

ITSS Model Curriculum

- To get level 2 -

(Corresponding with ITSS V3)

IT Skill Standards Center

IT Human Resources Development Headquarters

Information-Technology Promotion Agency (IPA), JAPAN



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Introduction

Information-Technology Promotion Agency (IPA), Japan has released a Training Road Map and Model Curriculum. The Training Road Map is to be a reference source of training courses when educational organizations and companies implement educational trainings, and the Model Curriculum is to provide specific reference information when they design and implement educational trainings corresponding with Skill Standards for IT Professionals, ITSS*.

This model curriculum is a subsequent volume of a model curriculum ITSS Model Curriculum - To get level 1 - (released on June 26, 2008). Taking the advantages of this curriculum, ITSS Model Curriculum - To get level 1 -, attendees can acquire broader knowledge and personal skills required of level 2 of ITSS. The knowledge would not be partial to any particular industries or fields.

Some features of this curriculum, utilizing information system development as a virtual case, are exercises that enable the attendees to sufficiently learn development processes, professional work ethics (including engineer ethics), and contents to develop their deeper understanding of up-skilling and careers.

This curriculum covers the BOK[†] of a Common Career/Skills Framework to make relationship to knowledge items in each course (except Personal Skill Fundamentals).

In this model curriculum, 1 subject consists of 15 units x 90 minutes. However, we have no restriction in regard to a learning term, organization, or situation. We believe this model curriculum will be widely used by any companies and educational organizations.

We hope this model curriculum will be exploited to develop human skills and promote systematic knowledge trainings.

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URL <http://www.ipa.go.jp/index-e.html>

* The Skill Standards for IT Professionals, ITSS, is indices that define clearly and systematically ability to accomplish various kinds of IT related services. In addition, it can provide a useful and common framework for educating and training IT service professionals.

ITSS V3, released in March 2008, integrated job categories of levels 1 and 2 for each level. ITSS, as a tool for assessing ITSS levels 1-3, shows its relationship to new ITEE to establish an objective human resource assessment mechanism.

[†] BOK: Body of Knowledge

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Chapter 1 Curriculum Overview

1. Outline

This model curriculum is designed for students or business workers who want to acquire the knowledge of ITSS level 2. Based on the Training Road Map, this curriculum is the reference book that specifies training methods to implement a training curriculum, so attendees can acquire the knowledge necessary to get level 2 of ITSS V3.

2. Target

The targets of this model curriculum are those who aim to acquire the knowledge necessary to get level 2 of ITSS. They are assumed to have already acquired common basic IT knowledge*. The specific example of the target personnel is as described below.

<Who is this model curriculum for?>

1. Those who are involved in the following business scenes in companies or organizations such as an IT enterprise
(Assumption: her/his job category has not yet been determined and her/his career paths are still open to all job categories related to ITSS)
 - Planning corporate strategies by using information technologies
 - Developing IT systems
 - Providing IT services
2. Those who are involved in the following business scenes in information system departments in user companies or organizations
 - Planning fundamental strategies
 - Implementing IT solutions, products, or services
3. Students who are attending information science-related faculties of any universities, technical colleges, or vocational schools, assumed to work in the business scenes mentioned above after graduation

In addition, this curriculum is assumed to be utilized in educational organizations or companies in the following scenes.

<Which scene is this curriculum for?>

1. Company: Implementation of trainings for new university, college, or vocational school graduates
2. Educational organization: Education of students in information science faculties of

* The knowledge corresponding with ITSS Model Curriculum-To get Level 1-

any universities, technical colleges, or vocational schools.

3. Features

The features of this model curriculum are given below.

(1) Relationships to ITSS V3

- Enable attendees to get common information technology knowledge and personal skills.

The knowledge is not partial to any specific products or fields.

- Have consistency with the Common Career/Skills Framework and shows the relationship to the knowledge items in each subject and unit.

(2) Practical and substantial IT education

- Include exercises that enable attendees to sufficiently learn development processes, by providing information system development as a model case.

(3) Professional ethic education and career education as IT professional

- Combine contents to deepen attendees' understanding of the professional work ethics (including the engineering ethics) and mind-set on their upskilling and careers.

(4) Wide use and utilizable model curriculum in educational organizations and companies

- Show examples in this model curriculum for educational organizations and companies to implement any kinds of trainings.

4. Relationship to Training Road Map

As ITSS V3 integrated the job categories of levels 1 and 2 into one category, we have created Common Training Course Groups. We have also formulated the model curriculum corresponding with level 1 to get level 2.

Below shows the correspondence with the Training Road Map and the model curriculum, and it lists 11 subjects corresponding with each course.

Training Roadmap			Model Curriculum			Examination to Take
Level	Course Group	Course Name	Subject	Total Hours of Training	Standard Term	
Level 1 (those who aim to get level 2)	IT Fundamentals 2	IT Engineer Fundamentals	IT Engineer Fundamentals (1)	22.5 hours	15 units (3 days)	Fundamental Information Technology Engineers Examination
			IT Engineer Fundamentals (2)	22.5 hours	15 units (3 days)	
		Programming Fundamentals	Programming Fundamentals (1)	22.5 hours	15 units (3 days)	
			Programming Fundamentals (2)	22.5 hours	15 units (3 days)	
	System Development Fundamentals	Application Development Fundamentals	Application Development Fundamentals (1)	22.5 hours	15 units (3 days)	
			Application Development Fundamentals (2)	22.5 hours	15 units (3 days)	
		Database Fundamentals	Database Fundamentals	22.5 hours	15 units (3 days)	
		Network Fundamentals	Network Fundamentals (1)	22.5 hours	15 units (3 days)	
			Network Fundamentals (2)	22.5 hours	15 units (3 days)	
	Security Fundamentals	Security Fundamentals	22.5 hours	15 units (3 days)		
	Personal Skill Fundamentals	Personal Skill Fundamentals	Personal Skill Fundamentals	22.5 hours	15 units (3 days)	—

1 subject consists of 15 units x 90 minutes. For instance, when an educational organization implements ITSS based trainings, 1 unit a week, it will take about a half year to complete 1 subject. When a company implements ITSS based trainings, 5 units a day (eight hours), it will take 3 days to complete 1 subject.

5. Structure

This curriculum consists of these themes.

1. Common Training Course Groups
2. Subject Overview
3. Subject Order
4. Schedule Example
5. Subject Structure
 - 1) Subject Details

a) Subject Description: Level Classification (Attendee), Precondition, Outline, Learning Goal, Training and Education Method, Evaluation, Correspondence to Major/Middle Category of Common Career/Skills Framework

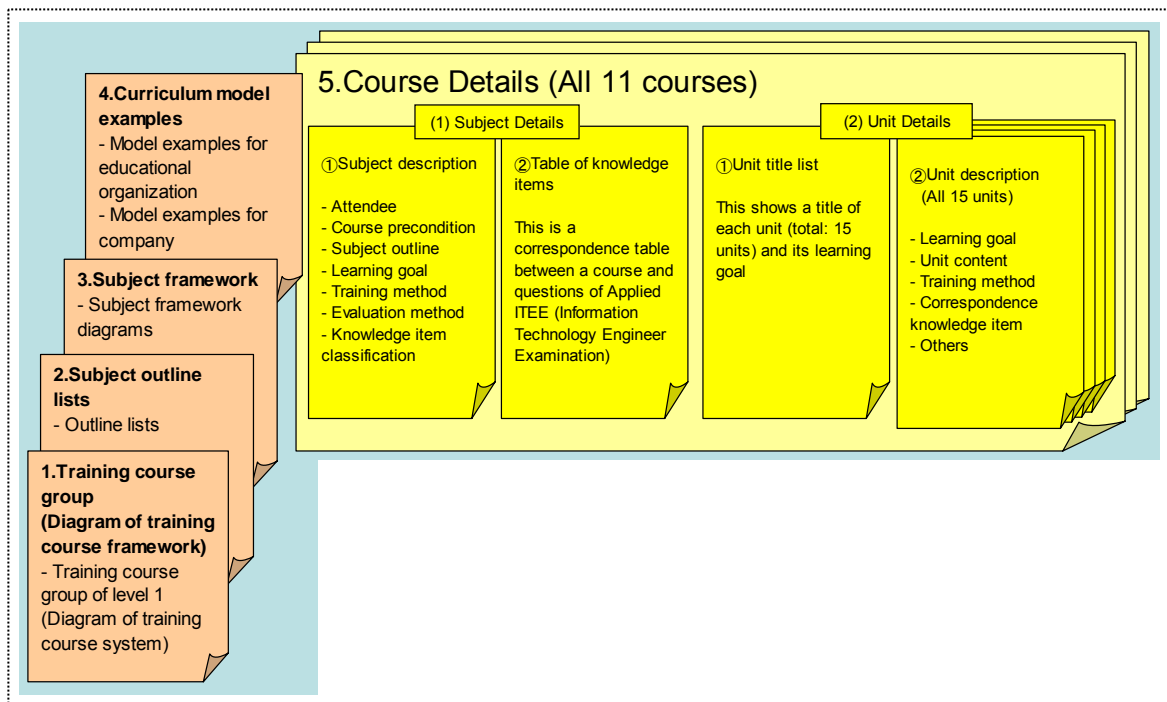
b) Table of Knowledge Items: the correspondence to the Major and Middle Categories of the Common Career/Skills Framework

2) Unit Details

a) Unit Title List: a list of unit titles and learning goals.

b) Unit Description: Learning Goal, Content, Training and Education Method, Corresponding Knowledge Item, etc.

< Structure of ITSS model curriculum >



5.1 Common Training Course Groups for levels 1 and 2

The figure below explains the Common Training Course Groups corresponding with ITSS V3.

This model curriculum is consisted of the subjects included into the Course Group, such as IT Fundamentals 2, System Development Fundamentals, and Personal Skill Fundamentals.

Training course group of common job category

	Inexperienced level (aim at level 1)	Level 1 (aim at Level 2)
Technology	IT Fundamentals 1	IT Fundamentals 2
Methodology		System Development Fundamentals
Project management		
Business/ Industry		
Personal		Personal Skill Fundamentals

5.2 Subject Overview

This is the list of the subject outlines of this model curriculum. We assign each subject a four-digit number by Level, Course Group, and Course Name.

<Subject code structure>

(1st digit) Level	(2nd digit) Course Group	(3rd digit) Course Name	(4th digit) Subject
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Level	Course Group	Course Name	Course Code	Subject Name	Outline	Attendees' Preconditions	Duration	Total Hours	Unit 1
Level1 (aim to get level 2)	IT Fundamentals 2	IT Engineer Fundamentals	B111	IT Engineer Fundamentals (1)	This subject is designed for attendees to acquire basic and general technical knowledge of information systems; technology including platforms, networks, databases and software engineering etc..	Have already completed Introduction to IT 1 Introduction to IT and 2 , or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / What is an Information System?
			B112	IT Engineer Fundamentals (2)	This subject is designed for attendees to acquire basic and general technical knowledge of information systems; system architecture, development procedures, and development methods of information systems.	Have already completed IT Engineer Fundamentals (1), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / System Configuration
		Programming Fundamentals	B121	Programming Fundamentals (1)	This subject is designed for the attendees to acquire basic knowledge on programming and grammar of Java programming languages. The attendees learn steps of program development and its environment by developing programs in hands-on lab.	Have already completed Introduction to IT 1 and Introduction to IT 2 , or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Programming Language and Software Engineering
			B122	Programming Fundamentals (2)		Have already completed Programming Fundamentals (1), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Classes and Methods
	System Development Fundamentals	Application Development Fundamentals	B211	Application Development Fundamentals (1)	This subject is designed for the attendees to acquire basic application design related techniques and knowledge, such as operational requirements analysis techniques, design techniques, development techniques, and related knowledge. Management techniques and its basic knowledge are also items of this subject.	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / System Development Processes
			B212	Application Development Fundamentals (2)	This subject is designed for the attendees to experience operational requirement analysis, design, coding, testing in model cases application development. This subject consists of lecture, exercise/hands-on lab. in group.	Have already completed Application Development Fundamentals (1)	90 minutes x 15 units	22.5h	Orientation / Review of Application Development Fundamentals (1)
		Database Fundamentals	B221	Database Fundamentals	This subject is designed for the attendees to understand or learn following DB related basic knowledge: - understand advantages of DB usage and to learn basic functions of RDBMS for effective database system management. - learn basic database models (three-layer schema and logical data models) and data analysis (normalization and ER model) for effective database design. - learn basic usage of SQL (DML, SDL, SML) for RDB data utilization. - learn how to install and construct DBMS and system configuration using databases.	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Database fundamentals
		Network Fundamentals	B231	Network Fundamentals (1)	This subject is designed for the attendees to acquire knowledge of network system configuration and its construction technology. They learn also whole image of networks including types and features of networks, importance of network protocols, OSI reference models, and TCP/IP.	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Outline of Network System and Communications Protocols (1)
			B232	Network Fundamentals (2)	This subject is designed for the attendees to learn basic knowledge related to networks including concepts of floor LAN installation, connections between LANs, connections between LAN and the Internet, and acquire techniques of exact procedures in details. They also learn importance of network management, administrator roles, protocols (SNMPs *1) used in network management, RMON *2 and LAN analyzers. *1 SNMP: Simple Network management Protocol *2 RMON: Remote network MONitoring	Have already completed Network Fundamentals (1), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation LAN Outline and Ethernet (1)
		Security Fundamentals	B241	Security Fundamentals	This subject is designed for the attendees to acquire wide range of basic security knowledge such as technical terms, structure, and mechanism. They learn also basic concepts of information security including importance of information security, threats and vulnerabilities of information systems, and their magnitude of influence. They learn basic countermeasures against information risks as well.	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Outline of Information Security Management
	Personal Skill Fundamentals	B311	Personal Skill Fundamentals	This subject is designed for attendees to learn basic knowledge related to personnel skills, such as key success factors of any projects (setting goals, organizing teams, communication, clarifying and promoting items in project implementation), basic skills related to leadership (i.e., motivation), effective and efficient communication skills, basic negotiation skills in any business scenes and situations.	Have already completed IT Fundamentals 1 and IT Fundamentals 2 course groups, or possess equivalent knowledge	90 minutes x 15 units	22.5h	Orientation / Personal Skills Required of IT Professionals	

<Correspondence table of course and subject>

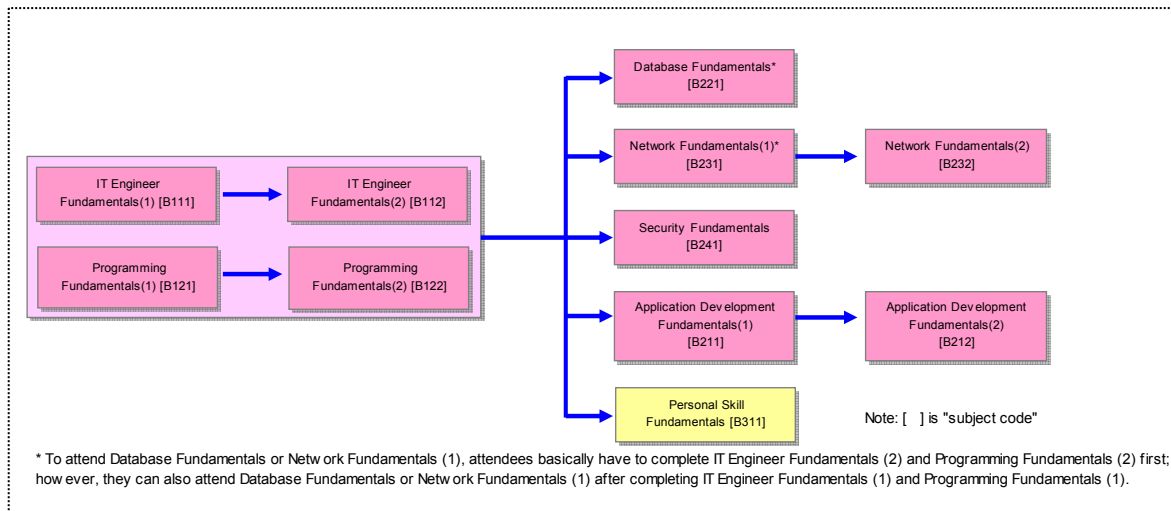
1st digit	2nd digit	3rd digit		4th digit					
Code	Level	Code	Course Group	Code	Course Name	Code	Subject		
B	Level 1 (aim to get level 2)	1	IT Fundamentals 2	1	IT Engineer Fundamentals	1	IT Engineer Fundamentals (1)		
				2	Programming Fundamentals	1	IT Engineer Fundamentals (2)		
		2	System Development Fundamentals	1	Application Development Fundamentals	1	Programming Fundamentals (1)	1	Programming Fundamentals (2)
				2	Database Fundamentals	1	Application Development Fundamentals (1)	2	Application Development Fundamentals (2)
				3	Network Fundamentals	1	Database Fundamentals	1	Database Fundamentals
				4	Security Fundamentals	1	Network Fundamentals (1)	2	Network Fundamentals (2)
				1	Personal Skill Fundamentals	1	Network Fundamentals (2)	1	Network Fundamentals (1)
				2	Personal Skill Fundamentals	1	Security Fundamentals	2	Security Fundamentals
		3	Personal Skill Fundamentals	1	Personal Skill Fundamentals	1	Personal Skill Fundamentals		

(2/2)

Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
Input/Output Devices	Memory (Storage)	Processors and Buses	Operating Systems	Middleware	File Systems	Networks	Data Representation	Information Basic Theory	Program Basic Theory	Data Structure	Algorithm (1)	Algorithm (2)	Final Wrap Up
Applied Mathematics	Software Development Outline	Standardization and Legal System	System Development Procedures (1)	System Development Procedures (2)	System Development Techniques (Structured Design)	System Development Techniques (Object-Oriented Design)	System Development Techniques (Data-Oriented Design)	System Development Techniques (Programming Languages)	System Development Management and Software Installation/Maintenance	Information Security	System Evaluation Indices	ITSS for Effective Human Resource Development	Final Wrap Up
Outline of Software Development Process	Flow of Software Development (1)	Flow of Software Development (2)	Basic Grammar of Java Language - Expression and Arithmetic Operators	Confirmation Practice of Basic Grammar	Basic Grammar - Condition Judgment	Confirmation Practice of Condition Judgment	Basic Grammar - Repetition	Repetition Confirmation Practice	Classes (1)	Class Confirmation Practice (1)	Classes (2)	Class Confirmation Practice	Final Wrap Up
Inheritance	Inheritance Confirmation Practice	Interface	Interface Confirmation Practice	Exception Handling	Exception Confirmation Practice	Input/Output	Confirmation Practice of Input/Output	Threads	Thread Confirmation Practice	Integration Practice (1)	Integration Practice (2)	Integration Practice (3)	Final Wrap Up
Application to Information System Business	Business Strategies and IT (1)	Business strategies and IT (2)	Systematization Planning (1)	Systematization Planning (2)	Software Quality Assurance	Performance Management	Company Activity Bases	OR/IE Fundamentals	Project Management in System Development	Project Planning and Management	Service Management	System Audit	Final Wrap Up
Software Development Processes and Exercise Explanation	System Proposal Creation	Exercises in Creating Proposals and Development Plans	Explanation of Software Architecture Design	Exercises in Software Architecture Design	Explanation of Software Detailed Design	Exercises in Software Detailed Design	Explanation of Software Coding and Development Environment	Exercises in Coding and Testing (1)	Exercises in Coding and Testing (2)	Tests/Debug	Exercises in Tests/Debug	Result Announcement	Final Wrap Up
Basic Functions of RDBMS (Constraints and Security Protection Function)	Basic Functions of RDBMS (Transaction Management)	Basic Functions of RDBMS (Measures against Failure and Recovery)	Database Design (Data Analysis and Normalization)	Database Design (Data Model Creation)	DBMS Installation and Database System Configuration	Search by SQL (Search Condition)	Search by SQL (Grouping and Sorting)	Search by SQL (JOIN)	Search by SQL (Subqueries)	Data Modification by SQL/Definition of Transaction and Database	Definition of Database by SQL (Consistency Constraints, Views, Rights)	Overall Practice	Final Wrap Up
Communications Protocols (2)	Communications Protocols (3)	LAN (1)	LAN (2)	WAN	The Internet Usage and Network Security	TCP/IP Basic Knowledge and IP Basic Functions and Addresses (1)	IP Basic Functions and Addresses (2)	Routing/IP Datagram Fragmentation and Reassembly /ARP/IP headers (1)	Routing/IP Datagram Fragmentation and Reassembly /ARP/IP headers (2)	ICMP and TCP/UDP (1)	TCP/UDP (2)	TCP/UDP (3) and Application Protocols	Final Wrap Up
Ethernet (2) and Application of LAN Switches (1)	Application of LAN Switches (2)	Application of LAN Switches (3)	Application of Routers (1)	Application of Routers (2)	VLAN/Application of Layer 3 Switches (1)	VLAN/Application of Layer 3 Switches (2)	LAN Component Examples and Wireless LAN	Outline of Network Management Tools (2) and Network Management Tools (1)	Network Management Tools (2) and SNMP (1)	Traffic Management and RMON-MIB (1)	Traffic Management and RMON-MIB (2)	LAN Analyzer	Final Wrap Up
Risk Analysis and Evaluation	Law and Guidelines on Information Security	Unauthorized Access	Viruses	Authentication Technology	OS Security	Application Security	Firewalls	IDS and IPS	Secure Programming	Cryptography/Signature	PKI	Security Protocols	Final Wrap Up
Communication Skills Required of IT Professionals	Communication Basics (Application of Information Passing) (1)	Communication Basics (Application of Information Passing) (2)	Communication Basics (Information Management)	Negotiation Outline	Use of Logical Thinking	Use of Problem Solving Technique	Negotiation Practice (1)	Negotiation Practice (2)	Leadership Basics	Leadership When Projects Start	Leadership When Projects Promoted	Leadership When Projects Executed	Feedback and Final Wrap Up

5.3 Subject Order

This diagram explains the training order of each subject.



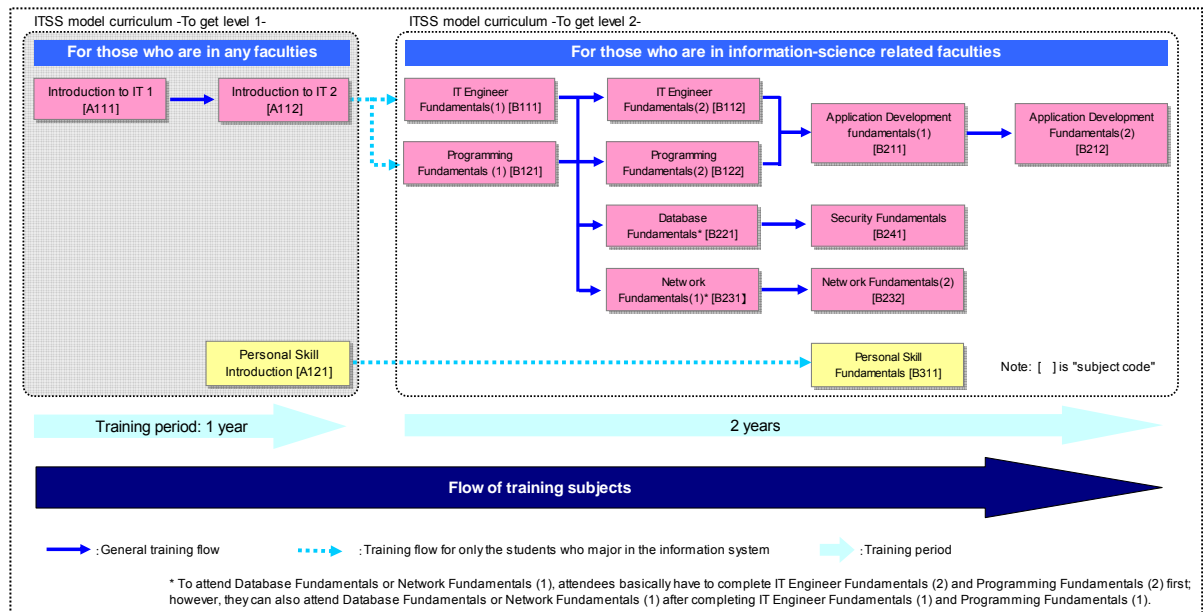
The subjects on the left are the precondition to take the ones on the right. It means the attendees have to take these subjects listed in this diagram from left to right; however, concerning the subjects on the arrows on the same level, there is no strict order of subject completion.

