POLYTECHNIC OF RIJEKA
BUSINESS DEPARTMENT

PROGRAMME OF STUDY

SPECIALIST GRADUATE PROFESSIONAL STUDY OF INFORMATION SYSTEMS

3.1 LIST OF COURSES

Specialist Graduate Study of Information Systems
Areas of specialization: Software Engineering and Information Technologies

1st year of study – Semester I (Winter Semester)

Course unit no.	Title of the course unit	Hours weekly				ECTS credits	Exam
		L	S	E	P		
1	Modeling and Simulations	2	2	-	-	6	1
2	Databases Management	2	-	2	-	4	1
3	Information Systems Development Tools	1	-	3	-	6	1
4	Communications Technologies	2	-	2	-	6	1
5	Information System Control and Revision	2	1	-	-	4	1
28	Systems for managing manufacturing processes	1	-	2		4	1
	Total / Semester	**10**	**3**	**9**	**-**	**30**	**6**

Note: L –lecture, S – seminar, E – exercise, P - practical

1st year of study - Semester II (Summer Semester)

Course unit no.	Title of the course unit	Hours weekly				ECTS credits	Exam
		L	S	E	P		
7	Software Engineering	1	-	2	-	4	1
8	Development of Object-oriented Applications	2	-	3	-	6	1
9	Multimedia System Development	2	-	2	-	6	1
10	Information System Quality Management	1	2	-	-	4	1
11	Computer Management of Complex Systems	2	2	-	-	6	1
29	Interface of business and process systems	1		2		4	
	Total / Semester	**9**	**4**	**9**	**-**	**30**	**6**

Note: L –lecture, S – seminar, E – exercise, P - practical

2nd year of study – Semester III (Winter Semester)
Area of specialization: Software Engineering

Course unit no.	Title of the course unit	Hours weekly				ECTS credits	Exam
		L	S	E	P		
13	Distributed Systems	2	1	-	-	4	1
14	Modular Software Engineering	1	-	2	-	4	1
15	Web Applications Safety	2	-	1	-	4	1
*	Elective Course I	1	1	2	-	6	1
*	Elective Course II	1	1	2	-	6	1
*	Elective Course III	1	1	2	-	6	1
	Total / Semester	**8**	**4**	**9**	**-**	**30**	**6**

Note: L –lecture, S – seminar, E – exercise, P - practical

2nd year of study – Semester III (Summer Semester)
Area of specialization: Information Technologies

Course unit no.	Title of the course unit	Hours weekly				ECTS credits	Exam
		L	S	E	P		
16	Information System Planning	2	1	-	-	4	1
17	Ergometrics and Computer Use	1	-	2	-	4	1
18	Internet Technologies and E-business operations	2	-	1	-	4	1
*	Elective Course I	1	1	2	-	6	1
*	Elective Course II	1	1	2	-	6	1
*	Elective Course III	1	1	2	-	6	1
	Total / Semester	**8**	**4**	**9**	**-**	**30**	**6**

Note: L –lecture, S – seminar, E – exercise, P - practical

* A student of each area of specialization chooses 3 of the following elective courses:

Course unit no.	Title of the course unit
19	Methodics of Technical and Research Work
22	Office Automation
24	Information System for Decision-making Support

2nd year of study – Semester IV

Course unit no.	Title of the course unit	Hours weekly				ECTS credits	Exam
		L	S	E	P		
25	Specialist Internship	-	-	-	(x)	15	-
26	Specialist Final Paper	-	-	(x)	-	15	1
	Total / Semester	**-**	**-**	(x)	(x)	**30**	**1**

The complete syllabus of Specialist Graduate Study of Information Systems

Semester of the study	Hours per semester					ECTS credits	Exam
	L	S	E	P	Total		
Semester I	135	60	135	-	330	30	6
Semester II	135	60	135	-	330	30	6
Semester III	120	60	135	-	315	30	6
Semester IV	-	-	(x)	(x)	(x)	30	1
Totally for the complete syllabus	**375**	**180**	**420**	**(x)**	**975**	**120**	**19**

During the studies a student has the total of 975 hours of various forms of courses, and by fulfilling the requirements of the programme s/ he acquires the total of 120 ECTS credits.

MODELLING AND SIMULATIONS **Course unit number: 01**

Hours weekly: 2+2+0+0 / I **ECTS credits: 6**

Syllabus outline

Basics of modelling: models and their classification. Modelling principles. Modelling methodology. Phases of modelling. Modelling as a base for decisions making. Types of modelling. Basics of probability and statistics. Selection of input distributions. Generation of patterns. Programming input data into a model. Output data analysis. Creating confidence in simulation models. Planning simulation experiments. System dynamics.

