and content of the discipline

The purpose of the discipline is to acquaint students with the features of wireless sensor networks, the principles of design and operation.

Content

Content module 1. Hardware and structural features of BSM
Topic 1. Introduction to BSM. Areas of use.
Topic 2. ZigBee and IEEE 802.15.4 standards. BSM topologies.
Topic 3. Hardware features of BSM elements. Typical solutions.
Topic 4. Wireless communication channels of sensor networks.
Topic 5. Energy consumption in BSM.

Content module 2. Telecommunication tasks of BSM
Topic 1. Channel layer protocols.
Topic 2. Self-organization. Network layer protocols.
Topic 3. Methods of positioning BSM.
Topic 4. Security in BSM.
Topic 5. MeshLogic
Topic 6. RFID-technologies.
Topic 7. The Internet of Things.

Learning outcomes of higher education

As a result of studying the discipline, students must:

know: basic algorithms of interaction of elements of sensor networks, methods of calculation of network parameters for designing;

be able to: perform design and configuration of BSM, software settings, determine the necessary for the given conditions algorithm of node interaction;

to own (list of competencies): PRN1. Be able to analyze the current state of information networks in order to develop scenarios for the development, modernization of existing or design of new information networks of any scale and for various purposes. PRN4. Be able to deploy network infrastructure based on modern technologies, protocols and operating systems. PRN5. Be able to programmatically implement optimization algorithms for information network management systems. PRN8. Be able to ensure reliable continuous operation of network infrastructure and software applications. PRN9. Be able to use a modern element base and the latest information technology to ensure the work of the "Internet of Things". PRN10. Be able to develop and use different platforms for providing information services.

Assessment system according to each task for passing the test / exam

To evaluate the student's work during the semester, the final rating Q_{sem} is calculated as the sum of grades for different types of classes and grades for control activities.

Type of lesson / control measure	Rating
Lk №1-5	(1…2)×5=5…10
Lb №1.2	(10…14)×2=20…28
Checkpoint 1	**25…38**
Lk №6-12	(1…2)×7=7…14
Lb №3.4	(4…6)×2=20…28
DKR / Abstract	8…20
Checkpoint 2	**35…62**
Total for the semester	**60…100**

Qualitative evaluation criteria in the national scale and ECTS

Satisfactory, D, E (60-74). Show the required minimum of theoretical knowledge. Know the ways and methods of solving practical problems and be able to use them in practice.

Good, C (75-89). Firmly know a minimum of theoretical knowledge. Demonstrate the ability to solve a practical problem and justify all stages of the proposed solution.

Excellent, A, B (90-100). Show complete knowledge of basic and additional theoretical material. Unmistakably solve a practical problem, explain and justify the chosen method of solution.

Assessment scale: national and ECTS

<table>
<tr><td rowspan="2">The sum of points for all types of educational activities</td><td rowspan="2">ECTS assessment</td><td colspan="2">Score on a national scale</td></tr>
<tr><td>for exam, course project (work), practice</td><td>for offset</td></tr>
<tr><td>90 – 100</td><td>A</td><td>perfectly</td><td rowspan="5">credited</td></tr>
<tr><td>82-89</td><td>B</td><td rowspan="2">fine</td></tr>
<tr><td>74-81</td><td>C</td></tr>
<tr><td>64-73</td><td>D</td><td rowspan="2">satisfactorily</td></tr>
<tr><td>60-63</td><td>E</td></tr>
<tr><td>35-59</td><td>FX</td><td>unsatisfactory with the possibility of reassembly</td><td>not credited with the possibility of re-assembly</td></tr>
<tr><td>0-34</td><td>F</td><td>unsatisfactory with mandatory re-examination</td><td>not credited with compulsory re-study of the discipline</td></tr>
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Methodical support

Basic literature

1. Konspekt lekcij z disciplini «Bezdrotovi sensorni merezhi» dlya studentiv usih form navchannya za specialnistyu 8.05090301 «Informacijni merezhi zv'yazku» [Elektronne vidannya]/ Uporyad.: V.O. Vlasova, A.M. Zelenin. – Harkiv, HNURE, 2014. – 132 s.

2. Balonin N.A., Sergeev M.B. Besprovodnye personalnye seti na osnove ZigBee [Tekst]: Ucheb. Posobie, SPbGUAP. – SPb., 2012. – 68 s.

Supporting literature

3. IEEE Std. 802.15.4-2003. IEEE Standard for Information technology, Telecommunications and information exchange between systems, Local and metropolitan area networks. Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs) [Tekst]/ IEEE Computer Society. – NY, USA: The Institute of Electrical and Electronics Engineers, Inc, 2003. – 670 c.
4. ZigBee Specification [Tekst]: 053474r06, Ver. 1.0. − Accepted by ZigBee Alliance Board of Directors. – 2005. – 378 p.
5. Kratkij teoreticheskij kurs po tehnologii besprovodnyh setej ZigBee, a takzhe demonstracionnyj otkrytyj proekt radiomodulya na baze ZigBee [Elektronnij resurs]/ INDEMDSYS – razrabotchiki elektroniki i vstraivaemyh sistem. – Rezhim dostupu: http://indemsys.ru/theoretical-electronics/62-wireless-networks/69-zigbee-project-embedded.html.
6. Rukovodstvo po vyboru radiochastotnyh komponentov maloj moshnosti [Tekst]/ Texas Instruments: Technology for Innovators. – M.: Kompel, 2006. – 52 s.
7. Posobie po besprovodnym setyam WPAN: Kratkij teoreticheskij kurs po tehnologii besprovodnyh setej [Elektronnij resurs]/ Obrazovatelnyj portal: matematika i internet-robototehnika. – Rezhim dostupu: http://mathscinet.ru/junior/wpan/index.php.

Methodical instructions for different types of classes

8. Metodichni vkazivki do laboratornih robit z disciplini «Bezdrotovi sensorni merezhi» dlya studentiv usih form navchannya specialnosti 172 «Telekomunikaciyi ta radiotehnika», specializaciya: Informacijni merezhi zv'yazku [Tekst]/ Uporyad. V.O. Vlasova, A.I. Kostromickij – Harkiv: HNURE, 2016. – 22 s.
9. Metodichni vkazivki do samostijnoyi roboti z disciplini «Bezdrotovi sensorni merezhi» dlya studentiv usih form navchannya specialnosti 172 «Telekomunikaciyi ta radiotehnika», specializaciya: Informacijni merezhi zv'yazku [Tekst]/ Uporyad. V.O. Vlasova – Harkiv: HNURE, 2016. – 15 s.

Information support

1. Programne zabezpechennya IAR Embedded Workbench, programa-terminal HyperTerminal, ZigBee Sensor Monitor ta Packet Sniffer.
2. Model rozpodilu energetichnih resursiv ta model procesu pozicionuvannya vuzliv BSM movoyu Code Gear C++ Builder 2007.