Neither of the IT Engineer Fundamentals (1) nor Programming Fundamentals (1) has a precondition subject, so attendees can choose either of them first.

5.4 Schedule Examples

(1) Schedule for long term session recommended for educational organization's training

In this model curriculum, 1 subject consists of 15 units, and it takes about a half year to complete 1 subject. Usually it is possible to take several trainings in parallel in educational organizations such as universities. Therefore it requires 2 years to complete 11 subjects in the diagram below.



(2) Schedule for intensive session recommended for company's training

Unlike the educational organizations, it is difficult for companies to implement several trainings for different subjects in parallel. Considering this background, we suggest the model curriculum in which 15 units are implemented in 3 days by a company (5 units are implemented in 1 day and no order change in the unit in the subject). Therefore, it requires 33 days to complete 11 subjects in the diagram below.

The 1st	The 2nd	The 3rd	The 4th	The 5th	The 6th	The 7th	The 8th	The 9th	The 10th	The 11th	The 12th
IT Engineer Fundamentals(1) [B111]			IT Engineer Fundamentals(2) [B112]			Programming Fundamentals(1) [B121]			Programming Fundamentals(2) [B122]		
The 13th	The 14th	The 15th	The 16th	The 17th	The 18th	The 19th	The 20th	The 21st	The 22nd	The 23rd	The 24th
Database Fundamentals [B221]			Network Fundamentals(1) [B23]			Network Fundamentals(2) [B232]			Security Fundamentals [B241]		
The 25th	The 26th	The 27th	The 28th	The 29th	The 30th	The 31st	The 32nd	The 33rd			
Application Development Fundamentals(1) [B211]			Application Development Fundamentals(2) [B212]			Personal Skill Fundamentals [B311]			(Note) [] is subject code		

5.5 Subject Structure

You can closely see how subjects and units are prepared.

The subject details in each course group are organized into one chapter (from Chapter 2).

(1) Subject details

a) Subject description

The subject description is shown in the format below.

[Example]

Subject	Subject Name
Subject Code	Subject code number
Job Category	Job category relationship with ITSS (In this curriculum, all subjects are <u>common job category</u> .)
Level Classification (Attendees)	Target level of a curriculum (In this curriculum, <u>Those who aim to acquire the knowledge of ITSS level 2.</u>)
Precondition	Course preconditions
Training Road Map (Course Group)	Name of Course Group corresponding with the Training Road Map
Training Road Map (Course Name)	Course Name of the Training Road Map corresponding with this curriculum
Outline	Subject outlines
Learning Goal	Subject learning goals
Training and Education Method	Learning methods: lecture, exercise, hands-on lab. (Please refer to a sample format of unit description about definition of <u>exercise</u> , <u>hands-on lab</u> .)
Evaluation	Descriptions of how to evaluate knowledge and skills that attendees acquire For example, reports, quantitative questionnaires, knowledge tests, effort and attitude towards exercises, etc.
Course Construction (Estimated Time)	Duration of a unit, a total number of units Total hours of a subject (In this model curriculum, 90 minutes per 1 unit x 15 units, total learning hours: 22.5 hours)
Correspondence to Major/Middle Category of Common Career/Skills Framework	Relationship to Major/Middle Category of Common Career/Skills Framework

b) Table of Knowledge Items

A Table of Knowledge Items shows the relations between items used in subjects and the Common Career/Skills Framework. (There is no table of knowledge items for Personal Skill Fundamentals.)

** : Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics	
					2	Applied mathematics	
					3	Theory of information	
					4	Theory of communications	
					5	Theory of measurement and control	
			2	Algorithm and programming	1	Data structure	
					2	Algorithm	
					3	Programming	
					4	Programming languages	
					5	Other languages	
	2	Computer system	3	Computer component	1	Processor	
					2	Memory	
					3	Bus	
					4	Input/output interface	
					5	Input/output device	
			4	System component	1	System configuration	
					2	System evaluation indexes	
			5	Software	1	Operating system (OS)	
					2	Middleware	
					3	File system	
					4	Development tools	
					5	Open source software	
	6	Hardware	1	Hardware			
	3	Technology element	7	Human interface	1	Human interface technology	
					2	Interface design	
			8	Multimedia	1	Multimedia technology	
					2	Multimedia application	
			9	Database	1	Database architecture	
					2	Database design	
					3	Data manipulation	
					4	Transaction processing	
					5	Database application	
			10	Network	1	Network architecture	
2					Data communication and control		
3					Communications protocol		
4					Network management		
5	Network application						
11	Security	1	Information security				
		2	Information security management				
		3	Security technology evaluation				
		4	Information security measures				
		5	Security implementation technology				
4	Development technology	12	System development technology	1	System requirements definition		
				2	Systems architecture design		
				3	Software requirements definition		
				4	Software architecture design and software detailed design		
				5	Software coding and testing		
				6	Software integration and software qualification tests		

Common Career/Skills Framework			Information-Technology Engineers Examination		Object					
Area	Major Category	Middle Category	Minor Category							
				7	System integration and system qualification tests					
				8	Software installation					
				9	Software acceptance					
				10	Software maintenance					
			13	Software development management techniques	1	Development process and methods				
					2	Intellectual property application management				
					3	Development environment management				
					4	Configuration management and change control				
					1	Project integration management				
					2	Project scope management				
	Management	5	Project management	14	3	Project time management				
					4	Project cost management				
					5	Project quality management				
6					Project human resources-management					
7					Project communications management					
8					Project risk management					
9					Project procurement management					
6					Service management	15	Service management	1	Service management	
								2	Operations design and tools	
	3	Service support								
	4	Service delivery								
	5	Service management foundation								
	6	Facility management								
Strategy	7	System strategy	17	System strategy	1	Information systems strategy				
				2	Business process					
				3	Solution business					
		18	System planning	1	Computerization planning					
				2	Requirements definition					
				3	Procurement planning and implementation					
	8	Business strategy	19	Business strategy management	1	Business strategy techniques				
					2	Marketing				
					3	Business strategy and goal/evaluation				
					4	Business management system				
20			Technological strategy management	1	Planning of technology development strategy					
				2	Technology development plan					
21			Business industry	1	Business system					
				2	Engineering system					
				3	e-business					
	4	Consumer appliances								
	5	Industrial devices								
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory					
				2	OR and IE					
				3	Accounting and financial affairs					
		23	Legal affairs	1	Intellectual property rights					
				2	Laws on security					
				3	Laws on labor and transaction					
				4	Other laws, guidelines, and engineer ethics					
				5	Standardization					

(2) Unit details

a) Unit title list

The unit titles and their learning goals are described on a unit basis.

b) Unit description

A unit description is stated in the format below.

[Sample]

Unit X Unit title (Lecture X minutes + Exercise X minutes *duration of a lecture and an exercise)	
Learning Goal	Learning goals
Content	Unit information 1.xxxxx (1)xxx (2)xxx <ul style="list-style-type: none"> • xxx • xxx 2.xxxxx 3.xxxxx
Training and Education Method (Schedule Time)	Lecture or exercise duration on a minute basis Lecture: a lecturer which is given to a group of people in a subject Hands-on lab.: activities using a PC Exercise: activities not using a PC Hands-on lab. in group: activities using a PC in group Exercise in group: activities not using a PC in group
Corresponding Knowledge Item	Here is shown the relationship between the unit contents and the Middle/Minor Category of the Common Career/Skills Framework. (No remark in the final wrap up of each subject.) If no minor category name is shown, it means that all minor categories are dealt in an appropriate unit.
Other Special Note	Other notice or specific information

Chapter 2 Subject Details – Corresponding With IT Fundamentals 2 Course Group -

- 1. Subject corresponding with IT Engineer Fundamentals course B1-1
 - 1.1 IT Engineer Fundamentals (1)..... B1-1
 - 1.2 IT Engineer Fundamentals (2)..... B1-21
- 2. Subject corresponding with Programming Fundamentals course B1-41
 - 2.1 Programing Fundamentals (1)..... B1-41
 - 2.2 Programming Fundamentals (2)..... B1-60

1. Subject corresponding with IT Engineer Fundamentals course

1.1 IT Engineer Fundamentals (1)

(1) Subject details

a) Subject description

Subject	IT Engineer Fundamentals (1)																								
Subject Code	B111																								
Job Category	Common job category																								
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2																								
Precondition	Have already completed Introduction to IT 1 Introduction to IT and 2*, or possess equivalent knowledge																								
Training Road Map (Course Group)	IT Fundamentals 2																								
Training Road Map (Course Name)	IT Engineer Fundamentals																								
Outline	This subject is designed for attendees to acquire basic and general technical knowledge of information systems; technology including platforms, networks, databases and software engineering etc..																								
Learning Goal	Can, apply basic technical knowledge related to information systems to perform activities such as development, operation and maintenance work as a member of a system development team under a supervision of a superior.																								
Training and Education Method	Lecture (Parts of the lectures can be provided via e-learning)																								
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests and attitude and effort towards exercises.																								
Curriculum Construction	1 unit 90 minutes x 15 (Total hours: 22.5 hours)																								
Correspondence to Major/Middle Category of Common Career/Skills Framework	<table border="0"> <tr> <td>[Area]Technology</td> <td></td> </tr> <tr> <td>[Major category]</td> <td>[Middle category]</td> </tr> <tr> <td>1 Basic theory</td> <td>1 Basic theory</td> </tr> <tr> <td>2 Computer system</td> <td>2 Algorithm and programming</td> </tr> <tr> <td></td> <td>3 Computer component</td> </tr> <tr> <td></td> <td>4 System component</td> </tr> <tr> <td></td> <td>5 Software</td> </tr> <tr> <td></td> <td>6 Hardware</td> </tr> <tr> <td>3 Technology element</td> <td>7 Human interface</td> </tr> <tr> <td></td> <td>8 Multimedia</td> </tr> <tr> <td></td> <td>9 Database</td> </tr> <tr> <td></td> <td>10 Network</td> </tr> </table>	[Area] Technology		[Major category]	[Middle category]	1 Basic theory	1 Basic theory	2 Computer system	2 Algorithm and programming		3 Computer component		4 System component		5 Software		6 Hardware	3 Technology element	7 Human interface		8 Multimedia		9 Database		10 Network
[Area] Technology																									
[Major category]	[Middle category]																								
1 Basic theory	1 Basic theory																								
2 Computer system	2 Algorithm and programming																								
	3 Computer component																								
	4 System component																								
	5 Software																								
	6 Hardware																								
3 Technology element	7 Human interface																								
	8 Multimedia																								
	9 Database																								
	10 Network																								

* Refer to IT skill standard curriculum – To get level 1–.

b) Table of knowledge items **: Consider as main items *: Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination			Object			
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics	**		
					2	Applied mathematics			
					3	Theory of information	**		
					4	Theory of communications	**		
					5	Theory of measurement and control	*		
			2	Algorithm and programming	1	Data structure	**		
					2	Algorithm	**		
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor	**		
					2	Memory	**		
					3	Bus	**		
					4	Input/output interface	**		
					5	Input/output device	**		
			4	System component	1	System configuration	**		
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)	**		
					2	Middleware	**		
					3	File system	**		
					4	Development tools			
					5	Open source software	*		
			6	Hardware	1	Hardware	**		
			3	Technology element	7	Human interface	1	Human interface technology	**
							2	Interface design	*
	8	Multimedia			1	Multimedia technology	**		
					2	Multimedia application	*		
	9	Database			1	Database architecture	*		
					2	Database design	*		
					3	Data manipulation	*		
					4	Transaction processing			
					5	Database application			
	10	Network			1	Network architecture	*		
					2	Data communication and control	*		
					3	Communications protocol	*		
					4	Network management	*		
					5	Network application			
	11	Security			1	Information security			
			2	Information security management					
			3	Security technology evaluation					
			4	Information security measures					
5			Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition				
				4	Software architecture design and software detailed design				
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object			
Area	Major Category	Middle Category	Minor Category					
				6	Software integration and software qualification tests			
				7	System integration and system qualification tests			
				8	Software installation			
				9	Software acceptance			
				10	Software maintenance			
				13	Software development management techniques	1	Development process and methods	
						2	Intellectual property application management	
						3	Development environment management	
						4	Configuration management and change control	
				Management	5	14	Project management	1
		2	Project scope management					
		3	Project time management					
		4	Project cost management					
5	Project quality management							
6	Project human resources-management							
7	Project communications management							
8	Project risk management							
9	Project procurement management							
6	Service management	15	Service management		1	Service management		
					2	Operations design and tools		
					3	Service support		
					4	Service delivery		
16	System audit	1	System audit					
		2	Internal control					
Strategy	7	17	System strategy	1	Information systems strategy			
				2	Business process			
				3	Solution business			
		18	System planning	1	Computerization planning			
				2	Requirements definition			
				3	Procurement planning and implementation			
	8	19	Business strategy management	1	Business strategy techniques			
				2	Marketing			
				3	Business strategy and goal/evaluation			
				4	Business management system			
		20	Technological strategy management	1	Planning of technology development strategy			
				2	Technology development plan			
		21	Business industry	1	Business system			
2	Engineering system							
3	e-business							
4	Consumer appliances							
5	Industrial devices							
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory			
				2	OR and IE			
				3	Accounting and financial affairs			

Common Career/Skills Framework			Information-Technology Engineers Examination			Object
Area	Major Category	Middle Category		Minor Category		
		23	Legal affairs	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation What is an Information System?	Can, explain position, roles, and use history of information systems in information-oriented society.
Unit 2	Input/Output Devices	Can, explain computer components. Can, explain input-output equipment which is one of computer components.
Unit 3	Memory (Storage)	Can, explain storage and auxiliary storage that are ones of computer components.
Unit 4	Processors and Buses	Can, explain processors and busses that are ones of computer components.
Unit 5	Operating Systems	Can, explain operating systems (OS) that are ones of computer components.
Unit 6	Middleware	Can, explain middlewares that are essential for building up information systems.
Unit 7	File Systems	Can, explain file systems that are ones of computer components. Can, explain databases that are ones of middlewares.
Unit 8	Networks	Can, explain outlines of network types and their roles. Can, explain an outline of communications protocols.
Unit 9	Data Representation	Can, explain methods of data representation processed in a computer.
Unit 10	Information Basic Theory	Can, explain fundamental laws of sets and logical operations.
Unit 11	Program Basic Theory	Can, explain programming basic theory among basic theories related to computer operating principals.
Unit 12	Data Structure	Can, explain data structure which is used in programs.
Unit 13	Algorithm (1)	Can, explain processes of sort and search algorithm.
Unit 14	Algorithm (2)	Can, explain how to use flowchart, arrays, and string processing.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish IT engineering skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation What is an Information System? (Lecture 90 minutes)			
Learning Goal	Can, explain position, roles, and use history of information systems in information-oriented society.		
Content	<ul style="list-style-type: none"> 1.Orientation 2.Information society and networks <ul style="list-style-type: none"> (1)Information and information processing (2)Components of information systems (3)Communications using information systems 3.System processing forms and usage patterns 4.Current status and future trends of information system applicable area <ul style="list-style-type: none"> (1)Information systems and their roles in company (2)Information systems and their roles as social infrastructure (3)Trends of basic technology that composes information systems 		
Training and Education Method (Schedule Time)	Lecture 90 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] System component</td> <td style="width: 50%; border: none;">[Minor category] System configuration</td> </tr> </table>	[Middle category] System component	[Minor category] System configuration
[Middle category] System component	[Minor category] System configuration		
Other Special Note			

Unit 2 Input/Output Devices (Lecture 90 minutes)											
Learning Goal	Can, explain computer components. Can, explain input-output equipment which is one of computer components.										
Content	<p>1. Computer components (1) Computer components and their roles</p> <ul style="list-style-type: none"> • Data flow and control flow <p>2. Input/output devices (1) Data representation</p> <ul style="list-style-type: none"> • Input/output device types and features • Input/output interfaces • Device drivers etc. <p>3. Input devices (1) Keyboards (2) Bar-code readers (3) OCR/OMR * (4) Image scanners (5) Speech recognition, etc.</p> <p>4. Output devices and display devices (1) Printers (2) Displays, etc.</p> <p>5. Multimedia technology (1) Multimedia and media integration</p> <ul style="list-style-type: none"> • Still images and video processing (compression and extension) • Speech recognition systems, etc. <p>6. Human interfaces (1) Human interface technology</p> <ul style="list-style-type: none"> • GUI • Usability/universal design etc. 										
Training and Education Method (Schedule Time)	Lecture 90 minutes										
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Computer component</td> <td>Input/output interface</td> </tr> <tr> <td></td> <td>Input/output device</td> </tr> <tr> <td>Human interface</td> <td></td> </tr> <tr> <td>Multimedia</td> <td></td> </tr> </table>	[Middle category]	[Minor category]	Computer component	Input/output interface		Input/output device	Human interface		Multimedia	
[Middle category]	[Minor category]										
Computer component	Input/output interface										
	Input/output device										
Human interface											
Multimedia											
Other Special Note	* OCR/OMR: Optical Character Recognition / Optical Mark Recognition (Reading)										

Unit 3 Memory (Storage) (Lecture 90 minutes)	
Learning Goal	Can, explain storage and auxiliary storage that are ones of computer components.
Content	<p>1.Memory</p> <p>(1)Types and features of memory</p> <ul style="list-style-type: none"> • Semiconductor memory (IC memory) • RAM (Random Access Memory) • ROM (Read Only Memory) • DRAM(Dynamic Random Access Memory) • SRAM (Static Random Access Memory) <p>(2)Capacity and performance of memory</p> <ul style="list-style-type: none"> • Access time • Cycle time • Effective access time <p>(3)Structure and storage hierarchies of memory systems</p> <ul style="list-style-type: none"> • Cache • Main storage • Auxiliary storage <p>2.Main storage</p> <p>(1)Main storage and addresses</p> <p>(2)Access methods</p> <ul style="list-style-type: none"> • Memory interleave • Banks <p>3.Auxiliary storage</p> <p>(1)Types of storage media and their features</p> <ul style="list-style-type: none"> • HDD (Hard disk drive) • CD (CD-ROM, CD-R) • DVD (DVD-ROM, DVD-RAM, DVD-R) • Flash memory (USB memory, SD card) etc. <p>(2)Record and files</p> <p>(3)Volume and files</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] Computer component [Minor category] Memory, Input/output device
Other Special Note	

Unit 4 Processors and Buses (Lecture 90 minutes)											
Learning Goal	Can, explain processors and busses that are ones of computer components.										
Content	<ol style="list-style-type: none"> 1.Computer types and configurations 2.Processor types and configurations (controller, ALU(Arithmetic and Logic Unit), etc.) 3.Processor input/output control 4.Processor operating principles <ol style="list-style-type: none"> (1)Interrupt (2)Instruction and addressing (3)Microprogram control (4)Various control methods (prefetch, pipeline control, etc.) (5)Parallel processing (6)CISC and RISC 5.Buses <ol style="list-style-type: none"> (1)Bus types and features (2)Bus system configuration (3)Bus control methods (4)Bus access mode (5)Bus capacity and performance 6.Outline of principle related to hardware design, measurement and control. <ol style="list-style-type: none"> (1)Outline of configuration and design of electricity and electric circuits (2)Signal processing and feedback control, etc. 										
Training and Education Method (Schedule Time)	Lecture 90 minutes										
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Basic theory</td> <td>Theory of measurement and control</td> </tr> <tr> <td>Computer component</td> <td>Processor</td> </tr> <tr> <td></td> <td>Bus</td> </tr> <tr> <td>Hardware</td> <td></td> </tr> </table>	[Middle category]	[Minor category]	Basic theory	Theory of measurement and control	Computer component	Processor		Bus	Hardware	
[Middle category]	[Minor category]										
Basic theory	Theory of measurement and control										
Computer component	Processor										
	Bus										
Hardware											
Other Special Note											

Unit 5 Operating Systems (Lecture 90 minutes)	
Learning Goal	Can, explain operating systems (OS) that are ones of computer components.
Content	<p>1. Operating system types and their features</p> <p>2. Operating system functions</p> <p>(1) Multiprogramming and interrupt</p> <p>(2) Virtual storage/virtual memory</p> <p>(3) Job management</p> <p>(4) Process/task management</p> <p>(5) Data management</p> <p>(6) Input/output management</p> <p>(7) Storage management, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Software Operating system (OS)</p>
Other Special Note	

Unit 6 Middleware (Lecture 90 minutes)			
Learning Goal	Can, explain middlewares that are essential for building up information systems.		
Content	<ul style="list-style-type: none"> 1. Middleware roles and their functions 2. Major middlewares and their usage <ul style="list-style-type: none"> (1) Shell functions and their roles (2) Web servers (3) Database management systems (4) Support systems for software development (5) Support systems for operations management, etc. 3. Outline of open source software (OSS) <ul style="list-style-type: none"> (1) OSS types and their features (2) UNIX-family OSs (3) Open source community (4) OSS usage and considerations, etc. 		
Training and Education Method (Schedule Time)	Lecture 90 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Software</td> <td style="width: 50%; border: none;">[Minor category] Middleware Open source software</td> </tr> </table>	[Middle category] Software	[Minor category] Middleware Open source software
[Middle category] Software	[Minor category] Middleware Open source software		
Other Special Note			

Unit 7 File Systems (Lecture 90 minutes)											
Learning Goal	<p>Can, explain file systems that are ones of computer components.</p> <p>Can, explain databases that are ones of middleware.</p>										
Content	<p>1.What is a file system?</p> <p>(1)File system types and their features</p> <p>(2)Access methodologies and search techniques</p> <p>2.File organization</p> <p>(1)Sequential files</p> <p>(2)Indexed sequential access method (ISAM) files</p> <p>(3)Direct access files</p> <p>(4)Partitioned files</p> <p>(5)Virtual storage access method (VSAM) files, etc.</p> <p>3.Directory management</p> <p>4.Backup</p> <p>5.Databases</p> <p>(1)What is a database?</p> <p>(2)Databases types and their features</p> <p>(3)Database normalization</p> <p>(4)Database management systems</p> <p>(5)Data manipulation (SQL)</p>										
Training and Education Method (Schedule Time)	Lecture 90 minutes										
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Software</td> <td>File system</td> </tr> <tr> <td>Database</td> <td>Database architecture</td> </tr> <tr> <td></td> <td>Database design</td> </tr> <tr> <td></td> <td>Data manipulation</td> </tr> </table>	[Middle category]	[Minor category]	Software	File system	Database	Database architecture		Database design		Data manipulation
[Middle category]	[Minor category]										
Software	File system										
Database	Database architecture										
	Database design										
	Data manipulation										
Other Special Note											