Basic ideas of system dynamics. Approaches to simulation modelling. Classification of simulation models. Simulation experiments programming. Simulation models development. Discrete events simulation. Examples of simulation languages: CSMP (Continuous System Modelling Program), Jess (Java Expert System Shell), object simulation languages SERVICEMODEL. Simulation language: GPSS. System equations, programs and Dynamo language. Arena language. Virtual reality. Tool/language VRML.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in modelling and simulations. They apply their knowledge in information systems design. They also develop a sense for necessity of iteration in designing and maintaining information and business systems.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

DATABASES MANAGEMENT **Course unit number: 02**

Hours weekly: 2+0+2+0 / I **ECTS credits: 4**

Syllabus outline

Relational algebra. Dependences in relational databases (functional, fuzzy and link dependences). Normalization and normal forms. Partial information and databases. Techniques of inductive reasoning for relational databases modelling. Client-Server architecture. Characteristics of SQL databases according to ANSI SQL 99 specification. Application of relational algebra to SQL databases. Working with SQL databases (queries, triggers, storage procedures and functions). Databases upgrade in relation with the goal of upgrading and maintaining canned IS. BP maintenance (testing tables accuracy, consistency, BP fine tuning for more rapid and efficient response). Managing users for access to BP, defining authorizations. Making BP backup copies. Backup recovery demands. Reinstallation of BP on other hardware specifications.

Developing of general and specific competence (knowledge and skills)

Students gain theoretical knowledge of databases; they master the procedures of organizing data, their security and ways of accessing databases.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INFORMATION SYSTEMS DEVELOPMENT TOOLS **Course unit number: 03**

Hours weekly: 1+0+3+0 / I **ECTS credits: 6**

Syllabus outline

About information system in general. Access to information system development. Development phases of information system. Engineering approach to information system development. Information technology in the development of IS. Definition of CASE tools. Structure of CASE tools. Classification of CASE tools. Overview of the most common CASE tools. Criterion of comparison. CASE tools quality evaluation. Information system analysis and design through the application of CASE tools.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in the application of designing tools of information systems. Students apply their knowledge in information systems design, they develop skills in working with various tools.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

COMMUNICATIONS TECHNOLOGIES **Course unit number: 04**

Hours weekly: 2+0+2+0 / I **ECTS credits: 6**

Syllabus outline

Introduction into communications technologies: communication models as a base for connecting open systems. Physical media. Transfer on the physical layer. Error and process management. Congestion management. Transfer services and teleservices. Optical communication networks and networks technologies. LAN and WAN network structures. Service integration on a single network. Analysis of services quality. ISDN, ATM and broadband networks. Users' access to the network. Principles of communication and link in local networks. Standards. Network layer. Theory of graphs and networks. Routing and algorithms. Transport layer. Application of telecommunications networks. Communications networks security. Data transfer security. Security technologies: Firewalls, Virtual Private Network (VPN).

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and skills in designing computer networks. They use their knowledge to design computer networks. Networks and data security.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INFORMATION SYSTEMS CONTROL AND REVISION **Course unit number: 05**

Hours weekly: 2+1+0+0 / I **ECTS credits: 4**

Syllabus outline

Information systems' life cycle. Information system quality evaluation. Relationship between business and information system. Concept of and the need for control and revision of information systems. Control as a component of information system management. Procedures and methods of information system revision. Controls in information system development procedure. Data controls. Security management controls. Communications controls. Databases controls. Collecting data. Revision software tools. Expert revision systems. Measurement of information system characteristics. Evaluation of revision and control results. Managing function of information system revision. Protection of data privacy. Virtual organizations.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in controlling and revising information system operation. They develop skills in using software tools in revision and control. Responsibility for control.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

SYSTEMS FOR MANAGING MANUFACTURING PROCESSES **Course number: 28**

Hours weekly: 1+0+2+0 Semester / III **ECTS credits: 4**

Syllabus outline

Classification of manufacturing processes. Terms such as process and business systems. Hierarchical structuring of levels of management and business functions in relation to current normative recommendations. A model of hierarchical structure of organizational units and equipment of manufacturing and business processes. A basic definition of process at certain functional levels. Information technologies as support for process management. Basic settings of a model of objectively based components. SCADA systems. Systems of advanced management.

Developing general and specific competence (knowledge and skills)

Acquiring knowledge and skills for choosing tools and products for process management.