Unit 8 Networks (Lecture 90 minutes)			
Learning Goal	Can, explain outlines of network types and their roles. Can, explain an outline of communications protocols.		
Content	<ol style="list-style-type: none"> 1. Network types and their features (WAN/LAN etc.) 2. Data communications and control <ol style="list-style-type: none"> (1) Transmission methods and lines (2) Data representation and codes in data communications (3) What is an OSI model? (4) Outline of transmission theory (transmission path, modulation, and multiplexing scheme, etc.) 3. Communications protocols <ol style="list-style-type: none"> (1) TCP/IP (2) HDLC (3) HTTP, FTP, etc. 4. Outline of network management 		
Training and Education Method (Schedule Time)	Lecture 90 minutes		
Corresponding Knowledge Item	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> [Middle category] Network Basic theory </td> <td style="width: 50%; vertical-align: top;"> [Minor category] Network architecture Data communication and control Communications protocol Network management Theory of communications </td> </tr> </table>	[Middle category] Network Basic theory	[Minor category] Network architecture Data communication and control Communications protocol Network management Theory of communications
[Middle category] Network Basic theory	[Minor category] Network architecture Data communication and control Communications protocol Network management Theory of communications		
Other Special Note			

Unit 9 Data Representation (Lecture 90 minutes)					
Learning Goal	Can, explain methods of data representation processed in a computer.				
Content	<p>1.Numeric representation</p> <p>(1)Cardinal numbers</p> <ul style="list-style-type: none"> • Decimal numbers • Binary numbers • Hexadecimal numbers etc. <p>(2)Conversion methods of cardinal numbers</p> <p>(3)Representation methods of cardinal numbers</p> <ul style="list-style-type: none"> • Complements • Fixed points • Floating points • Mantissas • Exponents, etc. <p>(4)Operations and precision</p> <ul style="list-style-type: none"> • Logical shifts • Arithmetic shifts • Cancellation of significant digits • Loss of trailing digits • Overflow • Underflow • Single precision • Double precision <p>2.Non-numeric representation</p> <p>(1)Character data</p> <p>(2)Code systems, etc.</p>				
Training and Education Method (Schedule Time)	Lecture 90 minutes				
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Basic theory</td> <td style="border: none;">Discrete mathematics</td> </tr> </table>	[Middle category]	[Minor category]	Basic theory	Discrete mathematics
[Middle category]	[Minor category]				
Basic theory	Discrete mathematics				
Other Special Note					

Unit 10 Information Basic Theory (Lecture 90 minutes)	
Learning Goal	Can, explain fundamental laws of sets and logical operations.
Content	<p>1.Sets</p> <p>(1)Product sets</p> <p>(2)Union sets</p> <p>(3)Complementary sets</p> <p>(4)Subsets</p> <p>(5)True and false, etc.</p> <p>2.Logical operations</p> <p>(1)Logical products (AND)</p> <p>(2)Logical sums (OR)</p> <p>(3)Negations (NOT)</p> <p>(4)Exclusive logical sums (XOR)</p> <p>(5)Negative logical products (NAND)</p> <p>(6)De Morgan's laws etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Basic theory Discrete mathematics</p>
Other Special Note	

Unit 11 Program Basic Theory (Lecture 90 minutes)	
Learning Goal	Can, explain programming basic theory among basic theories related to computer operating principals.
Content	1.Basic theories related to information (1)Automatons (2)Coding theory (3)Predicate logic (4)Formal languages (5)Computational complexity, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Basic theory Theory of information
Other Special Note	

Unit 12 Data Structure (Lecture 90 minutes)	
Learning Goal	Can, explain data structure which is used in programs.
Content	1.Data structure (1)Stack and queue (2)List (3)Array (4)Tree structure (5)Binary tree, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Data structure
Other Special Note	

Unit 13 Algorithm (1) (Lecture 90 minutes)	
Learning Goal	Can, explain processes of sort and search algorithm.
Content	1.Algorithm (1)Sort (2)Selection sort (3)Insertion sort (4)Quick sort, etc. (5)Search (6)Binary search (7)Search (storing and searching data by Hash method), etc. (8)Merge
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Algorithm
Other Special Note	

Unit 14 Algorithm (2) (Lecture 90 minutes)	
Learning Goal	Can, explain how to use flowchart, arrays, and string processing.
Content	1.Flowchart (1)What is a flowchart? (2)Sequence, selection, and repetition 2.Arrays and how to process them 3.Character strings and how to process them 4.Recursion, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Algorithm
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish IT engineering skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up 2.Exercises 3.Q&A
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

1.2 IT Engineer Fundamentals (2)

(1) Subject details

a) Subject description

Subject	IT Engineer Fundamentals (2)
Subject Code	B112
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Engineer Fundamentals (1), or possess equivalent knowledge
Training Road Map (Course Group)	IT Fundamentals 2
Training Road Map (Course Name)	IT Engineer Fundamentals
Outline	This subject is designed for attendees to acquire basic and general technical knowledge of information systems; system architecture, development procedures, and development methods of information systems.
Learning Goal	Can, apply basic technical knowledge related to information systems to perform activities such as development, operation, and maintenance work as a member of a system development team under a supervision of a superior.
Training and Education Method	Lecture (Parts of the lectures can be provided via e-learning)
Evaluation	The attendees are evaluated by following methods Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	<p>[Area]Technology [Major category] [Middle category] 1 Basic theory 1 Basic theory 2 Computer system 2 Algorithm and programming 4 Computer component 5 Software 3 Technology element 11 Security 4 Development technology 12 System development technology 13 Software development management techniques</p> <p>[Area]Strategy [Major category] [Middle category] 9 Corporate and legal affairs 23 Legal affairs</p>

b) Table of knowledge items **: Consider as main items *: Consider as related items

Common Career/Skills Framework				Information-Technology Engineers Examination		Object	
Area	Major Category	Middle Category	Minor Category				
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics	
					2	Applied mathematics	**
					3	Theory of information	
					4	Theory of communications	
					5	Theory of measurement and control	
			2	Algorithm and programming	1	Data structure	
					2	Algorithm	
					3	Programming	
					4	Programming languages	**
					5	Other languages	**
	2	Computer system	3	Computer component	1	Processor	
					2	Memory	
					3	Bus	
					4	Input/output interface	
					5	Input/output device	
			4	System component	1	System configuration	**
					2	System evaluation indexes	**
			5	Software	1	Operating system (OS)	
					2	Middleware	
					3	File system	
					4	Development tools	**
					5	Open source software	
			6	Hardware	1	Hardware	
			3	Technology element	7	Human interface	1
	2	Interface design					
	8	Multimedia			1	Multimedia technology	
					2	Multimedia application	
	9	Database			1	Database architecture	
					2	Database design	
					3	Data manipulation	
					4	Transaction processing	
					5	Database application	
	10	Network			1	Network architecture	
					2	Data communication and control	
					3	Communications protocol	
					4	Network management	
5					Network application		
11	Security	1			Information security	**	
		2			Information security management	*	
		3			Security technology evaluation	*	
		4			Information security measures	*	
		5			Security implementation technology	*	
4	Development technology	12	System development technology	1	System requirements definition		
				2	Systems architecture design	**	
				3	Software requirements definition	**	
				4	Software architecture design and software detailed design	**	
				5	Software coding and testing	**	
				6	Software integration and software qualification tests	**	

Common Career/Skills Framework				Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category							
				7	System integration and system qualification tests	**				
				8	Software installation	**				
				9	Software acceptance	**				
				10	Software maintenance	**				
			13	Software development management techniques	1	Development process and methods	**			
					2	Intellectual property application management	**			
					3	Development environment management	*			
					4	Configuration management and change control	*			
			Management	5	Project management	14	Project management	1	Project integration management	
								2	Project scope management	
3	Project time management									
4	Project cost management									
5	Project quality management									
6	Project human resources-management									
7	Project communications management									
8	Project risk management									
9	Project procurement management									
6	Service management	15		Service management	1	Service management				
					2	Operations design and tools				
					3	Service support				
					4	Service delivery				
					5	Service management foundation				
					6	Facility management				
		16		System audit	1	System audit				
					2	Internal control				
Strategy	7	System strategy	17	System strategy	1	Information systems strategy				
					2	Business process				
					3	Solution business				
		18	System planning	1	Computerization planning					
				2	Requirements definition					
				3	Procurement planning and implementation					
	8	Business strategy	19	Business strategy management	1	Business strategy techniques				
					2	Marketing				
					3	Business strategy and goal/evaluation				
					4	Business management system				
			20	Technological strategy management	1	Planning of technology development strategy				
					2	Technology development plan				
			21	Business industry	1	Business system				
					2	Engineering system				
					3	e-business				
	4	Consumer appliances								
	5	Industrial devices								
	9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory				
2					OR and IE					
3					Accounting and financial affairs					
23			Legal affairs	1	Intellectual property rights	**				
				2	Laws on security	**				
				3	Laws on labor and transaction	**				
				4	Other laws, guidelines, and engineer ethics	**				

Common Career/Skills Framework			Information-Technology Engineers Examination			Object
Area	Major Category	Middle Category	Minor Category			
			5	Standardization		**

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation System Configuration	Can, explain purposes of systems and system configurations that are suited to usage patterns.
Unit 2	Applied Mathematics	Can, explain an outline of applied mathematics; probability, statistics, and queuing theory, etc..
Unit 3	Software Development Outline	Can, explain an outline of information system development such as software development processes and development techniques, etc..
Unit 4	Standardization and Legal System	Can, explain issues in informatization from viewpoints of standardization and legal systems, etc..
Unit 5	System Development Procedures (1)	Can, understand bases of purposes and activities on each development process. Can, explain outlines of work objectives and activities handled between system requirements definition and software detailed design processes in system development procedures.
Unit 6	System Development Procedures (2)	Can, understand bases of purposes and activities on each development process. Can, explain outlines of work objectives and activities handled between software code and test in system development procedures.
Unit 7	System Development Techniques (Structured Design)	Can, explain structured techniques and structured design that are ones of system development techniques.
Unit 8	System Development Techniques (Object-Oriented Design)	Can, explain object-oriented design which is one of system development techniques.
Unit 9	System Development Technique (Data-Oriented Design)	Can, explain data-oriented design which is one of system development techniques.
Unit 10	System Development Techniques (Programming Languages)	Can, explain steps to create programs with understanding of roles of language processors; assembler, compiler, interpreter, and generator. Can, explain program language types and features.
Unit 11	System Development Management and Software Installation/Maintenance	Can, explain software development management which is one of system development processes. Can, explain software installation, acceptance, and maintenance.
Unit 12	Information Security	Can, explain information security and threads. Can, explain an outline of measures against threads.
Unit 13	System Evaluation Indices	Can, explain reliability of system evaluation indices. Can, explain an outline of system performance evaluation.
Unit 14	ITSS for Effective Human Resource Development	Can, explain purposes, roles, and an outline of ITSS. Can, also explain human resource development and skill evaluation by using ITSS.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish IT engineering skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation	
System Configuration (Lecture 90 minutes)	
Learning Goal	Can, explain purposes of systems and system configurations that are suited to usage patterns.
Content	<ul style="list-style-type: none"> 1.Orientation 2.System configuration methods <ul style="list-style-type: none"> (1)Dual systems (2)Duplex systems (3)Tandem systems (4)Cluster systems, etc. 3.Distributed system configuration <ul style="list-style-type: none"> (1)Client/Server systems (2)Web systems (3)PtoP systems 4.High-reliability and high-confidentiality systems <ul style="list-style-type: none"> (1)Thin client systems (2)Fault tolerant systems (3)NAS (Network Attached Storage) systems (4)SAN (Storage Area Network) systems
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">[Middle category] System component</div> <div style="width: 45%;">[Minor category] System configuration</div> </div>
Other Special Note	

Unit 2 Applied Mathematics (Lecture 90 minutes)	
Learning Goal	Can, explain an outline of applied mathematics; probability, statistics, and queuing theory, etc..
Content	1.Applied mathematics (1)Probability and statistics (2)Numerical analysis (3)Formula manipulation (4)Graph theory (5)Queuing theory, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Basic theory Applied mathematics
Other Special Note	

Unit 3 Software Development Outline (Lecture 90 minutes)	
Learning Goal	Can, explain an outline of information system development such as software development processes and development techniques, etc..
Content	<p>1. Software development processes</p> <p>(1) Software life cycle models (SLCP)</p> <p>(2) Process maturity levels</p> <p>2. Development techniques</p> <p>(1) System development procedures</p> <p>(2) Structured techniques</p> <p>(3) Software reuse</p> <p>(4) Reverse engineering</p> <p>(5) MashUp etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Software development management techniques</p> <p>[Minor category]</p> <p>Development process and methods</p>
Other Special Note	

Unit 4 Standardization and Legal System (Lecture 90 minutes)	
Learning Goal	Can, explain issues in informatization from viewpoints of standardization and legal systems, etc..
Content	<p>1.Standardization</p> <p>(1)Roles of various organizations for standardization</p> <p>(2)Outline of JIS Q 15001</p> <p>(3)Outline of ISO9000</p> <p>(4)Outline of ISO14000, etc.</p> <p>2.Legal system</p> <p>(1)Intellectual property rights and application management</p> <p>(2)Laws on security</p> <p>(3)Laws on labor and transactions</p> <p>(4)Engineer ethics, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] Legal affairs
	[Middle category] Software development management techniques [Minor category] Intellectual property application management
Other Special Note	

Unit 5 System Development Procedures (1) (Lecture 90 minutes)	
Learning Goal	<p>Can, understand bases of purposes and activities on each development process.</p> <p>Can, explain outlines of work objectives and activities handled between system requirements definition and software detailed design processes in system development procedures.</p>
Content	<p>1.Outline of system development</p> <p>(1)Outline of system requirements definition</p> <p>(2)Outline of system architecture design</p> <p>(3)Outline of software requirements definition</p> <p>(4)Outline of software architecture design</p> <p>(5)Outline of software detailed design</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>System requirements definition</p> <p>Systems architecture design</p> <p>Software requirements definition</p> <p>Software architecture design and software detailed design</p>
Other Special Note	

Unit 6 System Development Procedures (2) (Lecture 90 minutes)	
Learning Goal	Can, understand bases of purposes and activities on each development process. Can, explain outlines of work objectives and activities handled between software code and test in system development procedures.
Content	1.Program creation and tests (1)Programming design (2)Software codes and tests (3)System integration/system tests (4)Utilization of various development tools (test tools and CASE, etc.)
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests System integration and system qualification tests
	[Middle category] Software [Minor category] Development tools
Other Special Note	

Unit 7 System Development Techniques (Structured Design) (Lecture 90 minutes)	
Learning Goal	Can, explain structured techniques and structured design that are ones of system development techniques.
Content	1.Structured techniques (1)Outline of structured techniques (2)Notations used in structured design (3)Structured programming and flowcharts
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software architecture design and software detailed design
Other Special Note	

Unit 8 System Development Techniques (Object-Oriented Design) (Lecture 90 minutes)	
Learning Goal	Can, explain object-oriented design which is one of system development techniques.
Content	1.Object-oriented paradigms (1)Object-oriented paradigm outline (2)Object-oriented design and UML (3)Object-oriented programming
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software architecture design and software detailed design
Other Special Note	

Unit 9 System Development Technique (Data-Oriented Design) (Lecture 90 minutes)	
Learning Goal	Can, explain data-oriented design which is one of system development techniques.
Content	1.Data-oriented design (DOA) (1)Outline of data-oriented approaches (2)Data-oriented design (3)E-R diagrams
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software architecture design and software detailed design
Other Special Note	

Unit 11 System Development Management and Software Installation/Maintenance (Lecture 90 minutes)	
Learning Goal	Can, explain software development management which is one of system development processes. Can, explain software installation, acceptance, and maintenance.
Content	1.System development management and software installation / maintenance (1)Software development environment management (2)Configuration management and change control (3)Software installation and acceptance (4)Software maintenance, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] Software development management techniques [Minor category] Development environment management Configuration management and change control
	[Middle category] System development technology [Minor category] Software installation Software acceptance Software maintenance
Other Special Note	

Unit 12 Information Security (Lecture 90 minutes)	
Learning Goal	Can, explain information security and threads. Can, explain an outline of measures against threads.
Content	<p>1. Outline of information security</p> <p>(1) Various security technologies</p> <ul style="list-style-type: none"> • Cryptography • Authentication • User verification, etc. <p>(2) Various security measures</p> <ul style="list-style-type: none"> • Physical security measures • Technical security measures • Human security measures, etc. <p>(3) Information security management</p> <ul style="list-style-type: none"> • Risk types • Measures • Information security policy • ISMS, etc. <p>(4) Security technology evaluation</p> <ul style="list-style-type: none"> • Evaluation methods • JISX5070, etc. <p>(5) Security implementation technology, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Security
Other Special Note	

Unit 13 System Evaluation Indices (Lecture 90 minutes)	
Learning Goal	Can, explain reliability of system evaluation indices. Can, explain an outline of system performance evaluation.
Content	<p>1. System reliability and cost efficiency</p> <p>(1) Significance and purposes</p> <p>(2) Reliability calculation</p> <p>(3) Reliability indices</p> <p>(4) Reliability characteristics and evaluation</p> <p>(5) Cost efficiency evaluation, etc.</p> <p>2. System performance indexes</p> <p>(1) Performance indices</p> <p>(2) Performance characteristics and evaluation</p> <p>(3) Capacity planning, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>System component System evaluation indexes</p>
Other Special Note	

Unit 14 ITSS for Effective Human Resource Development (Lecture 90 minutes)	
Learning Goal	Can, explain purposes, roles, and an outline of ITSS. Can, also explain human resource development and skill evaluation by using ITSS.
Content	<p>1.Outline of ITSS</p> <p>(1)Objectives of its introduction</p> <p>(2)Job categories, specialty fields, levels</p> <p>2.ITSS for effective human resource development (career development)</p> <p>(1)Level evaluation</p> <p>(2)Creating a training road map for human resource development, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(No corresponding knowledge item)
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish IT engineering skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up 2.Exercises 3.Q&A
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 13)
Other Special Note	

2. Subject corresponding with Programming Fundamentals course

2.1 Programing Fundamentals (1)

(1) Subject details

a) Subject description

Subject	Programming Fundamentals (1)
Subject Code	B121
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed Introduction to IT 1 and Introduction to IT 2**, or possess equivalent knowledge
Training Road Map (Course Group)	IT Fundamentals 2
Training Road Map (Course Name)	Programming Fundamentals
Outline	This subject is designed for the attendees to acquire basic knowledge on programming and grammar of Java programming languages. The attendees learn steps of program development and its environment by developing programs in hands-on lab.
Learning Goal	Can, apply basic knowledge related to programming languages to perform programming as a member of an application development team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (Parts of the lectures can be provided via e-learning) (Lecture and hands-on lab. are conducted alternately in order to enhance the attendees' understanding through acquiring and applying knowledge. During the hands-on lab., the attendees understand purposes and usages of development environment and other related tools.)
Evaluation	The attendees are evaluated by following methods Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	[Area] Technology [Major category] 1 Basic theory 4 Development technology [Middle category] 2 Algorithms and programming 12 System development technology 13 Software development management techniques

** Refer to the *IT skill standard curriculum – To get level 1–*.

b) Table of knowledge items **: Consider as main items *: Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object	
Area	Major Category	Middle Category	Minor Category			
Technology	1 Basic theory	1 Basic theory	1	Discrete mathematics		
			2	Applied mathematics		
			3	Theory of information		
			4	Theory of communications		
			5	Theory of measurement and control		
		2 Algorithm and programming	1	Data structure		
			2	Algorithm		
			3	Programming	**	
			4	Programming languages	**	
			5	Other languages		
	2 Computer system	3 Computer component	1	Processor		
			2	Memory		
			3	Bus		
			4	Input/output interface		
			5	Input/output device		
		4 System component	1	System configuration		
			2	System evaluation indexes		
		5 Software	1	Operating system (OS)		
			2	Middleware		
			3	File system		
			4	Development tools		
			5	Open source software		
		6	Hardware	1	Hardware	
		3 Technology element	7 Human interface	1	Human interface technology	
				2	Interface design	
	8 Multimedia		1	Multimedia technology		
			2	Multimedia application		
	9 Database		1	Database architecture		
			2	Database design		
			3	Data manipulation		
			4	Transaction processing		
			5	Database application		
	10 Network		1	Network architecture		
			2	Data communication and control		
			3	Communications protocol		
			4	Network management		
			5	Network application		
	11 Security		1	Information security		
		2	Information security management			
		3	Security technology evaluation			
		4	Information security measures			
5		Security implementation technology				
4 Development technology	12 System development technology	1	System requirements definition	*		
		2	Systems architecture design			
		3	Software requirements definition			
		4	Software architecture design and software detailed design	*		
		5	Software coding and testing	*		
		6	Software integration and software qualification tests	*		

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
				7	System integration and system qualification tests				
				8	Software installation				
				9	Software acceptance				
				10	Software maintenance				
			13	Software development management techniques	1	Development process and methods	*		
					2	Intellectual property application management			
					3	Development environment management			
					4	Configuration management and change control			
			Management	5	14	Project management	1	Project integration management	
							2	Project scope management	
							3	Project time management	
							4	Project cost management	
							5	Project quality management	
6	Project human resources-management								
7	Project communications management								
8	Project risk management								
9	Project procurement management								
6	Service management	15		Service management	1	Service management			
					2	Operations design and tools			
					3	Service support			
					4	Service delivery			
					5	Service management foundation			
					6	Facility management			
16	System audit	1		System audit					
		2		Internal control					
Strategy	7	17		System strategy	1	Information systems strategy			
			2		Business process				
			3		Solution business				
		18	System planning	1	Computerization planning				
				2	Requirements definition				
				3	Procurement planning and implementation				
	8	19	Business strategy management	1	Business strategy techniques				
				2	Marketing				
				3	Business strategy and goal/evaluation				
				4	Business management system				
		20	Technological strategy management	1	Planning of technology development strategy				
				2	Technology development plan				
		21	Business industry	1	Business system				
				2	Engineering system				
				3	e-business				
4	Consumer appliances								
5	Industrial devices								
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory				
				2	OR and IE				
				3	Accounting and financial affairs				
		23	Legal affairs	1	Intellectual property rights				
				2	Laws on security				
				3	Laws on labor and transaction				
	4			Other laws, guidelines, and engineer ethics					
	5			Standardization					

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Programming Language and Software Engineering	Can, explain programming languages and details of software engineering development.
Unit 2	Outline of Software Development Process	Can, explain importance of software development processes and features of major development processes.
Unit 3	Flow of Software Development (1)	Can, explain a flow of software development and roles of each process (first half).
Unit 4	Flow of Software Development (2)	Can, explain a flow of software development and roles of each process (last half).
Unit 5	Basic Grammar of Java Language - Expression and Arithmetic Operators	Can, explain basic styles of Java programs, mechanism and types of variables and their types, usage of expression and arithmetic operations.
Unit 6	Confirmation Practice of Basic Grammar	Can, compile and initiate Java programs. Can, identify and correct errors when compilers return errors.
Unit 7	Basic Grammar - Condition Judgment	Can, explain mechanism of conditionals and how they work.
Unit 8	Confirmation Practice of Condition Judgment	Can, write programs that have conditional structures.
Unit 9	Basic Grammar – Repetition	Can, explain a mechanism and types of repetition syntax. Can, explain what types of structures are appropriate for purposes. Can, explain a mechanism and usage of arrays.
Unit 10	Repetition Confirmation Practice	Can, write programs that use repetition and arrays.
Unit 11	Classes (1)	Can, explain a definition and usage of classes.
Unit 12	Class Confirmation Practice (1)	Can, define classes, and write programs that create objects and access members.
Unit 13	Classes (2)	Can, explain mechanisms of access control, constructors, and overload of class members.
Unit 14	Class Confirmation Practice	Can, write programs that use access control to members, constructors, and overload.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish programming skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation	
Programming Language and Software Engineering (Lecture 90 minutes)	
Learning Goal	Can, explain programming languages and details of software engineering development.
Content	<p>1.Orientation</p> <p>2.Programming languages and software engineering</p> <p>(1)Flow from assembler language to high-level languages, and features of these languages</p> <p>(2)Appearance of object-oriented language and Java</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Algorithm and programming Programming languages</p>
Other Special Note	

Unit 2 Outline of Software Development Process (Lecture 90 minutes)	
Learning Goal	Can, explain importance of software development processes and features of major development processes.
Content	1.Importance of development processes 2.Features of major development processes (1)Waterfall (2)Prototyping (3)Spiral (4)RAD (Rapid Application Development), etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] Software development management techniques [Minor category] Development process and methods
Other Special Note	

Unit 3 Flow of Software Development (1) (Lecture 90 minutes)	
Learning Goal	Can, explain a flow of software development and roles of each process (first half).
Content	<p>1. Software requirement definition</p> <p>(1) What is a software requirements definition?</p> <p>(2) Requirement establishment</p> <ul style="list-style-type: none"> • Functional requirements • Non-function requirements <p>(3) Use cases</p> <ul style="list-style-type: none"> • Notations using UML (Unified Modeling Language), DFD (Data Flow Diagram), etc. <p>2. Software architecture design/detailed design</p> <p>(1) Software structure and component design</p> <p>(2) Module design</p> <p>(3) Interface design</p> <p>(4) Unit/integration test design</p> <p>(5) Quality and review</p> <p>(6) Design technique types</p> <ul style="list-style-type: none"> • Structuring • Object-oriented paradigms, etc. <p>(7) Design patterns, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software requirements definition</p> <p>Software architecture design and software detailed design</p>
Other Special Note	

Unit 4 Flow of Software Development (2) (Lecture 90 minutes)	
Learning Goal	Can, explain a flow of software development and roles of each process (last half).
Content	<p>1. Software coding</p> <p>(1) Prescribed coding standards</p> <p>(2) Software coding</p> <p>(3) Code review</p> <p>(4) Debug, etc.</p> <p>2. Tests</p> <p>(1) Test purposes and types (unit tests and integration tests, etc.)</p> <p>(2) Test planning</p> <p>(3) Test preparation</p> <p>(4) Test execution and evaluation of its result, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p> <p>Software integration and software qualification tests</p>
Other Special Note	

Unit 5 Basic Grammar of Java Language - Expression and Arithmetic Operators (Lecture 90 minutes)	
Learning Goal	Can, explain basic styles of Java programs, mechanism and types of variables and their types, usage of expression and arithmetic operations.
Content	<p>1.Mechanism of Java programs</p> <p>(1)Code structure</p> <p>(2)Compiler mechanism</p> <p>(3)Program execution mechanism</p> <p>2.Java basic grammar</p> <p>(1)Variable and literal</p> <p>(2)Type mechanism and variable declaration</p> <p>(3)Variable use</p> <p>3.Expression and arithmetic operators</p> <p>(1)Expression mechanism</p> <p>(2)Arithmetic operators types and usage</p> <p>(3)Arithmetic operator priority</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Programming
Other Special Note	

Unit 6 Confirmation Practice of Basic Grammar (Hands-on Lab. 90 minutes)	
Learning Goal	Can, compile and initiate Java programs. Can, identify and correct errors when compilers return errors.
Content	<p>1.Flow from program creation to execution (Hands-on lab.)</p> <p>(1)JDK installation and environment setup</p> <p>(2)Editor usage</p> <p>(3)How to compile and execute</p> <p>2.Understanding Java basic grammar (following items through hands-on lab.)</p> <p>(1)Output to Standard Output (STDOUT)</p> <p>(2)Various type declarations and value assignments</p> <p>(3)Major operators usage</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Algorithm and programming</p> <p>[Minor category]</p> <p>Programming</p>
	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p>
Other Special Note	To help the attendees to understand, explanations of how to install and use the hands-on lab environment are given. They practice writing, compiling, and executing a program on the basis of the understanding of the basic Java grammar for better understanding. Guidance for how to understand compile errors and how to correct the errors is provided in the hands-on lab..

Unit 7 Basic Grammar - Condition Judgment (Lecture 90 minutes)	
Learning Goal	Can, explain mechanism of conditionals and how they work.
Content	<p>1. Relational operators and conditionals (1) Condition mechanism and algorithm (2) Usage of relational operators</p> <p>2. <i>if</i> statements (1) Mechanism of <i>if</i> statements (2) Usage patterns</p> <p>3. <i>switch</i> statements (1) Mechanism of <i>switch</i> statements (2) Use patterns</p> <p>4. Logical operators</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Programming
Other Special Note	

Unit 8 Confirmation Practice of Condition Judgment (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs that have conditional structures.
Content	1. Writing basic programs (hands-on lab.) (1) <i>if</i> statements (2) <i>switch</i> statements 2. Writing complex condition judgment programs (hands-on lab.) (1) Nested condition judgment syntax (2) Logical operator usage (3) Combination of various elements
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing
Other Special Note	To help the attendees understand, they write Java programs by using basic Java grammar, and execute the programs and check results in the hands-on lab. Guidance for how to understand compile errors and how to correct errors are provided.

Unit 9 Basic Grammar – Repetition (Lecture 90 minutes)	
Learning Goal	<p>Can, explain a mechanism and types of repetition syntax.</p> <p>Can, explain what types of structures are appropriate for purposes.</p> <p>Can, explain a mechanism and usage of arrays.</p>
Content	<p>1. <i>for</i> statements</p> <p>(1)Flow of repetition and condition judgment</p> <p>(2)Variable usage</p> <p>2. <i>while</i> statements</p> <p>(1)Mechanism of <i>while</i> statements</p> <p>3. <i>do-while</i> statements</p> <p>(1)Mechanism of <i>do-while</i> statements</p> <p>4. Combination usage</p> <p>(1)Nest</p> <p>(2)Combination with <i>if</i> statements</p> <p>(3)Changing processing flow (break, continue)</p> <p>5. Arrays</p> <p>(1)Mechanism and definition of arrays</p> <p>(2)How to use arrays</p> <p>(3)How to use arrays in application programs</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Algorithm and programming Programming</p>
Other Special Note	

Unit 10 Repetition Confirmation Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs that use repetition and arrays.
Content	1. Writing basic programs (hands-on lab.) (1) <i>for</i> statements (2) <i>while, do-while</i> statements (3) Arrays 2. Writing complex repetition programs (hands-on lab.) (1) Nested repetition syntax (2) Sorting array content
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing
Other Special Note	

Unit 11 Classes (1) (Lecture 90 minutes)	
Learning Goal	Can, explain a definition and usage of classes.
Content	<p>1. Class fundamentals</p> <p>(1) What is a class?</p> <p>(2) Class declarations</p> <p>2. Object creation</p> <p>(1) Object creation</p> <p>(2) Accessing members</p> <p>3. Method fundamentals</p> <p>(1) Method definition</p> <p>(2) Calling methods</p> <p>(3) Argument passing</p> <p>(4) Mechanism of return value</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Algorithm and programming Programming</p>
Other Special Note	

Unit 12 Class Confirmation Practice (1) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, define classes, and write programs that create objects and access members.
Content	<p>1. Writing basic programs (hands-on lab.)</p> <p>(1) Class definition</p> <p>(2) Programs using classes</p> <p>(3) Calling methods and retrieving return values</p> <p>2. Writing application programs (hands-on lab.)</p> <p>(1) Use of multiple classes</p> <p>(2) Definition of methods with/without argument</p> <p>(3) Definition of methods with/without return value</p> <p>(4) Trace of processing flow</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Algorithm and programming</p> <p>[Minor category]</p> <p>Programming</p>
	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p>
Other Special Note	

Unit 13 Classes (2) (Lecture 90 minutes)	
Learning Goal	Can, explain mechanisms of access control, constructors, and overload of class members.
Content	<p>1.Access control</p> <p>(1)Encapsulation mechanism</p> <p>(2)Definition of public/private members</p> <p>2.Method application</p> <p>3.Overload</p> <p>(1)Overload mechanism</p> <p>(2)Calling methods</p> <p>4.Constructors</p> <p>(1)Constructor mechanism</p> <p>(2)Constructor definition</p> <p>(3)Constructor overload</p> <p>5.Class variables and class methods</p> <p>(1)Instance variables</p> <p>(2)Class variables</p> <p>(3)Class methods</p> <p>6.Class usage</p> <p>(1)Class library</p> <p>(2)Classes dealing with character strings</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Programming
Other Special Note	

Unit 14 Class Confirmation Practice (2) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs that use access control to members, constructors, and overload.
Content	<p>1. Writing basic programs (hands-on lab.)</p> <p>(1) Accessing private members</p> <p>(2) Method definition (overload)</p> <p>(3) Constructor definition</p> <p>(4) Definition of class variables and methods</p> <p>(5) Operating character strings</p> <p>2. Writing application programs (hands-on lab.)</p> <p>(1) Practice of class creation</p> <p>(2) Writing programs dealing with classes</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Algorithm and programming</p> <p>[Minor category]</p> <p>Programming</p>
	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p>
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish programming skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up 2.Organizing knowledge through exercises
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

2.2 Programming Fundamentals (2)

(1) Subject details

a) Subject description

Subject	Programming Fundamentals (2)
Subject Code	B122
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed Programming Fundamentals (1), or possess equivalent knowledge
Training Road Map (Course Group)	IT Fundamentals 2
Training Road Map (Course Name)	Programming Fundamentals
Outline	This subject is designed for attendees to acquire basic knowledge on programming and grammar of Java programming languages. The attendees learn steps of program development and its environment by developing programs in hands-on lab..
Learning Goal	Can, apply knowledge related to programming languages to perform programming as a member of an application development team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (Parts of the lectures can be provided via e-learning) (Lecture and hands-on lab. are conducted alternately in order to enhance the attendees' understanding through acquiring knowledge and applying it. During the hands-on lab., the attendees understand purposes and usage of development environment and other related tools)
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	[Area] Technology [Major category] 1 Basic theory [Middle category] 2 Algorithms and programming
	[Major category] 4 Development technology [Middle category] 12 System development technology

b) Table of knowledge items **: Consider as main items *: Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming	**		
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			3	Technology element	6	Hardware	1	Hardware	
					7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing			
					5	Database application			
	10	Network	1	Network architecture					
			2	Data communication and control					
			3	Communications protocol					
			4	Network management					
			5	Network application					
	11	Security	1	Information security					
			2	Information security management					
			3	Security technology evaluation					
			4	Information security measures					
			5	Security implementation technology					
	4	Development technology	12	System development technology	1	System requirements definition			
					2	Systems architecture design			
					3	Software requirements definition			
4					Software architecture design and software detailed design				
5					Software coding and testing	*			

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests	*	
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	
			Management	5	14	Project management	1
2	Project scope management						
3	Project time management						
4	Project cost management						
5	Project quality management						
6	Project human resources-management						
7	Project communications management						
8	Project risk management						
9	Project procurement management						
6	Service management	15		Service management	1	Service management	
					2	Operations design and tools	
					3	Service support	
					4	Service delivery	
					5	Service management foundation	
					6	Facility management	
		16		System audit	1	System audit	
2	Internal control						
Strategy	7	17	System strategy	1	Information systems strategy		
				2	Business process		
				3	Solution business		
		18	System planning	1	Computerization planning		
				2	Requirements definition		
				3	Procurement planning and implementation		
	8	Business strategy	19	Business strategy management	1	Business strategy techniques	
					2	Marketing	
					3	Business strategy and goal/evaluation	
					4	Business management system	
			20	Technological strategy management	1	Planning of technology development strategy	
					2	Technology development plan	
			21	Business industry	1	Business system	
2	Engineering system						
3	e-business						
4	Consumer appliances						
5	Industrial devices						
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory		
				2	OR and IE		
				3	Accounting and financial affairs		

Common Career/Skills Framework			Information-Technology Engineers Examination		Object	
Area	Major Category	Middle Category	Minor Category			
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Classes and Methods	Can, explain how to define classes and methods and how to create objects.
Unit 2	Inheritance	Can, explain a meaning and mechanism of inheritance.
Unit 3	Inheritance Confirmation Practice	Can, create subclasses.
Unit 4	Interface	Can, explain roles and mechanisms of interfaces and abstract classes.
Unit 5	Interface Confirmation Practice	Can, create interface implementation programs.
Unit 6	Exception Handling	Can, explain a mechanism of exception handling and syntax.
Unit 7	Exception Confirmation Practice	Can, write exception handling programs.
Unit 8	Input/Output	Can, understand a concept of stream and usage of input/output classes.
Unit 9	Confirmation Practice of Input/Output	Can, write output/input programs that use streams.
Unit 10	Threads	Can, explain a mechanism of threads and behavior of multi-thread programs.
Unit 11	Thread Confirmation Practice	Can, write simple multi-thread programs.
Unit 12	Integration Practice (1)	Can, write programs based on provided specifications.
Unit 13	Integration Practice (2)	Can, write programs based on provided specifications.
Unit 14	Integration Practice (3)	Can, write programs based on provided specifications.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish programming skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation	
Classes and Methods (Lecture 90 minutes)	
Learning Goal	Can, explain how to define classes and methods and how to create objects.
Content	1.Orientation 2.How to define classes and methods, how to create objects
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Programming
Other Special Note	

Unit 2 Inheritance (Lecture 90 minutes)	
Learning Goal	Can, explain a meaning and mechanism of inheritance.
Content	<p>1. Inheritance</p> <ul style="list-style-type: none"> (1) Inheritance mechanism (2) Subclass definition and object creation (3) Calling constructors of super classes <p>2. Accessing members</p> <ul style="list-style-type: none"> (1) Accessing from subclasses (2) <i>protected</i> modifiers <p>3. Override</p> <ul style="list-style-type: none"> (1) Override of methods (2) Object handling with super class variables (3) <i>final</i> modifiers <p>4. Object classes</p> <ul style="list-style-type: none"> (1) Mechanism of object classes (2) Method definition
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Algorithm and programming Programming
Other Special Note	An additional explanation of <u>class</u> fundamentals can be provided to help the attendees understand the topics in this unit.

Unit 3 Inheritance Confirmation Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Can, create subclasses.
Content	1. Writing basic programs (hands-on lab.) (1) Subclasses (2) Subclass object creation (3) Constructor creation (4) Override (5) Object class inheritance 2. Writing application programs (hands-on lab.) (1) Practice of subclass creation
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category][Minor category] System development technology [Minor category] Software coding and testing
Other Special Note	

Unit 4 Interface (Lecture 90 minutes)					
Learning Goal	Can, explain roles and mechanisms of interfaces and abstract classes.				
Content	<p>1.Abstract classes (1)Features and mechanism of abstract classes (2)Abstract class use</p> <p>2.Interfaces (1)Interface mechanism (2)Interface implementation</p> <p>3.Class layers</p>				
Training and Education Method (Schedule Time)	Lecture 90 minutes				
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Algorithm and programming</td> <td style="border: none;">Programming</td> </tr> </table>	[Middle category]	[Minor category]	Algorithm and programming	Programming
[Middle category]	[Minor category]				
Algorithm and programming	Programming				
Other Special Note					

Unit 5 Interface Confirmation Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Can, create interface implementation programs.
Content	<p>1. Writing basic programs (hands-on lab.)</p> <p>(1) Abstract classes and inheritance</p> <p>(2) Interface declaration and classes that implement declared interfaces</p> <p>2. Writing complex condition judgment programs (hands-on lab.)</p> <p>(1) Nested condition judgment syntax</p> <p>(2) Logical operation use</p> <p>(3) Combination of various elements</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Algorithm and programming</p> <p>[Minor category]</p> <p>Programming</p>
	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p>
Other Special Note	Writing and executing programs in the hands-on lab. helps the attendees understand the Java language grammar fundamentals. During the hands-on lab., how to take care of interface related errors should be provided.

Unit 6 Exception Handling (Lecture 90 minutes)	
Learning Goal	Can, explain a mechanism of exception handling and syntax.
Content	<p>1.Exception bases</p> <p>(1)Exception mechanism</p> <p>(2)Exception handling (<i>finally</i> clauses)</p> <p>2.Exception classes</p> <p>(1)Classes expressing exception</p> <p>(2)Types of output exception of exception information</p> <p>3.Throwing exceptions (<i>throw</i> clauses)</p> <p>(1)Exception class declarations</p> <p>(2)Throwing exceptions</p> <p>4.Package and import</p> <p>(1)Package mechanism</p> <p>(2)Package use</p> <p>(3)Import</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Algorithm and programming Programming</p>
Other Special Note	

Unit 7 Exception Confirmation Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write exception handling programs.
Content	<p>1. Writing basic programs (hands-on lab.)</p> <p>(1) Exception handling (<i>try</i> clauses, <i>catch</i> clauses)</p> <p>(2) Exception handling (<i>finally</i> clauses)</p> <p>(3) Throwing exceptions</p> <p>(4) Import</p> <p>2. Writing complex repetition programs (hands-on lab.)</p> <p>(1) Multiple exception handling</p> <p>(2) Nested exception handling</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>Algorithm and programming</p> <p>[Middle category]</p> <p>Programming</p>
	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software coding and testing</p>
Other Special Note	

Unit 8 Input/Output (Lecture 90 minutes)	
Learning Goal	Can, understand a concept of stream and usage of input/output classes.
Content	<p>1.Input/output bases</p> <p>(1)Stream mechanism</p> <p>(2)Stream examples</p> <p>(3)File mechanism</p> <p>(4)Output to files</p> <p>(5)Input from files</p> <p>(6)Exception handling</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Algorithm and programming Programming</p>
Other Special Note	

Unit 9 Confirmation Practice of Input/Output (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write output/input programs that use streams.
Content	1. Writing basic programs (hands-on lab.) (1) File output (2) File input (3) Usage of command line arguments 2. Writing application programs (hands-on lab.) (1) Input-output file
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing
Other Special Note	

Unit 10 Threads (Lecture 90 minutes)					
Learning Goal	Can, explain a mechanism of threads and behavior of multi-thread programs.				
Content	<ul style="list-style-type: none"> 1. Bases of thread <ul style="list-style-type: none"> (1) Thread mechanism (2) Thread initiation 2. Thread actions 3. Thread creation <ul style="list-style-type: none"> (1) Process definition (2) Thread creation 4. Synchronization <ul style="list-style-type: none"> (1) Synchronization mechanism 				
Training and Education Method (Schedule Time)	Lecture 90 minutes				
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Algorithm and programming</td> <td style="border: none;">Programming</td> </tr> </table>	[Middle category]	[Minor category]	Algorithm and programming	Programming
[Middle category]	[Minor category]				
Algorithm and programming	Programming				
Other Special Note					

Unit 11 Thread Confirmation Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write simple multi-thread programs.
Content	1. Writing basic programs (hands-on lab.) (1) Thread definition (2) Definition and execution of multiple threads 2. Writing application programs (hands-on lab.) (1) Synchronization control
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing
Other Special Note	

Unit 12 Integration Practice (1) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs based on provided specifications.
Content	1. Writing practice programs based on provided specifications 2. Extending functions step by step
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 13 Integration Practice (2) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs based on provided specifications.
Content	1. Writing practice programs based on provided specifications 2. Extending functions step by step
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 14 Integration Practice (3) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, write programs based on provided specifications.
Content	1. Writing practice programs based on provided specifications 2. Extending functions step by step
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] Algorithm and programming [Minor category] Programming
	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish programming skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up 2.Organizing knowledge by exercises
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

Chapter 3 Subject Details - Corresponding With System Development Fundamentals Course Group -

1. Subject corresponding with Application Development Fundamentals course B2-1
 - 1.1 Application Development Fundamentals (1)..... B2-1
 - 1.2 Application Development Fundamentals (2)..... B2-22
2. Subject corresponding with Database Fundamentals course B2-42
 - 2.1 Database Fundamentals B2-42
3. Subject corresponding with Network Fundamentals course B2-62
 - 3.1 Network Fundamentals (1)..... B2-62
 - 3.2 Network Fundamentals (2)..... B2-82
4. Subject corresponding with Security Fundamentals course B2-102
 - 4.1 Security Fundamentals B2-102

1. Subject corresponding with Application Development Fundamentals course

1.1 Application Development Fundamentals (1)

(1)1Subject details

a) Subject description

Subject	Application Development Fundamentals (1)
Subject Code	B211
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge
Training Road Map (Course Group)	System Development Fundamentals
Training Road Map (Course Name)	Application Development Fundamentals
Outline	This subject is designed for the attendees to acquire basic application design related techniques and knowledge, such as operational requirements analysis techniques, design techniques, development techniques, and related knowledge. Management techniques and its basic knowledge are also items of this subject.
Learning Goal	Can, apply basic knowledge related to application development to perform application development as a member of an application development team.
Training and Education Method	Lecture
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)