Types of classes and methods of assessment
The course is carried out weekly, in the form of consultancy.

SOFTWARE ENGINEERING **Course unit number: 07**

Hours weekly: 1+0+2+0 / II **ECTS credits: 4**

Syllabus outline

Concept of software engineering. Formal principles of software engineering. Methods and phases of software system development. Techniques of program specification design for particular development phases. Techniques of software system modelling. Objects structure modelling. Process modelling i.e. object response. Process designing on logical and physical level. Program modules design with stress on uniform approach. Designing user interface using methods. Aims and techniques of programming. Program team organization. Overview of programming languages and aids. Prototype development. Rapid application development and implementation of RAD tools. Software system management. Development and management of project planning. Software system cost evaluation. Software system maintenance. Software system configuration management. Ensuring quality. Software system documenation. Software system development supported by the computer (CASE).

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and skills in software design and modelling. They apply their knowledge in designing specific information systems software modules.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

DEVELOPMENT OF OBJECT-ORIENTED APPLICATIONS **Course unit number: 08**

Hours weekly: 2+0+3+0 / II **ECTS credits: 6**

Syllabus outline

Introduction into object-oriented analysis. Advantages of object-oriented technologies for the development of application software. Concepts of object-oriented approach. Classes and objects as basic units of abstraction. Class and object model. Determining links between classes. Defining class reaction using characteristics of polymorphism and other designing techniques. Message communication. Encapsulation. Incremental and iterative processes in the development of applications using object-oriented technologies. Static modelling in object-oriented analysis. Dynamic modelling in object-oriented analysis. Dynamic models identification and analysis. Modelling tools selection. UML (Uniform Modelling Language). Use of CASE tools in the analysis of the system demands. Jdeveloper 10g tool-example. Choice of programming language. Examples of object-oriented languages: C++, Pearl, Java. Script languages. Object-oriented technologies on the Client, server and network. Safety and control. Extension standards.

Developing of general and specific competence (knowledge and skills)

Comparative evaluation of object-oriented vs. procedural technologies. Students gain knowledge of object approach. They develop skills in program solving of certain problems, in using object-oriented programming languages as well as skills in using development tools.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

MULTIMEDIA SYSTEM DEVELOPMENT **Course unit number: 09**

Hours weekly: 2+0+2+0 / II **ECTS credits: 6**

Syllabus outline

Multimedia communication. Information content integration. Integration of various media content-hypermedia. Visualization of user interface. Multimedia devices. Multimedia document. Basic types of multimedia documents and their development. Interactive multimedia documents. Data models in hyper-media: media modelling, navigation, data and transfer perception, browsing semantics. Procedures of media processing. Specific quality of technological platforms for multimedia: CD-ROM/DVD, Web, multimedia mobile telephony, interactive television. XML and global data exchange standards. Basics of XML and XML document structure. Creating individual data format and exchange across the existing networks and applications. Data integration with existing applications using XML. Creating structure for data exchange and uniting the existing protocols and standards. Separating data from the process and functioning on any platform with different programming languages like Visual Basic, C++, Java, Pearl etc.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in modelling multimedia systems. They use their knowledge to design multimedia systems. They also develop sense for the need of iteration and modifications in designing and maintaining multimedia systems.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INFORMATION SYSTEM QUALITY MANAGEMENT

Hours weekly: 1+2+0+0 / II **ECTS credits: 4**

Syllabus outline
Concept and meaning of quality. Quality management as a prerequisite for successful business operations. Historical outline of quality management. TQM. Quality systems. IS quality evaluation.-value of information for business system. Application of quality standards in the development of information systems. Need for analysis and revision of information systems. Evaluation of ISO 9001 norm in informatics.
Developing of general and specific competence (knowledge and skills)
Students gain knowledge and skills in quality system management. They use their knowledge for anticipating and decision making related to quality of system functioning

Types of classes and methods of assessment
The course is carried out weekly, in the form of consultancy.