<p>Knowledge Item Classification</p>	<p>[Area] Technology [Major category] 2 Computer system 3 Technology element 4 Development technology</p> <p>[Area] Management [Major category] 5 Project management 6 Service management</p> <p>[Area] Strategy [Major category] 7 System strategy 8 Business strategy 9 Corporate and legal affair</p> <p>[Middle category] 4 System component 9 Database 12 System development technology 13 Software development management technology</p> <p>[Middle category] 14 Project management 15 Service management 16 System audit</p> <p>[Middle category] 17 System strategy 18 System planning 19 Business strategy management 20 Technological strategy management 21 Business industry 22 Corporate activity</p>
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b) Table of knowledge items **: Consider as main items *: Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration	**		
					2	System evaluation indexes	**		
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			6	Hardware	1	Hardware			
			3	Technology element	7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing	**		
					5	Database application			
	10	Network			1	Network architecture			
					2	Data communication and control			
					3	Communications protocol			
					4	Network management			
					5	Network application			
	11	Security			1	Information security			
			2	Information security management					
			3	Security technology evaluation					
4			Information security measures						
5			Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition	*			
				2	Systems architecture design	*			
				3	Software requirements definition	**			
				4	Software architecture design and software detailed design	**			
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests		
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	**
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	*
			Management	5	14	Project management	1
2	Project scope management	**					
3	Project time management	**					
4	Project cost management	**					
5	Project quality management	**					
6	Project human resources-management	*					
7	Project communications management	*					
8	Project risk management	**					
9	Project procurement management	**					
6	Service management	15		Service management	1	Service management	**
					2	Operations design and tools	*
					3	Service support	**
					4	Service delivery	**
					5	Service management foundation	*
					6	Facility management	*
		16		System audit	1	System audit	**
2	Internal control				*		
Strategy	7	17		System strategy	1	Information systems strategy	**
			2		Business process	**	
			3		Solution business	*	
		18	System planning	1	Computerization planning	**	
				2	Requirements definition	**	
				3	Procurement planning and implementation	*	
	8	Business strategy	19	Business strategy management	1	Business strategy techniques	**
					2	Marketing	*
					3	Business strategy and goal/evaluation	*
					4	Business management system	**
			20	Technological strategy management	1	Planning of technology development strategy	**
					2	Technology development plan	*
			21	Business industry	1	Business system	**
					2	Engineering system	**
					3	e-business	*
4	Consumer appliances	*					
5	Industrial devices	*					
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory	**	
				2	OR and IE	**	
				3	Accounting and financial affairs	**	

Common Career/Skills Framework				Information-Technology Engineers Examination		Object
Area	Major Category	Middle Category		Minor Category		
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation System Development Processes	Can, explain a flow of system development processes and basic terms.
Unit 2	Application to Information System Business	Can, understand features of business systems and industrial systems that have been the social infrastructure. Can, explain a mechanism to secure system reliability.
Unit 3	Business Strategies and IT (1)	Can, explain significance that usage of IT (Information technology) has impact on company's business strategies.
Unit 4	Business strategies and IT (2)	Can, explain important points on planning information system strategies, which have major impact on decision of corporate business strategies.
Unit 5	Systematization Planning (1)	Can, explain a position of company's information systems and points on systematization strategy planning.
Unit 6	Systematization Planning (2)	Can, explain requirements definition and procurement planning / implementation on formulation of systemization planning.
Unit 7	Software Quality Assurance	Can, explain a basic concept of software quality, measurements and a mechanism used for quality assurance.
Unit 8	Performance Management	Can, explain importance of performance management in a system and roles of performance management techniques.
Unit 9	Company Activity Bases	Can, explain a basic structure of company activities such as business management, financial accounting, and cash management, etc..
Unit 10	OR/IE Fundamentals	Can, explain tools and techniques that are used in organizations on decision making, production management, quality management, etc..
Unit 11	Project Management in System Development	Can, explain features of system development projects and necessary structure.
Unit 12	Project Planning and Management	Can, explain what should be discussed in project management planning and contents of project management plans. Can, explain fundamentals in project management.
Unit 13	Service Management	Can, explain significance, a purpose, and a concept of IT service management.
Unit 14	System Audit	Can, explain significance of reliability, efficiency and safety assurance of information system through learning roles and contents of system audit.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish application development skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation	
System Development Processes (Lecture 90 minutes)	
Learning Goal	Can, explain a flow of system development processes and basic terms.
Content	1.Orientation 2.System development processes (1)Flow of system development processes (2)Software life-cycle processes
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] Software development management techniques [Minor category] Development process and methods
Other Special Note	

Unit 2 Application to Information System Business (Lecture 90 minutes)									
Learning Goal	Can, understand features of business systems and industrial systems that have been the social infrastructure. Can, explain a mechanism to secure system reliability.								
Content	<p>1. Business systems</p> <p>(1) Distribution information systems</p> <p>(2) Logistics information systems</p> <p>(3) Public information systems</p> <p>(4) Medical information systems</p> <p>(5) Financial information systems</p> <p>(6) Electronic government, etc.</p> <p>2. Engineering systems</p> <p>(1) Purposes and significance</p> <p>(2) Production management systems</p> <p>(3) MRP (Material requirements planning)</p> <p>(4) PDM (Product Data Management)</p> <p>(5) CAE (Computer Aided Engineering), etc.</p> <p>3. E-business</p> <p>(1) EC (electronic commerce)</p> <p>(2) EDI (Electronic Data Interchange)</p> <p>(3) RFID (Radio Frequency Identification), etc.</p> <p>4. Consumer appliances and industrial devices</p> <p>5. What is a transaction processing system?</p> <p>6. Functions of transaction processing systems</p> <p>(1) Roles and basic functions</p> <p>(2) Transaction control</p> <p>(3) Securing performance/reliability</p>								
Training and Education Method (Schedule Time)	Lecture 90 minutes								
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Business industry</td> <td></td> </tr> <tr> <td>System component</td> <td>System configuration</td> </tr> <tr> <td>Database</td> <td>Transaction processing</td> </tr> </table>	[Middle category]	[Minor category]	Business industry		System component	System configuration	Database	Transaction processing
[Middle category]	[Minor category]								
Business industry									
System component	System configuration								
Database	Transaction processing								
Other Special Note	Transaction processing process is selected as an example to explain an information system. We recommend that further explanations of systems by referring other system structures.								

Unit 3 Business Strategies and IT (1) (Lecture 90 minutes)	
Learning Goal	Can, explain significance that usage of IT (Information technology) has impact on company's business strategies.
Content	<p>1. Business strategies</p> <p>(1) Business strategy management</p> <p>(2) Technology strategy management</p> <p>2. Business strategy management techniques</p> <p>(1) Business strategy techniques</p> <ul style="list-style-type: none"> • Competition strategies • SWOT* analysis • PPM (Products Portfolio Management), etc. <p>(2) Marketing</p> <ul style="list-style-type: none"> • Theory and techniques • Analysis • LTV (Lifetime value), etc. <p>(3) Business strategies and targets/evaluation</p> <ul style="list-style-type: none"> • Strategy planning • Environmental analysis • Needs/Wants analysis • Competition analysis • CSF (Critical Success Factors) • KPI (Key Performance Indicator) • BSC (balanced scorecard), etc. <p>(4) Outline of business management system</p> <ul style="list-style-type: none"> • CRM (Customer Relationship Management) • SCM (Supply Chain Management) • ERP (Enterprise Resource Planning), etc. <p>3. Technological strategy management techniques</p> <p>(1) Planning technological development strategies</p> <ul style="list-style-type: none"> • Technology trends • Research • Management of technology (MOT), etc. <p>(2) Technical development plan</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Business strategy management Technological strategy management
Other Special Note	* SWOT: Strength, Weakness, Opportunity and Threat

Unit 4 Business strategies and IT (2) (Lecture 90 minutes)	
Learning Goal	Can, explain important points on planning information system strategies, which have major impact on decision of corporate business strategies.
Content	<p>1.Information system strategies</p> <p>(1)Significance and purposes of information systematization strategy decision</p> <p>(2)Total optimization policy and plans</p> <p>(3)Informatization promotion frameworks</p> <p>(4)Investment plans</p> <p>(5)Business models</p> <p>(6)Information system models</p> <p>(7)EA (Enterprise Architecture), etc.</p> <p>2.Business processes</p> <p>(1)BPR (Business Process Reengineering)</p> <p>(2)Business analysis, improvement and design</p> <p>(3)BPM (Business Process Management)</p> <p>(4)BPO (Business Process Outsourcing)</p> <p>(5)SFA (Sales Force Automation), etc.</p> <p>3.Solution business</p> <p>(1)Business system proposals</p> <p>(2)Business packages</p> <p>(3)ASP (Application Service Provider)</p> <p>(4)SOA (Service Oriented Architecture)</p> <p>(5)SaaS (Software as a Service), etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] System strategy</p> <p>[Minor category] Information systems strategy Business process Solution business</p>
Other Special Note	

Unit 5 Systematization Planning (1) (Lecture 90 minutes)	
Learning Goal	Can, explain a position of company's information systems and points on systematization strategy planning.
Content	1.Drawing systematization plans (1)Planning total development schedules (2)Forming development project frameworks and staff education plans (3)Forming development investment planning (ROI *) (4)System life-cycle (5)Installation risk analysis
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] System planning Computerization planning
Other Special Note	* ROI: Return on Investment

Unit 6 Systematization Planning (2) (Lecture 90 minutes)	
Learning Goal	Can, explain requirements definition and procurement planning / implementation on formulation of systemization planning.
Content	<p>1.Requirement definition</p> <p>(1)Requirements analysis and user needs study</p> <p>(2)Current status analysis</p> <p>(3)Operational requirements definition, functional requirements definition, and non-functional requirements definition</p> <p>(4)Stakeholder requirements verification, etc.</p> <p>2.Procurement plans and implementation</p> <p>(1)Objects, required items, conditions of procurement</p> <p>(2)Request for proposal (RFP)</p> <p>(3)Written quotations, proposals, and procurement selection</p> <p>(4)Risk analysis</p> <p>(5)Criteria for judging whether internal manufacturing or outsourcing</p> <p>(6)Software asset management, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minute
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System planning</p> <p>[Minor category]</p> <p>Requirements definition</p> <p>Procurement planning and implementation</p>
Other Special Note	

Unit 7 Software Quality Assurance (Lecture 90 minutes)	
Learning Goal	Can, explain a basic concept of software quality, measurements and a mechanism used for quality assurance.
Content	<ol style="list-style-type: none"> 1. Quality planning 2. Quality assurance <ol style="list-style-type: none"> (1) Quality assurance activities related to development processes (2) Risk management (3) Review (4) Software configuration management, etc. 3. Quality management <ol style="list-style-type: none"> (1) Quality indexes (2) Defect analysis, etc. 4. Typical quality assurance models <ol style="list-style-type: none"> (1) ISO9000 (2) CMMI (Capability Maturity Model Integration)
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software architecture design and software detailed design
Other Special Note	

Unit 8 Performance Management (Lecture 90 minutes)	
Learning Goal	Can, explain importance of performance management in a system and roles of performance management techniques.
Content	1.Performance management 2.Performance management and system life-cycle 3.Performance management technologies (1)Benchmarking (2)Monitoring (3)Tuning, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] System component System evaluation indexes
Other Special Note	

Unit 9 Company Activity Bases (Lecture 90 minutes)			
Learning Goal	Can, explain a basic structure of company activities such as business management, financial accounting, and cash management, etc..		
Content	<ol style="list-style-type: none"> 1. Business management 2. Business organization <ol style="list-style-type: none"> (1) Divisional systems (2) Company systems (3) CIO (Chief Information Officer) (4) CEO (Chief Executive Officer), etc. 3. Corporate governance 4. CSR (Corporate Social Responsibility) 5. IR (Investor Relations) 6. Human resources <ol style="list-style-type: none"> (1) OJT (on-the-job training) (2) Objectives management (3) Case study (4) Discretionary work systems, etc. 7. Accounting and finance <ol style="list-style-type: none"> (1) Financial accounting, management accounting, accounting standards (2) Financial statements, consolidated accounting, depletion, break-even points, etc. (3) Cash planning and cash management, asset management, etc. 		
Training and Education Method (Schedule Time)	Lecture 90 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Corporate activities</td> <td style="width: 50%; border: none;">[Minor category] Management & organization theory Accounting and financial affairs</td> </tr> </table>	[Middle category] Corporate activities	[Minor category] Management & organization theory Accounting and financial affairs
[Middle category] Corporate activities	[Minor category] Management & organization theory Accounting and financial affairs		
Other Special Note			

Unit 10 OR/IE Fundamentals (Lecture 90 minutes)					
Learning Goal	Can, explain tools and techniques that are used in organizations on decision making, production management, quality management, etc..				
Content	<p>1.Decision making supportive tools (1)Linear programming (LP) (2)Inventory problems (3)PERT/CPM ^{*1} (4)Game theory, etc.</p> <p>2.Analysis techniques (1)Work analysis (2)PTS ^{*2} method (3)Work sampling method etc.</p> <p>3.Inspection techniques (1)OC curve (2)Sampling (3)Simulation, etc.</p> <p>4.Quality control techniques (1)The Seven QC Tools ^{*3} (2)The Seven New QC Tools ^{*4}, etc.</p>				
Training and Education Method (Schedule Time)	Lecture 90 minutes				
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Corporate activities</td> <td>OR and IE</td> </tr> </table>	[Middle category]	[Minor category]	Corporate activities	OR and IE
[Middle category]	[Minor category]				
Corporate activities	OR and IE				
Other Special Note	<p>^{*1} PERT/CPM :Program Evaluation and Review Technique/Critical Path Method ^{*2} PTS: Predetermined Time Standards ^{*3} The Seven QC Tools: the seven basic tools of quality control: control chart, histogram, Pareto chart, check sheet, cause-and-effect diagram, graph, and scatter diagram ^{*4} The Seven New QC Tools: affinity diagram, relation diagram, tree diagram, matrix diagram, program evaluation and review technique (PERT), matrix-data analysis</p>				

Unit 11 Project Management in System Development (Lecture 90 minutes)			
Learning Goal	Can, explain features of system development projects and necessary structure.		
Content	<ol style="list-style-type: none"> 1.Importance of project management in system development projects 2.System development project frameworks <ol style="list-style-type: none"> (1)Stakeholders (2)Project frameworks 3.What is project management? <ol style="list-style-type: none"> (1)Project definition (2)Knowledge structure of project management (3)Points of system development projects (4)Necessary skills as project managers 4.Project processes and necessary management skills 		
Training and Education Method (Schedule Time)	Lecture 90 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Project management</td> <td style="width: 50%; border: none;">[Minor category] Project integration management</td> </tr> </table>	[Middle category] Project management	[Minor category] Project integration management
[Middle category] Project management	[Minor category] Project integration management		
Other Special Note			

Unit 12 Project Planning and Management (Lecture 90 minutes)	
Learning Goal	Can, explain what should be discussed in project management planning and contents of project management plans. Can, explain fundamentals in project management.
Content	<p>1. Project plans</p> <ul style="list-style-type: none"> (1) Development methodology and processes (2) Charter preparation (3) Scope planning and definition (4) Estimation (FP method *1, etc.) (5) WBS*2 creation and development schedule (6) Quality management plans (7) Other plans <p>2. Project management</p> <ul style="list-style-type: none"> (1) Time management (progress management) (2) Cost management (3) Quality management (4) Human resources management (5) Communication management (6) Risk management (7) Procurement management (contract administration) <p>3. Project termination</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Project management
Other Special Note	*1 FP: Function Point *2 WBS: Work Breakdown Structure

Unit 13 Service Management (Lecture 90 minutes)	
Learning Goal	Can, explain significance, a purpose, and a concept of IT service management.
Content	<p>1.Operation management (1)Processes and standardization (2)ITIL *</p> <p>2.Service management (1)Service delivery <ul style="list-style-type: none"> • Service level management (SLM) • Availability management • Capacity management • IT service financial management • Business continuity management, etc. (2)Service support <ul style="list-style-type: none"> • Service desk (helpdesk) • Incident management (fault management) • Problem management • Change management • Resource management • Configuration management etc. </p> <p>3.Service management foundation (1)Gap analysis (2)Risk assessment, etc.</p> <p>4. Facility management (1)Equipment management (2)Facilities management, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Service management
Other Special Note	* ITIL: Information Technology Infrastructure Library

Unit 14 System Audit (Lecture 90 minutes)	
Learning Goal	Can, explain significance of reliability, efficiency and safety assurance of information system through learning roles and contents of system audit.
Content	<ul style="list-style-type: none"> 1.Purpose of system audit 2.Audit planning 3.Audit procedures 4.Audit implementation <ul style="list-style-type: none"> (1)Acquisition and evaluation of audit information (2)Frameworks 5.Audit reporting, etc. 6.Internal control <ul style="list-style-type: none"> (1)IT governance, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] System audit
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish application development skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up 2.Organizing knowledge by exercises
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

b) Table of knowledge items **: Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			3	Technology element	7	Human interface	1	Human interface technology	
							2	Interface design	
					8	Multimedia	1	Multimedia technology	
	2	Multimedia application							
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing			
					5	Database application			
	10	Network			1	Network architecture			
					2	Data communication and control			
3					Communications protocol				
4					Network management				
5			Network application						
11	Security	1	Information security						
		2	Information security management						
		3	Security technology evaluation						
		4	Information security measures						
		5	Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition	**			
				4	Software architecture design and software detailed design	**			
				5	Software coding and testing	**			

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests	**	
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	*
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	
Management	5	14	Project management	1	Project integration management		
				2	Project scope management		
				3	Project time management		
				4	Project cost management		
				5	Project quality management		
				6	Project human resources-management		
				7	Project communications management		
				8	Project risk management		
				9	Project procurement management		
	6	Service management	15	Service management	1	Service management	
					2	Operations design and tools	
					3	Service support	
					4	Service delivery	
					5	Service management foundation	
					6	Facility management	
16	System audit	1	System audit	1	System audit		
				2	Internal control		
Strategy	7	17	System strategy	1	Information systems strategy		
				2	Business process		
				3	Solution business	*	
		18	System planning	1	Computerization planning		
				2	Requirements definition		
				3	Procurement planning and implementation		
	8	19	Business strategy management	1	Business strategy techniques		
				2	Marketing		
				3	Business strategy and goal/evaluation		
				4	Business management system		
		20	Technological strategy management	1	Planning of technology development strategy		
				2	Technology development plan		
		21	Business industry	1	Business system		
				2	Engineering system		
				3	e-business		
4	Consumer appliances						
5	Industrial devices						
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory		
				2	OR and IE		
				3	Accounting and financial affairs		

Common Career/Skills Framework				Information-Technology Engineers Examination		Object
Area	Major Category	Middle Category		Minor Category		
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Review of Application Development Fundamentals (1)	Can, explain development processes executed through exercises. Can, explain essential points of <i>Application Development Fundamentals (1)</i> .
Unit 2	Software Development Processes and Exercise Explanation	Can, explain a relation between software development processes and worksheets to be made.
Unit 3	System Proposal Creation	Can, create system proposals and development plans for exercises provided in this subject.
Unit 4	Exercises in Creating Proposals and Development Plans	Can, create system proposals and development plans for exercises provided in this subject.
Unit 5	Explanation of Software Architecture Design	Can, create specifications of software architecture design for exercises provided in this subject.
Unit 6	Exercises in Software Architecture Design	Can, create specifications of software architecture design for exercises provided in this subject.
Unit 7	Explanation of Software Detailed Design	Can, create specifications of software detailed design for exercises provided in this subject.
Unit 8	Exercises in Software Detailed Design	Can, create specifications of software detailed design for exercises provided in this subject.
Unit 9	Explanation of Software Coding and Development Environment	Can, conduct software coding and unit tests for exercises provided.
Unit 10	Exercises in Coding and Testing (1)	Can, conduct coding activities and unit tests for exercises provided.
Unit 11	Exercises in Coding and Testing (2)	Can, conduct coding activities and unit tests for exercises provided.
Unit 12	Tests/Debug	Can, conduct integration tests for exercises provided.
Unit 13	Exercises in Tests/Debug	Can, conduct integration tests for exercises provided.
Unit 14	Result Announcement	Can, explain development project' results produced through exercises provided in this subject.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish application development skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation Review of Application Development Fundamentals (1) (Lecture 90 minutes)	
Learning Goal	Can, explain development processes executed through exercises. Can, explain essential points of Application Development Fundamentals (1).
Content	1.Orientation 2.Review of Application Development Fundamentals (1) and explanation of this subject's learning goals
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All of Application Development Fundamentals (1))
Other Special Note	Lectures and exercises are executed alternately from Unit 2 onward. The attendees are divided into groups during Unit 1 for following Exercise in Group.. If development activities cannot be completed in each unit, the rest of them can be assigned as homework.

Unit 2 Software Development Processes and Exercise Explanation (Lecture 60 minutes + Exercise in Group 30 minutes)	
Learning Goal	Can, explain a relation between software development processes and worksheets to be made.
Content	<ol style="list-style-type: none"> 1. Software development processes 2. Development flow and activities 3. Explanation of model cases' specifications
Training and Education Method (Schedule Time)	Lecture 60 minutes Exercise in Group 30 minutes (team sheet creation)
Corresponding Knowledge Item	[Middle category] Software development management techniques [Minor category] Development process and methods
Other Special Note	Explanatory documents about exercise contents are necessary.

Unit 3 System Proposal Creation (Lecture 60 minutes + Exercise in Group 30 minutes)					
Learning Goal	Can, create system proposals and development plans for exercises provided in this subject.				
Content	<ol style="list-style-type: none"> 1.How to create system proposals 2.How to create development plans 3.Explanation of cases 4.Exercise in Group (creating system proposals) 				
Training and Education Method (Schedule Time)	Lecture 60 minutes Exercise in Group 30 minutes				
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>System strategy</td> <td>Solution business</td> </tr> </table>	[Middle category]	[Minor category]	System strategy	Solution business
[Middle category]	[Minor category]				
System strategy	Solution business				
Other Special Note	The attendees perform exercises in the next unit continuously.				

Unit 4 Exercises in Creating Proposals and Development Plans (Exercise in Group 90 minutes)	
Learning Goal	Can, create system proposals and development plans for exercises provided in this subject.
Content	<p>1.Exercise in Group (creating system proposals and development plans)</p> <p>2.Creating review sheets</p>
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>System strategy Solution business</p>
Other Special Note	

Unit 5 Explanation of Software Architecture Design (Lecture 60 minutes + Exercise in Group 30 minutes)	
Learning Goal	Can, create specifications of software architecture design for exercises provided in this subject.
Content	<p>1. Software architecture design</p> <p>(1) How to create specifications</p> <p>(2) Roles and implementation of design review</p> <p>2. Exercise in Group (creating specifications)</p>
Training and Education Method (Schedule Time)	<p>Lecture 60 minutes</p> <p>Exercise in Group 30 minutes</p>
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software requirements definition</p> <p>Software architecture design and software detailed design</p>
Other Special Note	The attendees perform exercises in the next unit continuously.

Unit 6 Exercises in Software Architecture Design (Exercise in Group 90 minutes)	
Learning Goal	Can, create specifications of software architecture design for exercises provided in this subject.
Content	1.Exercise in Group (creating specifications and conducting design review) 2.Creating review sheets
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software requirements definition Software architecture design and software detailed design
Other Special Note	

Unit 7 Explanation of Software Detailed Design (Lecture 60 minutes + Exercise in Group 30 minutes)	
Learning Goal	Can, create specifications of software detailed design for exercises provided in this subject.
Content	<p>1.Basic techniques of software development</p> <p>(1)Analysis</p> <p>(2)Design</p> <p>2.Software detailed design</p> <p>3.Specifications</p> <p>4.Exercise in Group (creating specifications)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Exercise in Group 30 minutes
Corresponding Knowledge Item	<p>[Middle category]</p> <p>System development technology</p> <p>[Minor category]</p> <p>Software requirements definition</p> <p>Software architecture design and software detailed design</p>
Other Special Note	The attendees perform exercises in the next unit continuously.

Unit 8 Exercises in Software Detailed Design (Exercise in Group 90 minutes)	
Learning Goal	Can, create specifications of software detailed design for exercises provided in this subject.
Content	1.Exercise in Group (specifications creation, review conduct) 2.Creating review sheets
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software requirements definition Software architecture design and software detailed design
Other Special Note	

Unit 9 Explanation of Software Coding and Development Environment (Lecture 60 minutes + Hands-on Lab. in Group 30 minutes)	
Learning Goal	Can, conduct software coding and unit tests for exercises provided.
Content	<ol style="list-style-type: none"> 1. Additional explanation of coding <ol style="list-style-type: none"> (1) Coding conventions (2) Development environment to be used 2. Desk check 3. Source code review 4. Unit tests 5. Hands-on lab. in group (programming)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. in group 30 minutes
Corresponding Knowledge Item	<p>[Middle category] System development technology</p> <p>[Minor category] Software coding and testing Software integration and software qualification tests</p>
Other Special Note	The attendees perform exercises in the next unit continuously.

Unit 10 Exercises in Coding and Testing (1) (Hands-on Lab. in Group 90 minutes)	
Learning Goal	Can, conduct coding activities and unit tests for exercises provided.
Content	1.Hands-on lab. in group (coding, review, and tests) 2.Creating review sheets
Training and Education Method (Schedule Time)	Hands-on lab. in group 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 11 Exercises in Coding and Testing (2) (Hands-on Lab. in Group 90 minutes)	
Learning Goal	Can, conduct coding activities and unit tests for exercises provided.
Content	1.Hands-on lab. in group (coding, review, test) 2.Creating review sheets
Training and Education Method (Schedule Time)	Hands-on lab. in group 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 12 Tests/Debug (Lecture 60 minutes + Hands-on Lab. in Group 30 minutes)	
Learning Goal	Can, conduct integration tests for exercises provided.
Content	<ol style="list-style-type: none"> 1.What is a test? 2.How to implement combination tests 3.How to implement integration tests 4.Quality assurance methods 5.Hands-on lab. in group (tests)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. in group 30 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 13 Exercises in Tests/Debug (Hands-on Lab. in Group 90 minutes)	
Learning Goal	Can, conduct integration tests for exercises provided.
Content	1.Hands-on lab. in group (tests, creating unit test item lists, fault management lists, and integration test item lists) 2.Creating review sheets
Training and Education Method (Schedule Time)	Hands-on lab. in group 90 minutes
Corresponding Knowledge Item	[Middle category] System development technology [Minor category] Software coding and testing Software integration and software qualification tests
Other Special Note	

Unit 14 Result Announcement (Exercise in Group 90 minutes)	
Learning Goal	Can, explain development project' results produced through exercises provided in this subject.
Content	1.Result announcement 2.Comments
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 13)
Other Special Note	The attendees prepare and make presentations of what they learned, such as know-how through a series of exercise activities in group. The presentations should include viewpoints of project management (time management, progress management, member management) and quality assurance, etc..

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish application development skills by reviewing the contents they complete through performing exercises.
Content	<ol style="list-style-type: none">1.Final wrap up of lectures, exercises in development, announcements2.Final wrap up of specifications and programs created, etc.
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 13)
Other Special Note	

2. Subject corresponding with Database Fundamentals course

2.1 Database Fundamentals

(1) Subject details

a) Subject description

Subject	Database Fundamentals
Subject Code	B221
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge
Training Road Map (Course Group)	System Development Fundamentals
Training Road Map (Course Name)	Database Fundamentals
Outline	<p>This subject is designed for the attendees to understand or learn following DB related basic knowledge:</p> <ul style="list-style-type: none"> - understand advantages of DB usage and to learn basic functions of RDBMS for effective database system management. - learn basic database models (three-layer schema and logical data models) and data analysis (normalization and ER model) for effective database design. - learn basic usage of SQL (DML, SDL, SML) for RDB data utilization. - learn how to install and construct DBMS and system configuration using databases.
Learning Goal	Can, apply basic knowledge related to database to perform activities such as development, operation and maintenance as a member of an application development team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (Parts of the lectures can be provided via e-learning)
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	<p>[Area]Technology</p> <p>[Major category] [Middle category]</p> <p>3 Technology elements 9 Database</p>

b) Table of knowledge items **: Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			6	Hardware	1	Hardware			
			3	Technology element	7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture	**		
					2	Database design	**		
					3	Data manipulation	**		
					4	Transaction processing	**		
					5	Database application	**		
	10	Network			1	Network architecture			
2					Data communication and control				
3					Communications protocol				
4					Network management				
5			Network application						
11	Security	1	Information security						
		2	Information security management						
		3	Security technology evaluation						
		4	Information security measures						
		5	Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition				
				4	Software architecture design and software detailed design				
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests		
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	
Management	5	Project management	14	Project management	1	Project integration management	
					2	Project scope management	
					3	Project time management	
					4	Project cost management	
					5	Project quality management	
					6	Project human resources management	
					7	Project communications management	
					8	Project risk management	
					9	Project procurement management	
	6	Service management	15	Service management	1	Service management	
					2	Operations design and tools	
					3	Service support	
					4	Service delivery	
					5	Service management foundation	
16	System audit	1	System audit				
		2	Internal control				
Strategy	7	System strategy	17	1	Information systems strategy		
				2	Business process		
				3	Solution business		
		18	System planning	1	Computerization planning		
				2	Requirements definition		
				3	Procurement planning and implementation		
	8	Business strategy	19	Business strategy management	1	Business strategy techniques	
					2	Marketing	
					3	Business strategy and goal/evaluation	
					4	Business management system	
		20	Technological strategy management	1	Planning of technology development strategy		
				2	Technology development plan		
21	Business industry	1	Business system				
		2	Engineering system				
		3	e-business				
		4	Consumer appliances				
		5	Industrial devices				
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory		
				2	OR and IE		
				3	Accounting and financial affairs		

Common Career/Skills Framework			Information-Technology Engineers Examination		Object	
Area	Major Category	Middle Category	Minor Category			
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Database fundamentals	Can, explain issues on data management by file, advantages of using databases, database types, and data management methods of RDBMS.
Unit 2	Basic Functions of RDBMS (Constraints and Security Protection Function)	Can, explain constraints that are used to maintain consistency among tables, columns, and rows. Can, explain security protection functions to protect data of relational databases.
Unit 3	Basic Functions of RDBMS (Transaction Management)	Can, explain functions of RDBMS transaction management.
Unit 4	Basic Functions of RDBMS (Measures against Failure and Recovery)	Can, understand memory, log, and database components of RDBMS. Can, explain its measures against failures and recovery functions.
Unit 5	Database Design (Data Analysis and Normalization)	Can, explain a flow of database design. Can, explain a concept and specific steps of normalization which are requisite techniques of database design.
Unit 6	Database Design (Data Model Creation)	Can, explain a specific concept and how to create an ER model which is an important representation technique of database design. Can, explain outlines of logic design and physical design.
Unit 7	DBMS Installation and Database System Configuration	Can, explain a installation method of DBMS and examples of system configurations using the DBMS.
Unit 8	Search by SQL (Search Condition)	Can, explain features and types of SQL statements. Can, perform basic searches by SELECT statements.
Unit 9h	Search by SQL (Grouping and Sorting)	Can, retrieve data by using SELECT statements with grouping and sorting functions.
Unit 10	Search by SQL (JOIN)	Can, retrieve data by using SELECT statements with JOIN.
Unit 11	Search by SQL (Subqueries)	Can, retrieve data by subqueries and set operations nested in SELECT statements.
Unit 12	Data Modification by SQL/Definition of Transaction and Database	Can, insert, update, and delete tables by using SQL statements. Can define, modify, and delete tables by using SQL statements.
Unit 13	Definition of Database by SQL (Consistency Constraints, Views, Rights)	Can define constraints of tables by using SQL statements. Can create views by using SQL statements.
Unit 14	Overall Practice	Through these overall practices, the attendees review basic knowledge of DBMS and SQL to enrich their understanding. Assignments of this unit follows and latter assignments use former assignments.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish database skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation Database fundamentals (Lecture 90 minutes)			
Learning Goal	Can, explain issues on data management by file, advantages of using databases, database types, and data management methods of RDBMS ^{*1} .		
Content	1.Orientation 2.Data management by file (1)File components • Fields •Records •Record formats (2)File access methods • Sequential access •Direct access (3)File organization • Sequential files •Indexed organization files (4)File problems • Program dependence •Duplication •Conflict 3.Data management by database (1)Outline of databases • Data independence •Data exclusive management (2)Features and advantages of databases (3)Models and types of databases • Hierarchical model •Network model •Relational model 4.Relational algebra 5.DBMS ^{*2} (1)Outline of DBMS (2)System catalog • Repository •Metadata (3)Types of database languages (4)Classification of SQL statements (5)Basic grammar of SQL statements		
Training and Education Method (Schedule Time)	Orientation 30 minutes Lecture 60 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> [Middle category] Database </td> <td style="width: 50%; border: none;"> [Minor category] Database architecture Data manipulation </td> </tr> </table>	[Middle category] Database	[Minor category] Database architecture Data manipulation
[Middle category] Database	[Minor category] Database architecture Data manipulation		
Other Special Note	^{*1} RDBMS: Relational Database Management System ^{*2} DBMS: Database management system		

Unit 2 Basic Functions of RDBMS (Constraints and Security Protection Function) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, explain constraints that are used to maintain consistency among tables, columns, and rows. Can, explain security protection functions to protect data of relational databases.
Content	1. Outline of constraints (1) Roles of constraints 2. <i>UNIQUE</i> constraints (1) Constraints <ul style="list-style-type: none"> • No duplicated values • NULL is acceptable (only one NULL) 3. <i>PRIMARY KEY</i> constraints (1) Constraints <ul style="list-style-type: none"> • No duplicated values • No NULL is acceptable (2) Primary key 4. Reference consistency constraints (1) Parent tables and child tables (2) Constraints <ul style="list-style-type: none"> • Relational maintenance between parent tables and child tables (3) Foreign key 5. Security protection functions (1) User authentication functions <ul style="list-style-type: none"> • User names • Passwords (2) Access control functions <ul style="list-style-type: none"> • Limitation of available data (3) Encryption <ul style="list-style-type: none"> • Wiretapping protection by data encryption 6. Hands-on lab. (constraints and security functions)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Database Transaction processing
Other Special Note	

Unit 3 Basic Functions of RDBMS (Transaction Management) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, explain functions of RDBMS transaction management.
Content	<ol style="list-style-type: none"> 1.Transaction outline <ol style="list-style-type: none"> (1)Transaction definition 2.Understanding of ACID characteristics <ol style="list-style-type: none"> (1)Atomicity (2)Consistency (3)Isolation (4)Durability 3.Commit/roll back <ol style="list-style-type: none"> (1)Completion of transaction processing (commit) (2)Cancellation of transaction processing (roll back) 4.Concurrent control <ol style="list-style-type: none"> (1)Importance of concurrent control 5.Exclusive control <ol style="list-style-type: none"> (1)Exclusive lock (2)Shared lock (3)Lock granularity 6.Deadlock <ol style="list-style-type: none"> (1)Deadlock phenomenon (2)How to prevent deadlock 7.Hands-on lab. (commit/roll back, exclusive control, and deadlock)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Transaction processing
Other Special Note	

Unit 4 Basic Functions of RDBMS (Measures against Failure and Recovery) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, understand memory, log, and database components of RDBMS. Can, explain its measures against failures and recovery functions.
Content	<ol style="list-style-type: none"> 1.DBMS configuration <ol style="list-style-type: none"> (1)DBMS components <ul style="list-style-type: none"> • Memory •Log files •Databases 2.DBMS memory <ol style="list-style-type: none"> (1)Memory for data processing (2)Memory for log storage 3.Log file <ol style="list-style-type: none"> (1)Retention of change history data 4.Databases <ol style="list-style-type: none"> (1)Data retention 5.Failure types <ol style="list-style-type: none"> (1)Transaction failures (abnormal end of transactions) (2)System failures (abnormal end of DBMS) (3)Media failures (destruction of databases) 6.Measures against failures <ol style="list-style-type: none"> (1)Mirroring (database multiplexing) (2)Backup (database copy) 7.Failure recovery <ol style="list-style-type: none"> (1)Recovery of transaction failures (rollback) (2)Recovery of system failures (recovery by roll forward) (3)Recovery of media failures (restore, recovery) 8.Hands-on lab. (measures against failures /to recovery)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Transaction processing
Other Special Note	

Unit 5 Database Design (Data Analysis and Normalization) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, explain a flow of database design. Can, explain a concept and specific steps of normalization which are requisite techniques of database design.
Content	<p>1.Design outline</p> <p>2.Three-level schema</p> <p>(1)External schema</p> <p>(2)Conceptual schema</p> <p>(3)Internal schema</p> <p>3.Database design flow</p> <p>(1)Data analysis</p> <p>(2)Logical design</p> <p>(3)Physical design</p> <p>4.Data analysis</p> <p>(1)Bottom-up approach</p> <p>(2)Processes of bottom-up approach</p> <p>(3)Advantages and disadvantages of bottom-up approach</p> <p>5.Top-down approach</p> <p>(1)Processes of top-down approach</p> <p>(2) Advantages and disadvantages of top-down approach</p> <p>6.Normalization</p> <p>(1)Purpose of normalization</p> <p>(2)First normalization</p> <ul style="list-style-type: none"> • Detailed processes of first normalization <p>(3)Second normalization</p> <ul style="list-style-type: none"> • Detailed processes of second normalization • Functional dependency • Full functional dependency and partial functional dependency <p>(4)Third normalization</p> <ul style="list-style-type: none"> • Detailed processes of third normalization <p>7.Entity integration</p> <p>(1)Entity integration of a same primary key</p> <p>8.Hands-on lab. (normalization)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Database design
Other Special Note	

Unit 6 Database Design (Data Model Creation) (Lecture 60 minutes + Hands-on Lab. 30 minutes)			
Learning Goal	Can, explain a specific concept and how to create an ER model which is an important representation technique of database design. Can, explain outlines of logic design and physical design.		
Content	<ol style="list-style-type: none"> 1.Creating data models 2.Relationship <ol style="list-style-type: none"> (1)Entity (2)Instance (3)Relationship 3.Cardinality <ol style="list-style-type: none"> (1)One-to-one relation (2)One-to-many relation (3)Many-to-many relation 4.ER model <ol style="list-style-type: none"> (1)P.P.Chen notation (2)Information Engineering (IE) notation (3)Up-arrow notation 5.Outline of logic design <ol style="list-style-type: none"> (1)Design of tables (2)Design of indexes (3)Design of views (4)Design of consistency constraints 6.Outline of physical design <ol style="list-style-type: none"> (1)Purposes of physical design (system performance enhancement) (2)Use and selection of indexes (3)Physical configuration of databases on storage media 7.Hands-on lab. (ER model) 		
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Database</td> <td style="width: 50%; border: none;">[Minor category] Database design Transaction processing</td> </tr> </table>	[Middle category] Database	[Minor category] Database design Transaction processing
[Middle category] Database	[Minor category] Database design Transaction processing		
Other Special Note			

Unit 7 DBMS Installation and Database System Configuration (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, explain a installation method of DBMS and examples of system configurations using the DBMS.
Content	<p>1.DBMS selection</p> <p>(1)Functions (automation, GUI, parallel processing)</p> <p>(2)Processing performance (transactions, searches)</p> <p>(3)Data size limit (number of tables, number of columns)</p> <p>(4)Cost (license cost, management cost)</p> <p>2.DBMS installation</p> <p>(1)Installation, parameter setting</p> <p>(2)User creation, granting rights</p> <p>(3)Database area allocation</p> <p>3.DBMS architecture</p> <p>(1)Creating tables, indexes, and views</p> <p>(2)Granting access rights</p> <p>4.Database system configuration</p> <p>(1)Client/server configuration</p> <p>(2)Three-tier architecture</p> <p>5.Distributed database components</p> <p>(1)Distributed transactions</p> <p>(2)Two-phase commitment</p> <p>(3)Replication</p> <p>6.Data warehouses</p> <p>(1)Features of data warehouses</p> <p>(2)Types of data warehouses (central warehouse, data mart)</p> <p>(3)Configuration of data warehouse systems (ETL, DBMS, OLAP, data mining)</p> <p>7.Hands-on lab. (DBMS architecture, data warehouses)</p>
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Database application
Other Special Note	

Unit 8 Search by SQL (Search Condition) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, explain features and types of SQL statements. Can, perform basic searches by SELECT statements.
Content	<p>1.Features and types of SQL</p> <p>(1)SQL-SDL (schema definition language)</p> <p>(2)SQL-SML (schema manipulation language)</p> <p>(3)SQL-DML (data manipulation language)</p> <p>2.Data type</p> <p>(1)Character type</p> <p>(2)National character type</p> <p>(3)Numeric type</p> <p>(4)Date type</p> <p>3.Queries in tables</p> <p>(1)Basic grammar of SELECT statements</p> <p>(2)Queries in all columns of tables</p> <p>(3)Elimination of duplicate data by DISTINCT clauses</p> <p>4.Conditional searches</p> <p>(1)WHERE clauses</p> <p>(2)Comparison predicates</p> <p>(3)BETWEEN predicates</p> <p>(4)IN predicates</p> <p>(5)LIKE predicates</p> <p>(6)NULL predicates</p> <p>(7)Complex conditions (AND, OR, NOT)</p> <p>5.Arithmetic operators</p> <p>(1)Types of arithmetic operators (+, -, *, /)</p> <p>(2)Specifying column alias (AS clauses)</p> <p>6.Hands-on lab. (search conditions)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Database Data manipulation
Other Special Note	

Unit 9 Search by SQL (Grouping and Sorting) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, retrieve data by using SELECT statements with grouping and sorting functions.
Content	<p>1.Searches with grouping functions</p> <p>(1)SUM set functions (sum total of specified columns)</p> <p>(2)AVG set functions (average of specified columns a)</p> <p>(3)MAX set functions (maximum value of specified columns)</p> <p>(4)MIN set functions (minimum value of specified columns)</p> <p>(5)COUNT set functions (number of data cases)</p> <p>(6)Grouping rows by GROUP BY clauses</p> <p>(7)Selecting rows by HAVING clauses</p> <p>2.Sorting search results</p> <p>(1)How to use ORDER BY clauses</p> <p>(2)Ascending sort by ASC</p> <p>(3)Descending sort by DESC</p> <p>(4)Sorting rows by two or more columns as keys</p> <p>(5)How to use integers to identify Nth columns of result tables as keys in ORDER BY clauses</p> <p>3.Hands-on lab. (grouping and sorting)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Data manipulation
Other Special Note	

Unit 10 Search by SQL (JOIN) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, retrieve data by using SELECT statements with JOIN.
Content	<p>1.INNER JOIN</p> <p>(1)Mechanism of JOIN (2)How INNER JOIN works (3)JOIN keys (4)Notation of INNER JOIN (5)How to use duplicated column names (6)How to use correlation names</p> <p>2.OUTER JOIN</p> <p>(1)Differences between INNER JOIN and OUTER JOIN (2)How LEFT OUTER JOIN works (3)Notation of LEFT OUTER JOIN (4)How RIGHT OUTER JOIN works (5)Notation of RIGHT OUTER JOIN (6)How FULL OUTER JOIN works (7)Notation of FULL OUTER JOIN</p> <p>3.Hands-on lab. (JOIN)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Database Data manipulation
Other Special Note	

Unit 11 Search by SQL (Subqueries) (Lecture 60 minutes + Hands-on lab. 30 minutes)	
Learning Goal	Can, retrieve data by subqueries and set operations nested in SELECT statements.
Content	<p>1.Subqueries</p> <p>(1)Mechanism of subqueries</p> <p>(2)How subqueries work</p> <p>(3)Qualifier (ALL, ANY, SOME)</p> <p>(4)Subqueries not using qualifiers</p> <p>(5)Subqueries using qualifiers; ANY, SOME</p> <p>(6)Subqueries using a qualifier ALL</p> <p>(7)Subqueries using EXSTS predicates</p> <p>(8)Subqueries using NOT EXSTS predicates</p> <p>2.Outline of set operations</p> <p>(1)Mechanism of searches using set operations</p> <p>(2)Preconditions to use set operations</p> <p>3.Set operator UNION</p> <p>(1)How set operations using UNION work</p> <p>(2)Notation of set operations using UNION</p> <p>4.Set operator EXCEPT</p> <p>(1)How set operations using EXCEPT work</p> <p>(2)Notation of set operations using EXCEPT</p> <p>5.Set operator INTERSECT</p> <p>(1)How set operations using INTERSECT work</p> <p>(2)Notation of set operations using INTERSECT</p> <p>6.Hands-on lab. (subqueries)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Database Data manipulation
Other Special Note	

Unit 12 Data Modification by SQL/Definition of Transaction and Database (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, insert, update, and delete tables by using SQL statements. Can define, modify, and delete tables by using SQL statements.
Content	<p>1.Data insertion</p> <p>(1)Notation of INSERT statements</p> <p>(2)Insertion by providing all columns' values of a raw</p> <p>(3)Insertion by providing specific columns' values of a raw</p> <p>(4)How to insert results of SELECT statements</p> <p>2.Data update</p> <p>(1)Notation of UPDATE statements</p> <p>(2)How to describe WHERE clauses in UPDATE statements</p> <p>3.Data deletion</p> <p>(1)Notation of DELETE statements</p> <p>(2)How to describe of WHERE clauses in DELETE statements</p> <p>4.Determination and cancelation of updating processes</p> <p>(1)Completion of transactions (COMMIT)</p> <p>(2)Cancelation of transactions (ROLLBACK)</p> <p>5.Database definition</p> <p>(1)Schema contents (definitions of tables, views, rights)</p> <p>6.Table definition</p> <p>(1)Table creation by CREATE TABLE statements</p> <p>(2)Table modification by ALTER TABLE statements</p> <p>(3)Table deletion by DROP TABLE statements</p> <p>7.Hands-on lab. (data modification, transactions, table definition)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Data manipulation
Other Special Note	

Unit 13 Definition of Database by SQL (Consistency Constraints, Views, Rights) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can define constraints of tables by using SQL statements. Can create views by using SQL statements.
Content	<p>1.How to define constraints</p> <p>(1)Column constraints</p> <p>(2)Table constraints</p> <p>2.NOT NULL constraints</p> <p>(1)Definition of NOT NULL constraints as column constraints</p> <p>3.PRIMARY KEY constraints</p> <p>(1)Definition of PRIMARY KEY constraints as column constraints</p> <p>(2)Definition of PRIMARY KEY constraints as table constraints</p> <p>4.UNIQUE constraints</p> <p>(1)Definition of UNIQUE constraints as column constraints</p> <p>(2)Definition of UNIQUE constraint as table constraints</p> <p>5.Referential integrity constraints</p> <p>(1)Definition of reference consistency constraints as column constraints</p> <p>(2)Reference consistency constraints as table constraints</p> <p>6.Check constraints</p> <p>(1)Definition of check constraints as column constraints</p> <p>(2)Definition of check constraints as table constraints</p> <p>7.View</p> <p>(1)View definition by CREATE VIEW statements</p> <p>(2)View deletion by DROP VIEW statements</p> <p>8.Granting or revoking rights</p> <p>(1)Granting rights by GRANT statements</p> <p>(2)Revoking rights by REVOKE statements</p> <p>9.Hands-on lab. (definitions of constraints, views, and rights)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Database [Minor category] Transaction processing
Other Special Note	