COMPUTER MANAGEMENT OF COMPLEX SYSTEMS **Course unit number: 11**

Hours weekly: 2+2+0+0 / II **ECTS credits: 6**

Syllabus outline

System and its characteristics. System as a starting point for researches and solving problems. Parts of a system, its characteristics, rules. Types of systems. System approach. Basics of system approach. Algorithmic and heuristic methods. Technique of presenting system and system relationships. System models. Models in informatics. Techniques in system presenting and analysis. Complex systems. Guidelines on complexity and complex systems characteristics. Systems from the aspect of differences of their components. System holism. Complex systems models. System dynamics. Examples of complex systems: sociological, economic, ecological, energy, biological, health, military, geophysical. System management. Application of the usual management techniques. System analysis and evaluation. Decision preparing. Information selection. System hierarchical structuring from the aspect of information use. Information technologies as a support in complex system management. Information technologies as methods, methodologies and tools.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in recognizing systems and their modelling. Developing diagnosis ability in process and system analysis and modelling. They apply their knowledge in information system design. They also develop sense for measure in detailing particular processes of system analysis and and its environment.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INTERFACE OF BUSINESS AND PROCESS SYSTEMS **Course number: 29**

Hours weekly: 1+ 0+2+0/ II **ECTS credits: 4**

Syllabus outline

The term – a problem of disconnection between process and business systems. The outline of usual computer products that are used in these systems. A problem analysis of disconnection with the aid of chosen examples from practice. Normative recommendations for the function structure of an interface between two systems. The definition of basic interface objects and their attributes.
The definition of the MES system (Manufacturing Execution Systems) – excellent manufacturing systems. A basic structure of an executive production system: basic functions and support functions. Concrete realization examples. Criteria for choosing complete solutions.

Developing general and specific competence (knowledge and skills)
Acquiring knowledge and skills for developing interface systems between business and process systems. Acquiring abilities for assessing the quality and normative compliance of such an integration.

Types of classes and methods of assessment
The course is carried out weekly, in the form of consultancy.

DISTRIBUTED SYSTEMS **Course unit number: 13**

Hours weekly: 2+1+0+0 / III **ECTS credits: 4**

Syllabus outline

.Concept, goals and characteristics of distributed systems. Technical basis of distributed systems, assemblies and programming support. Basic structures of distributed systems. Management of distributed databases and distributed processing. Special requirements for operating systems and other programming support. Internet as a distributed system, characteristics, services. Internet and electronic business. Advantages and disadvantages.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in recognizing and modelling distributed systems. They apply their knowledge in designing distributed information system

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

MODULAR SOFTWARE ENGINEERING **Course unit number: 14**

Hours weekly: 1+0+2+0 / III **ECTS credits: 4**

Syllabus outline

Principles and technologies of modular software engineering. Object-oriented methodology. Modelling: object, dynamic, functional. Development of program support. Unified Modelling Language (UML). Component-oriented programming architecture. Goals of component-oriented architecture. Multi-layer programming architecture. Component-standards, link to UML, development of object-oriented components. Development of software system with modular software engineering. Comparative analysis of traditional and object paradigm. Common Object Request Broker Architecture (CORBA). Advanced concepts of distributed computing. JavaBeans (Enhanced JavaBeans). Principles of designing JavaBeans.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in designing and modelling modular software. They apply their knowledge in designing specific modules of information system software.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

WEB APPLICATIONS SAFETY **Course unit number: 15**

Hours weekly: 2+0+1+0 / III **ECTS credits: 4**

Syllabus outline

Introduction to web services, definition of web services, web scripts with web services. Security, basic terms and aspects (reliability, integrity, nonrejection, authenticity, authorization, accessibility). Security presentation for each network layer. New challenges and threats for web services. XML signature. XML encryption.

SAML. Assigning authorization-permission (XACML), XKMS. Modern technological specifications (Pass-port, Liberty project). Influence of UDDI on enhanced safety. Legal aspects of security and protection of web services and applications. Destructive activities on web applications. Training all users of IT in security. Security implementation.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in designing safety systems of web applications.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INFORMATION SYSTEM PLANNING **Course unit number: 16**

Hours weekly: 2+1+0+0 / III **ECTS credits: 4**

Syllabus outline

Business strategy and information system. Influence of business strategy on the development of IS and evaluation of IT. Dependence of a company business operations on IS/IT. Factors of business strategy and their role in strategic planning of IS. Reorganization of business operations. Principles of reorganization. Methods of IS strategic planning. Goals and results of IS strategic planning. Formalization of the problem of strategic planning and mode of its implementation. IS structure optimization, time and development costs optimization. Business system and its IS performance evaluation. Operating costs calculated on the basis of activity analysis. Balanced system of success measurement with examples for profitable and non-profitable organizations.