Unit 14 Overall Practice (Hands-on Lab. 90 minutes)	
Learning Goal	Through these overall practices, the attendees review basic knowledge of DBMS and SQL to enrich their understanding. Assignments of this unit follows and latter assignments use former assignments.
Content	<p>1.Normalization (1)Normalization of data bases on given themes • First normalization •Second normalization •Third normalization</p> <p>2.Data model creation (1)Data model based on the result of assignment 1.Normalization (drawing E-R diagrams)</p> <p>3.Logical design (table design) (1)Table design based on the result of assignment 2.Data model creation • Table name •Column name •Data type • Constraint</p> <p>4.Logic design (view design) (1)View design to show requested data</p> <p>5.Table creation (1)Table creation based on the result of assignment 3.Logical design (table design) by CREATE TABLE statements</p> <p>6.View creation (1)Table creation based on the result of assignment 4.Logical design (view design) by CREATE TABLE statements</p> <p>7.Granted privileges (1)Privilege settings that allow access to tables created by other users</p> <p>8.Data insertion (1)Data insertion by INSERT statements based on the result of assignment 5.Table creation</p> <p>9.Data searches (1)Creation of SELECT statements that search requested data</p> <p>10.Data modification (1)Creation of UPDATE statements that modify data</p> <p>11.Data deletion (1)Creation of DELETE statements that delete unnecessary data</p>
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Database
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish database skills by reviewing the contents they complete through performing exercises.
Content	1.Final wrap up (1)Database types (2)Functions of database management system (DBMS) (3)Database design (4)Database systems (5)Data warehouses (6)Data searches by SQL (7)Data modification by SQL (8)Database definition
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

3. Subject corresponding with Network Fundamentals course

3.1 Network Fundamentals (1)

(1) Subject details

a) Subject description

Subject	Network Fundamentals (1)
Subject Code	B231
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge
Training Road Map (Course Group)	System Development Fundamentals
Training Road Map (Course Name)	Network Fundamentals
Outline	This subject is designed for the attendees to acquire knowledge of network system configuration and its construction technology. They learn also whole image of networks including types and features of networks, importance of network protocols, OSI reference models, and TCP/IP.
Learning Goal	Can, apply basic knowledge related to network to perform proposal activities as a member of network design/construction team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (Parts of the lectures can be provided via e-learning)
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	[Area] Technology [Major category] [Middle category] 3 Technology element 10 Network

b) Table of knowledge items **: Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			3	Technology element	6	Hardware	1	Hardware	
					7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing			
					5	Database application			
	10	Network			1	Network architecture	**		
2					Data communication and control	**			
3					Communications protocol	**			
4			Network management						
5			Network application	**					
11	Security	1	Information security						
		2	Information security management						
		3	Security technology evaluation						
		4	Information security measures						
		5	Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition				
				4	Software architecture design and software detailed design				
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests		
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	
Management	5	14	Project management	1	Project integration management		
				2	Project scope management		
				3	Project time management		
				4	Project cost management		
				5	Project quality management		
				6	Project human resources-management		
				7	Project communications management		
				8	Project risk management		
				9	Project procurement management		
	6	Service management	15	Service management	1	Service management	
					2	Operations design and tools	
					3	Service support	
					4	Service delivery	
					5	Service management foundation	
16	System audit	1	System audit				
		2	Internal control				
Strategy	7	17	System strategy	1	Information systems strategy		
				2	Business process		
				3	Solution business		
		18	System planning	1	Computerization planning		
				2	Requirements definition		
				3	Procurement planning and implementation		
	8	19	Business strategy management	1	Business strategy techniques		
				2	Marketing		
				3	Business strategy and goal/evaluation		
				4	Business management system		
		20	Technological strategy management	1	Planning of technology development strategy		
				2	Technology development plan		
		21	Business industry	1	Business system		
2	Engineering system						
3	e-business						
4	Consumer appliances						
5	Industrial devices						
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory		
				2	OR and IE		
				3	Accounting and financial affairs		

Common Career/Skills Framework				Information-Technology Engineers Examination		Object
Area	Major Category	Middle Category		Minor Category		
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Outline of Network System and Communications Protocols (1)	Can, explain types, usage patterns, and communications methods of networks and roles and a concept of communications protocols.
Unit 2	Communications Protocols (2)	Can, understand a concept of layered protocols through OSI reference models. Can, explain an outline of TCP/IP protocols.
Unit 3	Communications Protocols (3)	Can, explain features of TCP and IP and a concept of routing. Can, set up personal computer networks in typical environment.
Unit 4	LAN (1)	Can, explain specifications and components of LAN.
Unit 5	LAN (2)	Can, explain internetworking devices and LAN system configuration. Can, visualize simple configuration examples of LAN systems.
Unit 6	WAN	Can, explain usage patterns and connection patterns of WAN, types and features of WAN services. Can, roughly select WAN services according to network system requirements.
Unit 7	The Internet Usage and Network Security	Can, explain Internet connection, outlines of DNS and proxy servers, and major network security measures.
Unit 8	TCP/IP Basic Knowledge and IP Basic Functions and Addresses (1)	Can, explain TCP/IP history and its standardization, TCP/IP protocol stacks, TCP/IP communications steps, and basic functions of IP.
Unit 9	IP Basic Functions and Addresses (2)	Can explain IP addresses and execute simple calculations required for IP address design.
Unit 10	Routing/IP Datagram Fragmentation and Reassembly/ARP/IP headers (1)	Can, explain routing and datagram fragmentation/reassembly.
Unit 11	Routing/IP Datagram Fragmentation and Reassembly/ARP/IP headers (2)	Can, explain operations and functions of ARP (Address Resolution Protocol) and IP header constructions.
Unit 12	ICMP and TCP/UDP (1)	Can, explain functions and roles of ICMP (Internet Control Message Protocol), types and concepts of ICMP messages, basic functions and port numbers of TCP. Can execute PC commands using ICMP.
Unit 13	TCP/UDP (2)	Can, explain TCP connection management, window control, flow control, congestion control, and TCP headers.
Unit 14	TCP/UDP (3) and Application Protocols	Can, explain an outline of UDP, types and functions of application protocols.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish network skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation			
Outline of Network System and Communications Protocols (1) (Lecture 90 minutes)			
Learning Goal	Can, explain types, usage patterns, and communications methods of networks and roles and a concept of communications protocols.		
Content	<ul style="list-style-type: none"> 1.Orientation 2.Network usage <ul style="list-style-type: none"> (1)Network usage patterns (client server system) 3.Network types * <ul style="list-style-type: none"> (1)LAN and WAN 4.Basic knowledge of networks <ul style="list-style-type: none"> (1)Transmission mechanism (2)Synchronization mechanism (3)Communications mechanism 5.Outline of communications protocols <ul style="list-style-type: none"> (1)Roles of communications protocols 		
Training and Education Method (Schedule Time)	Orientation 30 minutes Lecture 60 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> [Middle category] Network </td> <td style="width: 50%; vertical-align: top;"> [Minor category] Network architecture Data communication and control Communications protocol </td> </tr> </table>	[Middle category] Network	[Minor category] Network architecture Data communication and control Communications protocol
[Middle category] Network	[Minor category] Network architecture Data communication and control Communications protocol		
Other Special Note	* Wireless LANs are explained as a type of transmission path in Unit 4.		

Unit 3 Communications Protocols (3) (Lecture 45 minutes + Hands-on Lab. 45 minutes)	
Learning Goal	Can, explain features of TCP and IP and a concept of routing. Can, set up personal computer networks in typical environment.
Content	<p>1.IP</p> <p>(1)IP addresses ^{*1}</p> <p>(2)Hands-on lab. (connecting to network)</p> <p>(3)Hands-on lab. (TCP/IP setup)</p> <p>(4)Routing ^{*2}</p> <p>2.Hands-on lab. (networks beyond routers)</p> <p>3.TCP/UDP ^{*3}</p> <p>(1)Port numbers</p> <p>(2)Sequence control</p> <p>(3)Connecting management</p>
Training and Education Method (Schedule Time)	Lecture 45 minutes Hands-on lab. 45 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Communications protocol
Other Special Note	<p>^{*1} Subnet, ideas of CIDR, use of IP address or setup of devices (including PC, DHCP server) are explained in Unit 9.</p> <p>^{*2} Necessary information for routing and its gathering process are explained in Unit 10.</p> <p>^{*3} TCP operations and parameter are explained in the Unit 12.</p>

Unit 4 LAN (1) (Lecture 90 minutes)	
Learning Goal	Can, explain specifications and components of LAN.
Content	<p>1.LAN specifications (1)IEEE802 Committee and WG activities</p> <p>2.LAN components (1)Network topology (2)Transmission paths (3)LAN adapters (4)Media access control</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] Network</p> <p>[Minor category] Network architecture Data communication and control</p>
Other Special Note	

Unit 5 LAN (2) (Lecture 90 minutes)	
Learning Goal	Can, explain internetworking devices and LAN system configuration. Can, visualize simple configuration examples of LAN systems.
Content	<p>1.Internetworking devices</p> <p>(1)Repeaters</p> <p>(2)Bridges *¹</p> <p>(3)Routers *²</p> <p>2.LAN system configuration</p> <p>(1)Floor LAN</p> <p>(2)Backbone LAN</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Data communication and control
Other Special Note	* ¹ Layer 2 switches (switching HUB) are explained in this unit. * ² Layer 3 switches and collision domains are explained in this unit.

Unit 6 WAN (Lecture 90 minutes)							
Learning Goal	Can, explain usage patterns and connection patterns of WAN, types and features of WAN services. Can, roughly select WAN services according to network system requirements.						
Content	<p>1.WAN usage (1)Usage patterns of WAN ^{*1} (2)Connection to WAN</p> <p>2.Types and features of WAN services ^{*2} (1)WAN service construction (2)WAN service types (3)Leased line services (4)Switched line services</p> <p>3.Major WAN services (1)IP-VPN services (2)Wide-area Ethernet services (3)Broadband services</p>						
Training and Education Method (Schedule Time)	Lecture 90 minutes						
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Network</td> <td>Network architecture</td> </tr> <tr> <td></td> <td>Data communication and control</td> </tr> </table>	[Middle category]	[Minor category]	Network	Network architecture		Data communication and control
[Middle category]	[Minor category]						
Network	Network architecture						
	Data communication and control						
Other Special Note	^{*1} It includes an explanation of mobile communications. ^{*2} It includes an explanation of communications services.						

Unit 7 The Internet Usage and Network Security (Lecture 70 minutes + Hands-on Lab. 20 minutes)									
Learning Goal	Can, explain Internet connection, outlines of DNS and proxy servers, and major network security measures.								
Content	<p>1.Connection to the Internet *¹</p> <p>(1)IP address allocation</p> <p>(2)Global/Private addresses</p> <p>2.DNS (Domain Name System)</p> <p>(1)Domain names</p> <p>(2)DNS structure</p> <p>(3)Name resolution</p> <p>3.Hands-on lab. (service usage)</p> <p>4.Proxy servers</p> <p>(1)Relay functions</p> <p>(2)Cache functions</p> <p>5.Web application systems</p> <p>(1)Configuration examples</p> <p>(2)Usage examples</p> <p>(3)Usage techniques *²</p> <p>6.Network security</p> <p>(1)Importance of security</p> <p>(2)Ways of unauthorized access</p> <p>(3)Major security measures</p>								
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes								
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Network</td> <td style="border: none;">Network architecture</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">Communications protocol</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">Network application</td> </tr> </table>	[Middle category]	[Minor category]	Network	Network architecture		Communications protocol		Network application
[Middle category]	[Minor category]								
Network	Network architecture								
	Communications protocol								
	Network application								
Other Special Note	<p>*¹ It includes introductions of an intranet and extranet.</p> <p>*² It includes introductions of CORBA and SOAP.</p>								

Unit 8 TCP/IP Basic Knowledge and IP Basic Functions and Addresses (1) (Lecture 90 minutes)	
Learning Goal	Can, explain TCP/IP history and its standardization, TCP/IP protocol stacks, TCP/IP communications steps, and basic functions of IP.
Content	<ul style="list-style-type: none"> 1. TCP/IP history and its standardization <ul style="list-style-type: none"> (1) TCP/IP history (2) TCP/IP standardization 2. TCP/IP protocol stacks (review) <ul style="list-style-type: none"> (1) Each of layers from network interface layers to application layers 3. TCP/IP data flow <ul style="list-style-type: none"> (1) TCP/IP data flow and frame formats 4. IP basic functions <ul style="list-style-type: none"> (1) IP communications features (2) Routing (3) Datagram fragmentation/reassembly
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">[Middle category] Network</div> <div style="width: 45%;">[Minor category] Communications protocol</div> </div>
Other Special Note	

Unit 9 IP Basic Functions and Addresses (2) (Lecture 90 minutes)	
Learning Goal	Can explain IP addresses and execute simple calculations required for IP address design.
Content	1.IP addresses (1)IP address structure (2)Address classes (3)Subnets (4)CIDR (Classless Inter-Domain Routing)
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Communications protocol
Other Special Note	IP address basic structure is explained in Unit 3.

Unit 11 Routing/IP Datagram Fragmentation and Reassembly/ARP/IP headers (2) (Lecture 30 minutes + Hands-on Lab. 60 minutes)	
Learning Goal	Can, explain operations and functions of ARP (Address Resolution Protocol) and IP header constructions.
Content	1.ARP (1)ARP operations (2)ARP message formats (3)Proxy ARP 2.Hands-on lab. (understanding ARP) 3.IP headers (1)IP header formats (2)IPv6
Training and Education Method (Schedule Time)	Lecture 30 minutes Hands-on lab. 60 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Communications protocol
Other Special Note	

Unit 12 ICMP and TCP/UDP (1) (Lecture 50 minutes + Hands-on Lab. 40 minutes)	
Learning Goal	Can, explain functions and roles of ICMP (Internet Control Message Protocol), types and concepts of ICMP messages, basic functions and port numbers of TCP. Can execute PC commands using ICMP.
Content	<ol style="list-style-type: none"> 1.Functions and roles of ICMP <ol style="list-style-type: none"> (1)Functions, roles and features of ICMP 2.ICMP messages <ol style="list-style-type: none"> (1)ICMP message formats (2)ICMP error messages (3)ICMP inquiry messages 3.Hands-on lab. (understanding of ICMP) 4.Basic functions of TCP <ol style="list-style-type: none"> (1)Features of TCP (2)Sequence numbers and acknowledgements (3)Retransmission control 5.Port numbers <ol style="list-style-type: none"> (1)Scope of port numbers (2)Sockets
Training and Education Method (Schedule Time)	Lecture 50 minutes Hands-on lab. 40 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Communications protocol
Other Special Note	TCP basic knowledge is explained in Unit 3.

Unit 13 TCP/UDP (2) (Lecture 90 minutes)					
Learning Goal	Can, explain TCP connection management, window control, flow control, congestion control, and TCP headers.				
Content	<ol style="list-style-type: none"> 1.Connection management <ol style="list-style-type: none"> (1)Establishing connection (2)Releasing connection (3)Reset 2.Window control <ol style="list-style-type: none"> (1)Window control (2)Retransmission control 3.Flow control <ol style="list-style-type: none"> (1)Mechanism of flow control 4.Congestion control of TCP * <ol style="list-style-type: none"> (1)Slow start (2)Congestion avoidance 5.TCP headers (review) <ol style="list-style-type: none"> (1)TCP header formats 				
Training and Education Method (Schedule Time)	Lecture 90 minutes				
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Network</td> <td style="border: none;">Communications protocol</td> </tr> </table>	[Middle category]	[Minor category]	Network	Communications protocol
[Middle category]	[Minor category]				
Network	Communications protocol				
Other Special Note					

Unit 14 TCP/UDP (3) and Application Protocols (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, explain an outline of UDP, types and functions of application protocols.
Content	<p>1.Hands-on lab. (TCP packet capture) *¹</p> <p>2.UDP</p> <p>(1)UDP basic functions</p> <p>(2)UDP headers</p> <p>3.Application layer protocols</p> <p>(1)DNS</p> <p>(2)WWW</p> <p>(3)E-mail</p> <p>(4)TELNET</p> <p>(5)FTP</p> <p>(6)SNMP</p> <p>(7)IP telephone *²</p>
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Communications protocol
Other Special Note	<p>*¹ Through the hands-on lab., the attendees understand that the followings are performed by TCP communications.</p> <ul style="list-style-type: none"> • At the start of communications: three way handshake • At the end of communications: connection release • Flow control <p>*² VoIP protocols that support IP telephone systems such as SIP are explained in this unit.</p>

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish network skills by reviewing the contents they complete through performing exercises.
Content	<p>1. Final wrap up</p> <ul style="list-style-type: none"> (1) Outline of network systems (2) Communications protocols (3) LAN (4) WAN (5) Internet usage (6) Network security (7) Basic knowledge of TCP/IP (8) Basic functions and addresses of IP (9) Routing (10) IP datagram fragmentation/reassembly (11) ARP (12) IP headers (13) ICMP (14) TCP/UDP (15) Application protocols
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

3.2 Network Fundamentals (2)

(1) Subject details

a) Subject description

Subject	Network Fundamentals (2)
Subject Code	B232
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed Network Fundamentals (1), or possess equivalent knowledge
Training Road Map (Course Group)	System Development Fundamentals
Training Road Map (Course Name)	Network Fundamentals
Outline	<p>This subject is designed for the attendees to learn basic knowledge related to networks including concepts of floor LAN installation, connections between LANs, connections between LAN and the Internet, and acquire techniques of exact procedures in details. They also learn importance of network management, administrator roles, protocols (SNMPs ^{*1}) used in network management, RMON ^{*2} and LAN analyzers.</p> <p>^{*1} SNMP: Simple Network management Protocol ^{*2} RMON: Remote network MONitoring</p>
Learning Goal	Can, apply basic knowledge related to network to perform proposal, design, construction, maintenance activities as a member of network/construction team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (parts of the lectures can be provided via e-learning)
Evaluation	The attendees are evaluated by following methods. Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	<p>[Area]Technology</p> <p>[Major category] [Middle category]</p> <p>3 Technology element 10 Network</p>

b) Table of knowledge items **: Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			3	Technology element	6	Hardware	1	Hardware	
					7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing			
					5	Database application			
	10	Network	1	Network architecture					
2			Data communication and control	**					
3			Communications protocol						
4			Network management	**					
5			Network application	**					
11	Security	1	Information security						
		2	Information security management						
		3	Security technology evaluation						
		4	Information security measures						
		5	Security implementation technology						
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition				
				4	Software architecture design and software detailed design				
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object		
Area	Major Category	Middle Category	Minor Category				
				6	Software integration and software qualification tests		
				7	System integration and system qualification tests		
				8	Software installation		
				9	Software acceptance		
				10	Software maintenance		
			13	Software development management techniques	1	Development process and methods	
					2	Intellectual property application management	
					3	Development environment management	
					4	Configuration management and change control	
Management	5	14	Project management	1	Project integration management		
				2	Project scope management		
				3	Project time management		
				4	Project cost management		
				5	Project quality management		
				6	Project human resources-management		
				7	Project communications management		
				8	Project risk management		
				9	Project procurement management		
	6	Service management	15	Service management	1	Service management	
					2	Operations design and tools	
					3	Service support	
					4	Service delivery	
					5	Service management foundation	
16	System audit	1	System audit				
		2	Internal control				
Strategy	7	17	System strategy	1	Information systems strategy		
				2	Business process		
				3	Solution business		
		18	System planning	1	Computerization planning		
				2	Requirements definition		
				3	Procurement planning and implementation		
	8	Business strategy	19	Business strategy management	1	Business strategy techniques	
					2	Marketing	
					3	Business strategy and goal/evaluation	
					4	Business management system	
		20	Technological strategy management	1	Planning of technology development strategy		
				2	Technology development plan		
21	Business industry	1	Business system				
		2	Engineering system				
		3	e-business				
		4	Consumer appliances				
		5	Industrial devices				
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory		
				2	OR and IE		
				3	Accounting and financial affairs		

Common Career/Skills Framework				Information-Technology Engineers Examination		Object
Area	Major Category	Middle Category		Minor Category		
		23	Legal affaires	1	Intellectual property rights	
				2	Laws on security	
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation LAN Outline and Ethernet (1)	Can, explain LAN types and technology trends, a variety and frame formats of Ethernet.
Unit 2	Ethernet (2) and Application of LAN Switches (1)	Can, explain access control methods, Ethernet construction rules, and basic functions of LAN switches.
Unit 3	Application of LAN Switches (2)	Can, explain a mechanism of realization of full duplex transmission and auto negotiation with LAN switches.
Unit 4	Application of LAN Switches (3)	Can, explain failure preventive measures using LAN switches.
Unit 5	Application of Routers (1)	Can, explain an outline of routers and types of routing protocols.
Unit 6	Application of Routers (2)	Can, explain an outline of typical routing protocols and failure preventive measures using routing protocols.
Unit 7	VLAN/Application of Layer 3 Switches (1)	Can, explain outlines and implementation methods of VLAN, VLAN tagging, and communications between VLANs.
Unit 8	VLAN/Application of Layer 3 Switches (2)/LAN Component Examples and Wireless LAN	Can, explain functions and features of layer 3 switches, examples of LAN components and an outline of wireless LAN.
Unit 9	Outline of Network Management and Network Management Tools (1)	Can, explain purposes and categories of network management and basic tools of the network management. Can, execute commands for the network management used in general personal computers.
Unit 10	Network Management Tools (2) and SNMP (1)	Can, explain network management tools and outlines of SNMP/MIB.
Unit 11	SNMP (2)	Can, explain MIB-II and SNMP. Can, setup and gather information of SNMP on personal computers.
Unit 12	Traffic Management and RMON-MIB (1)	Can, explain outlines of traffic management and RMON-MIB.
Unit 13	Traffic Management and RMON-MIB (2)	Can, gather and analyze information defined in RMON-MIB. Can, understand features of network management tools and use them for network management.
Unit 14	LAN Analyzer	Can, explain an outline of LAN analyzers and network traffic management using the LAN analyzers. Can, use the LAN analyzers to analyze packets.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish network skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation	
LAN Outline and Ethernet (1) (Lecture 90 minutes)	
Learning Goal	Can, explain LAN types and technology trends, a variety and frame formats of Ethernet.
Content	<ul style="list-style-type: none"> 1.Orientation 2.Outline of LAN <ul style="list-style-type: none"> (1)Network types (LAN and WAN) (2)LAN types (3)Connections between LANs (4)Internet connections (5)LAN technology trends 3.Ethernet <ul style="list-style-type: none"> (1)Ethernet history and standardization (2)Frame formats of Ethernet * (3)Ethernet types
Training and Education Method (Schedule Time)	Orientation 30 minutes Lecture 60 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Data communication and control
Other Special Note	

Unit 2 Ethernet (2) and Application of LAN Switches (1) (Lecture 90 minutes)	
Learning Goal	Can, explain access control methods, Ethernet construction rules, and basic functions of LAN switches.
Content	<p>1.Ethernet</p> <p>(1)Ethernet access control methods (CSMA/CD)</p> <p>(2)Ethernet construction rules</p> <p>2.How to use LAN switches</p> <p>(1)Outline, basic functions, and operation methods of LAN switches</p> <p>(2)Collision domains/broadcast domains</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Network Data communication and control</p>
Other Special Note	