Developing of general and specific competence (knowledge and skills)

Students learn planning and information systems evaluation techniques from designing to maintaining.
They gain knowledge and develop skills in the implementation of methods and techniques of information systems business planning.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

ERGOMETRICS AND COMPUTER USE **Course unit number: 17**

Hours weekly: 1+0+2+0 / III **ECTS credits: 4**

Syllabus outline

Introduction to the course. Ergometrics as a scientific discipline. Working environment. Work place. Ergometrics and rules in force. Rules in force related to providing computer equipment in a work place. Computer equipment and its application on a work place. Computer equipment ergometrics. Computer and its parts. Monitor. Keyboard. Mouse. Magnetic effects on the environment. Magnetic radiation guards. Software ergometrics. Ergometrics characteristics related to the communication between the user and computer equipment. Ergometrics of working environment. A desk. A chair. Lighting. Noises and sounds. Microclimate. Tiredness and its causes. Prevention of tiredness. Employer's attitude towards ergometrics requirements. Need for ensuring improved working conditions with computer equipment.

Developing of general and specific competence (knowledge and skills)

Students learn about ergometrics organization of information systems-work place, equipment and working environment as well as about need for improved working conditions. They also develop ability to find solutions.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INTERNET AND ELECTRONIC COMMERCE **Course unit number: 18**

Hours weekly: 2+0+1+0 / III **ECTS credits: 4**

Syllabus outline

Introductory review of traditional and electronic business operations. Digital society and digital economy. Elements of electronic business. Development of Internet and Internet services. E-business and e-commerce. E-commerce environment. E-commerce market. Business models of e-commerce. Infrastructure of e-business operations. Managing e-business operations infrastructure. Electronic data exchange. Strategy of e-business and ERP (Enterprise resource planning). Information systems development in a communication environment. Managing e-business organizations. Models of e-business. Brokerage (commission) models. Advertising models. Information intermediary models. Commercial models. Production models. Collaborators models. Models of virtual communities. Subscribers' models. Auxiliary services models. CRM, SCM and electronic environment (managing supply chain). Methods of payment: electronic payment, electronic cash. Smart card. Methods and digital commerce canned software. Security of e-business. Electronic management. Business enterprise on the Internet.

Developing of general and specific competence (knowledge and skills)

Students learn about basic processes and organization of e-business. They develop skills in organizing e-commecial models. They gain knowledge and develop skills in the application of methods and techniques of e-business.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

METHODICS OF TECHNICAL AND RESEARCH WORK **Course unit number: 19**

Hours weekly: 1+1+2+0 / III **ECTS credits: 6**

Syllabus outline

Science and scientific-research work. Methods of writing technical and scientific paper. Research methods in information science. Scientific and technological information. Sources of information. Choosing a theme for a research. Categorization of scientific papers. Quoting. Writing a technical paper and doing a poster. Terms of technical and scientific paper. Planning and organizing research work. Research. Types of scientific-research and technical papers. Structure, style and language. Parts of the paper and scientific documentation. Research and development. Techniques of writing a technical paper. Presentation of the paper. Law on higher education institutions. Law on scientific-research activity.

Developing of general and specific competence (knowledge and skills)

Students develop ability to write technical and scientific paper on their own. They master techniques necessary to write technical and scientific papers.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

OFFICE AUTOMATION **Course unit number: 22**

Hours weekly: 1+1+2+0 / III **ECTS credits: 6**

Syllabus outline

Business operations in a digital society, activities and functions, principles, development, advantages. Prerequisites for automation, history, evolution of office information systems, types and models of office information systems, security procedures, regulations and standards, office automation in the government administration, business communication, data processing and storage. Presentation procedures and multimedia documents. Office automation at a distance (telecommuting). Computer component of office automation, integrated office applications, data transfer technologies, electronic and mobile business operations, working at a distance. Multimedia approach. Computer networks and their services. Internet telephony. Business operations via Internet, planning and designing office automation: impact on productivity, effectiveness and efficiency, telephone, telefax, teletext-videotext, video conferences-teleconferences, paging systems.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in enhancing office business operations.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.

INFORMATION SYSTEM FOR DECISION SUPPORT **Course unit number: 24**

Hours weekly: 1+1+2+0 / III **ECTS credits: 6**

Syllabus outline

Importance of decision-making. Information systems for management support. Systems for decision support. Modelling as a process of decomposition and problem formalization. Historical outline. Types of systems and classification. System development, special characteristics.
Utility measurement. Methods of decision-making. Psychological-sociological problems.
Data warehouses. Development methodology of data warehouses. Data mining.
Expert systems. Knowledge bases. Modern development.

Developing of general and specific competence (knowledge and skills)

Students gain knowledge and develop skills in using information and managing business systems. They also develop skills in decision-making.

Types of classes and methods of assessment

The course is carried out weekly, in the form of consultancy.