Unit 3 Application of LAN Switches (2) (Lecture 90 minutes)	
Learning Goal	Can, explain a mechanism of realization of full duplex transmission and auto negotiation with LAN switches.
Content	<p>1.Application of LAN switches</p> <p>(1)Half duplex transmission and full duplex transmission</p> <p>(2)Conditions of full duplex transmission</p> <p>(3)Flow control</p> <p>(4)Mechanism of auto negotiation *</p> <ul style="list-style-type: none"> • Negotiation priority • Identifying methods of operating modes <p>(5)Measures against auto negotiation failures, etc.</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Network Data communication and control</p>
Other Special Note	

Unit 4 Application of LAN Switches (3) (Lecture 90 minutes)	
Learning Goal	Can, explain failure preventive measures using LAN switches.
Content	1.Application of LAN switches (1)Failure preventive measures (spanning tree and link aggregation)
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Data communication and control
Other Special Note	

Unit 5 Application of Routers (1) (Lecture 90 minutes)	
Learning Goal	Can, explain an outline of routers and types of routing protocols.
Content	<p>1.Outline of routers</p> <p>(1)Outline of routers (functions and roles)</p> <p>(2)Mechanism of path definition (routing)</p> <p>(3)Packet relay</p> <p>2.Routing protocols</p> <p>(1)Types of routing protocols (IGP/EGP)</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Network Data communication and control</p>
Other Special Note	

Unit 6 Application of Routers (2) (Lecture 90 minutes)	
Learning Goal	Can, explain an outline of typical routing protocols and failure preventive measures using routing protocols.
Content	1.Routing protocols (1)Outlines of RIP, OSPF, and BGP (2)Failure preventive measures using routing protocols
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Data communication and control
Other Special Note	

Unit 7 VLAN/Application of Layer 3 Switches (1) (Lecture 90 minutes)	
Learning Goal	Can, explain outlines and implementation methods of VLAN, VLAN tagging, and communications between VLANs.
Content	<p>1.VLAN</p> <p>(1)Functions, usage, and implementation of VLAN</p> <ul style="list-style-type: none"> • Port-based VLAN • MAC address-based VLAN • Protocol-based VLAN • IP subnet-based VLAN <p>(2)VLAN tagging</p> <ul style="list-style-type: none"> • Tag handling • Frame formats,etc. <p>(3)Communications between VLANs</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Network Data communication and control</p>
Other Special Note	

Unit 8 VLAN/Application of Layer 3 Switches (2)/LAN Component Examples and Wireless LAN (Lecture 90 minutes)	
Learning Goal	Can, explain functions and features of layer 3 switches, examples of LAN components and an outline of wireless LAN.
Content	<p>1.Layer 3 switches (1)Functions and features of layer 3 switches</p> <p>2.Examples of LAN configurations (1)Central routing patterns (2)Edge routing patterns (3)Doubling center routing patterns (4)Doubling edge routing patterns (5)Floor LAN switch doubling</p> <p>3.Wireless LAN (1)Outline of wireless LAN (2)Standards (3)IEEE802.11b (4)IEEE802.11a (5)IEEE802.11g (6)IEEE802.11n (7)Security of wireless LAN</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	<p>[Middle category] Network</p> <p>[Minor category] Network architecture Data communication and control</p>
Other Special Note	

Unit 9 Outline of Network Management and Network Management Tools (1) (Lecture 75 minutes + Hands-on Lab. 15 minutes)	
Learning Goal	Can, explain purposes and categories of network management and basic tools of the network management. Can, execute commands for the network management used in general personal computers.
Content	<p>1. Network management outline</p> <p>(1) Purposes of network management</p> <p>(2) Life cycle and operation management of network systems</p> <p>(3) Categories of network management</p> <p>2. Network management tools</p> <p>(1) Basic tools</p> <ul style="list-style-type: none"> • ipconfig • ifconfig • arp • netstat, etc. <p>3. Hands-on lab. (network commands review)</p>
Training and Education Method (Schedule Time)	Lecture 75 minutes Hands-on lab. 15 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 10 Network Management Tools (2) and SNMP (1) (Lecture 90 minutes)	
Learning Goal	Can, explain network management tools and outlines of SNMP/MIB.
Content	1.Network management tools (continued) (1)LAN analyzers * (2)Network management systems 2.SNMP (1)SNMP outline (2)MIB outline
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 11 SNMP (2) (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, explain MIB-II and SNMP. Can, setup and gather information of SNMP on personal computers.
Content	1.SNMP (continued) (1)MIB-II (2)SNMP 2.Hands-on lab. (SNMP)
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 12 Traffic Management and RMON-MIB (1) (Lecture 90 minutes)	
Learning Goal	Can, explain outlines of traffic management and RMON-MIB.
Content	1. Traffic management outline 2. RMON-MIB 3. RMON-MIB (1) RMON-MIB outline (2) Network traffic management using RMON-MIB (3) Group lists of RMON-MIB (4) RMON2-MIB outline
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 13 Traffic Management and RMON-MIB (2) (Hands-on Lab. 90 minutes)	
Learning Goal	Can, gather and analyze information defined in RMON-MIB. Can, understand features of network management tools and use them for network management.
Content	1.Hands-on lab. (RMON-MIB) 2.Hands-on lab. (MRTG)
Training and Education Method (Schedule Time)	Hands-on lab. 90 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 14 LAN Analyzer (Lecture 30 minutes + Hands-on Lab. 60 minutes)	
Learning Goal	Can, explain an outline of LAN analyzers and network traffic management using the LAN analyzers. Can, use the LAN analyzers to analyze packets.
Content	1.LAN analyzers (1)O LAN analyzer outline (major functions and advantages) (2)Information gathering and collection scope of LAN analyzers (3)Use of LAN analyzers by switching HUB 2.Hands-on lab. (LAN analyzers)
Training and Education Method (Schedule Time)	Lecture 30 minutes Hands-on lab. 60 minutes
Corresponding Knowledge Item	[Middle category] [Minor category] Network Network management
Other Special Note	

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish network skills by reviewing the contents they complete through performing exercises.
Content	1. Final wrap up (1) LAN outline (2) Ethernet (3) LAN switches (4) Routers (5) VLAN (6) Layer 3 switches (7) LAN components (8) Wireless LAN (9) Network management (10) Network management tools (11) SNMPs (12) Traffic management (13) RMON-MIB (14) LAN analyzers
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	(All from Unit 1 to Unit 14)
Other Special Note	

4. Subject corresponding with Security Fundamentals course

4.1 Security Fundamentals

(1) Subject details

a) Subject description

Subject	Security Fundamentals
Subject Code	B241
Job Category	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Engineer Fundamentals (1) and IT Engineer Fundamentals (2) and Programming Fundamentals (1) and Programming Fundamentals (2), or possess equivalent knowledge
Training Road Map (Course Group)	System Development Fundamentals
Training Road Map (Course Name)	Security Fundamentals
Outline	This subject is designed for the attendees to acquire wide range of basic security knowledge such as technical terms, structure, and mechanism. They learn also basic concepts of information security including importance of information security, threats and vulnerabilities of information systems, and their magnitude of influence. They learn basic countermeasures against information risks as well.
Learning Goal	Can, apply basic knowledge related to security to develop security systems as a member of application business development team under a supervision of a superior.
Training and Education Method	Lecture, Hands-on lab. (Parts of the lectures can be provided via e-learning)
Evaluation	Attendees are evaluated by following methods Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)
Knowledge Item Classification	[Area] Technology [Major category] [Middle category] 3 Technology elements 11 Security [Area] Strategy [Major category] [Middle category] 9 Corporate and legal affairs 23 Legal affairs

b) Table of knowledge items **: Consider as main items * : Consider as related items

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
Technology	1	Basic theory	1	Basic theory	1	Discrete mathematics			
					2	Applied mathematics			
					3	Theory of information			
					4	Theory of communications			
					5	Theory of measurement and control			
			2	Algorithm and programming	1	Data structure			
					2	Algorithm			
					3	Programming			
					4	Programming languages			
					5	Other languages			
	2	Computer system	3	Computer component	1	Processor			
					2	Memory			
					3	Bus			
					4	Input/output interface			
					5	Input/output device			
			4	System component	1	System configuration			
					2	System evaluation indexes			
			5	Software	1	Operating system (OS)			
					2	Middleware			
					3	File system			
					4	Development tools			
					5	Open source software			
			6	Hardware	1	Hardware			
			3	Technology element	7	Human interface	1	Human interface technology	
							2	Interface design	
	8	Multimedia			1	Multimedia technology			
					2	Multimedia application			
	9	Database			1	Database architecture			
					2	Database design			
					3	Data manipulation			
					4	Transaction processing			
					5	Database application			
	10	Network			1	Network architecture			
2					Data communication and control				
3					Communications protocol				
4					Network management				
5			Network application						
11	Security	1	Information security	**					
		2	Information security management	**					
		3	Security technology evaluation	**					
		4	Information security measures	**					
		5	Security implementation technology	**					
4	Development technology	12	System development technology	1	System requirements definition				
				2	Systems architecture design				
				3	Software requirements definition				
				4	Software architecture design and software detailed design				
				5	Software coding and testing				

Common Career/Skills Framework			Information-Technology Engineers Examination		Object				
Area	Major Category	Middle Category	Minor Category						
				6	Software integration and software qualification tests				
				7	System integration and system qualification tests				
				8	Software installation				
				9	Software acceptance				
				10	Software maintenance				
				13	Software development management techniques	1	Development process and methods		
						2	Intellectual property application management		
						3	Development environment management		
						4	Configuration management and change control		
				Management	5	Project management	14	Project management	1
		2	Project scope management						
		3	Project time management						
		4	Project cost management						
5	Project quality management								
6	Project human resources-management								
7	Project communications management								
8	Project risk management	*							
9	Project procurement management								
6	Service management	15	Service management		1	Service management			
					2	Operations design and tools			
					3	Service support			
					4	Service delivery			
16	System audit	1	System audit	*					
		2	Internal control						
Strategy	7	System strategy	17	System strategy	1	Information systems strategy			
					2	Business process			
					3	Solution business			
		18	System planning	1	Computerization planning				
				2	Requirements definition				
				3	Procurement planning and implementation				
	8	Business strategy	19	Business strategy management	1	Business strategy techniques			
					2	Marketing			
					3	Business strategy and goal/evaluation			
					4	Business management system			
			20	Technological strategy management	1	Planning of technology development strategy			
					2	Technology development plan			
			21	Business industry	1	Business system			
2	Engineering system								
3	e-business								
4	Consumer appliances								
5	Industrial devices								
9	Corporate and legal affairs	22	Corporate activities	1	Management & organization theory				
				2	OR and IE				
				3	Accounting and financial affairs				
		23	Legal affairs	1	Intellectual property rights				

Common Career/Skills Framework				Information-Technology Engineers Examination		Object
Area	Major Category		Middle Category		Minor Category	
				2	Laws on security	**
				3	Laws on labor and transaction	
				4	Other laws, guidelines, and engineer ethics	
				5	Standardization	

(2) Unit details

a) Unit title list

	Title	Learning Goal
Unit 1	Orientation Outline of Information Security Management	Can, explain components of information security and an outline of information security management systems (ISMS).
Unit 2	Risk Analysis and Evaluation	Can, identify threats and vulnerabilities to information assets. Can understand importance of risk analysis and evaluation to implement appropriate security measures.
Unit 3	Law and Guidelines on Information Security	Can, explain outlines of various guidelines, standards, and laws concerning information security.
Unit 4	Unauthorized Access	Can, understand psychology and behavior of those who attempt unauthorized access. Can, select appropriate preventive measures against unauthorized access and attacks.
Unit 5	Viruses	Can, understand types and activities of malicious programs. Can, select appropriate detection methods and handling methods when computers/files are infected and preventive measures against viruses.
Unit 6	Authentication Technology	Can, understand importance of authentication and authentication technology. Can, select appropriate authentication techniques for purposes.
Unit 7	OS Security	Can, understand necessary elements (account management, file system management, service management, log management, etc.) for OS security settings. Can, perform fortification settings.
Unit 8	Application Security	Can, understand mechanisms of DNS, e-mail, Web, and threats of each application. Can, select appropriate preventive measures against threats.
Unit 9	Firewalls	Can, understand an outline of firewalls and various types of access control. Can, select appropriate firewalls to meet security requirements.
Unit 10	IDS and IPS	Can, understand IDS *1 types and each mechanism. Can, select appropriate IDS or IPS *2 to meet security requirements.
Unit 11	Secure Programming	Can, understand an outline of secure programming. Can, identify buffer overflow causes, and implement disinfection and preventive measures.
Unit 12	Cryptography/Signature	Can, understand types and an outline of cryptography, and roles and a mechanism of electronic signature. Can, implement appropriate security measures (ensuring confidentiality and integrity).
Unit 13	PKI	Can, understand how PKI works and what elements are in PKI. Can, propose safe electronic commerce and electronic application systems.
Unit 14	Security Protocols	Can, understand security protocol types and roles. Can, select appropriate security protocols to meet security requirements.
Unit 15	Final Wrap Up	This final wrap up enables the attendees to establish security skills by reviewing the contents they complete through performing exercises.

b) Unit description

Unit 1 Orientation							
Outline of Information Security Management (Lecture 90 minutes)							
Learning Goal	Can, explain components of information security and an outline of information security management systems (ISMS).						
Content	<ul style="list-style-type: none"> 1.Orientation 2.Information security outline <ul style="list-style-type: none"> (1)Information security outline (2)Information assets and risks (3)Threats and vulnerabilities 3.Information security management <ul style="list-style-type: none"> (1)Information security management (2)Standards of information security management 4.Information security policies <ul style="list-style-type: none"> (1)Construction of information security policies (2)Introduction and operations of information security policies (3)Audit of information security 						
Training and Education Method (Schedule Time)	Orientation 30 minutes Lecture 60 minutes						
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category]</td> <td style="width: 50%; border: none;">[Minor category]</td> </tr> <tr> <td style="border: none;">Security</td> <td style="border: none;">Information security</td> </tr> <tr> <td style="border: none;">System audit</td> <td style="border: none;">System audit</td> </tr> </table>	[Middle category]	[Minor category]	Security	Information security	System audit	System audit
[Middle category]	[Minor category]						
Security	Information security						
System audit	System audit						
Other Special Note	This unit includes an explanation concerning information security audit.						

Unit 2 Risk Analysis and Evaluation (Lecture 90 minutes)							
Learning Goal	Can, identify threats and vulnerabilities to information assets. Can understand importance of risk analysis and evaluation to implement appropriate security measures.						
Content	<p>1.Threats and vulnerabilities to information assets</p> <p>(1)Definitions of threats and vulnerabilities</p> <p>(2)Types of threats and / vulnerabilities</p> <p>2.Risk analysis</p> <p>(1)Importance of risk analysis</p> <p>(2)Methods of risk analysis</p> <p>3.Risk evaluation</p> <p>(1)Importance of risk evaluation</p> <p>(2)Methods of risk evaluation</p> <p>4.Risk handling</p>						
Training and Education Method (Schedule Time)	Lecture 90 minutes						
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category]</td> <td>[Minor category]</td> </tr> <tr> <td>Security</td> <td>Information security</td> </tr> <tr> <td>Project management</td> <td>Project risk management</td> </tr> </table>	[Middle category]	[Minor category]	Security	Information security	Project management	Project risk management
[Middle category]	[Minor category]						
Security	Information security						
Project management	Project risk management						
Other Special Note	This unit includes an explanation of risk management in project management.						

Unit 3 Law and Guidelines on Information Security (Lecture 90 minutes)							
Learning Goal	Can, explain outlines of various guidelines, standards, and laws concerning information security.						
Content	<p>1.Guidelines (1)OECD guidelines (2)ISO/IEC standards (3)JIS standards</p> <p>2.Laws on information security (1)Laws Concerning Electronic Signatures and Certification Services ^{*1} (2)Act on the Limitation of Liability for Damages of Specified Telecommunications Service Providers and the Right to Demand Disclosure of Identification Information of the Senders ^{*2} (3)Act concerning the Prohibition of Unauthorized Computer Access ^{*3} (4)Act on the Protection of Personal Information ^{*4} (5)Copyright Law ^{*5}</p>						
Training and Education Method (Schedule Time)	Lecture 90 minutes Laws of Japan						
Corresponding Knowledge Item	<table border="0"> <tr> <td>[Middle category] Security</td> <td>[Minor category] Information security</td> </tr> <tr> <td></td> <td>Security technology evaluation</td> </tr> <tr> <td>Legal affairs</td> <td>Laws on security</td> </tr> </table>	[Middle category] Security	[Minor category] Information security		Security technology evaluation	Legal affairs	Laws on security
[Middle category] Security	[Minor category] Information security						
	Security technology evaluation						
Legal affairs	Laws on security						
Other Special Note	^{*1-5} These are Laws of Japan.						

Unit 4 Unauthorized Access (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	<p>Can, understand psychology and behavior of those who attempt unauthorized access.</p> <p>Can, select appropriate preventive measures against unauthorized access and attacks.</p>
Content	<p>1.Purposes of unauthorized access</p> <p>(1)Information buying and selling, etc.</p> <p>(2)Motivation of unauthorized access</p> <p>2.Preparation of unauthorized access</p> <p>(1)Information gathering/reconnaissance actions/password cracking</p> <p>3.Ways of unauthorized access</p> <p>(1)Service stoppage (DoS, DDoS)</p> <p>(2)Buffer overflow</p> <p>(3)Wire tapping</p> <p>(4)Falsification</p> <p>(5)Backdoor</p> <p>(6)Log falsification, etc.</p> <p>4.Hands-on lab. (password cracking)</p>
Training and Education Method (Schedule Time)	<p>Lecture 70 minutes</p> <p>Hands-on lab. 20 minutes</p>
Corresponding Knowledge Item	<p>[Middle category] Security</p> <p>[Minor category] Information security measures</p>
Other Special Note	

Unit 5 Viruses (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, understand types and activities of malicious programs. Can, select appropriate detection methods and handling methods when computers/files are infected and preventive measures against viruses.
Content	<ol style="list-style-type: none"> 1.Virus types <ol style="list-style-type: none"> (1)Virus types 2.Virus infection routes <ol style="list-style-type: none"> (1)Infection via E-mail (2)Infection via Web access (3)Infection by using infected medium (USB memory, etc.) 3.Virus behavior <ol style="list-style-type: none"> (1)Back door creation (2)Falsification (3)Attacks on organizations or individuals outside (4)Sending infected E-mail sending, etc. 4.Virus detection/measures when computers/files are infected, preventive measures <ol style="list-style-type: none"> (1)Detection (2)Disinfection (3)Prevention 5.Hands-on lab. (virus detection and prevention)
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Information security measures
Other Special Note	

Unit 6 Authentication Technology (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, understand importance of authentication and authentication technology. Can, select appropriate authentication techniques for purposes.
Content	<p>1.Scenes requested authentication and necessary measures</p> <p>(1)Access patterns to information assets and necessary authentication procedures</p> <p>2.Authentication procedures and when they can be used</p> <p>(1>Password authentication and when it can be used</p> <p>(2)Biometrics authentication and when it can be used</p> <p>(3)Authentication devices and when they can be used</p> <p>(4)Authentication protocols and when they can be used</p> <p>(5)Web authentication and when it can be used</p> <p>(6)System authentication and when it can be used</p> <p>(7)Single sign-on and when it can be used</p> <p>3.Hands-on lab. (password authentication, biometrics authentication)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Information security
Other Special Note	

Unit 7 OS Security (Lecture 60 minutes + Hands-on Lab. 30 minutes)			
Learning Goal	Can, understand necessary elements (account management, file system management, service management, log management, etc.) for OS security settings. Can, perform fortification settings.		
Content	<ol style="list-style-type: none"> 1.Patch management <ul style="list-style-type: none"> (1)Patch application methods/management methods 2.Account management <ul style="list-style-type: none"> (1)User types (2)Appropriate access control for different rights 3.File system management <ul style="list-style-type: none"> (1)Owner-users (2)Rights settings (3)File system security, etc. 4.Application/service management <ul style="list-style-type: none"> (1)Unnecessary service stoppage and maintenance of latest AP status (2)Service management 5.Network protection <ul style="list-style-type: none"> (1)Routing (2)Filtering (3)File sharing 6.Log management <ul style="list-style-type: none"> (1)Roles and handling methods of log (2)Log audit 7.Hands-on lab. (OS fortification settings) 		
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes		
Corresponding Knowledge Item	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;">[Middle category] Security</td> <td style="width: 50%; vertical-align: top;">[Minor category] Information security measures Security implementation technology</td> </tr> </table>	[Middle category] Security	[Minor category] Information security measures Security implementation technology
[Middle category] Security	[Minor category] Information security measures Security implementation technology		
Other Special Note	This unit includes an explanation related to secure OSs.		

Unit 8 Application Security (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	Can, understand mechanisms of DNS, e-mail, Web, and threats of each application. Can, select appropriate preventive measures against threats.
Content	<p>1.Web (1)Web mechanism (2)Web servers/browser security measures</p> <p>2.E-mail (1)E-mail mechanism (2)Mail servers/client security measurers</p> <p>3.DNS (1)DNS mechanism (2)DNS server security measures, etc.</p> <p>4.Hands-on lab. (Web servers, browser security settings)</p>
Training and Education Method (Schedule Time)	Lecture 60 minutes Hands-on lab. 30 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Security implementation technology
Other Special Note	

Unit 9 Firewalls (Lecture 60 minutes + Hands-on Lab. 30 minutes)	
Learning Goal	<p>Can, understand an outline of firewalls and various types of access control.</p> <p>Can, select appropriate firewalls to meet security requirements.</p>
Content	<ol style="list-style-type: none"> 1.Firewall outline <ol style="list-style-type: none"> (1)Firewall outline 2.Firewall access control <ol style="list-style-type: none"> (1)Packet filtering (2)Circuit level gateways (3)Application level gateways (4)Stateful inspections 3.NAT (Network Address Translation) <ol style="list-style-type: none"> (1)NAT outline (2)NAT (StaticNAT, DynamicNAT) (3)NAPT 4.Firewall installation and operations <ol style="list-style-type: none"> (1)Rule design (2)Construction design such as DMZ (3)Log analysis 5.Hands-on lab. (firewalls, rule creation)
Training and Education Method (Schedule Time)	<p>Lecture 60 minutes</p> <p>Hands-on lab. 30 minutes</p>
Corresponding Knowledge Item	<p>[Middle category] [Minor category]</p> <p>Security Information security measures</p>
Other Special Note	

Unit 10 IDS and IPS (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, understand IDS ^{*1} types and each mechanism. Can, select appropriate IDS or IPS ^{*2} to meet security requirements.
Content	<p>1.IDS outline (1)IDS functions</p> <p>2.IDS types (1)Network type (2)Host type (3)Hybrid type</p> <p>3.Detection algorithm (1)Fraud detection (2)Abnormal detection</p> <p>4.IDS installation and operations (1)IDS installation and operations (2)IDS limits</p> <p>5.Related technologies (1)IPS (2)Honey pots ^{*3}</p> <p>6.Hands-on lab. (detection by NIDS ^{*4})</p>
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Information security measures
Other Special Note	^{*1} IDS: Intrusion Detection System ^{*2} IPS: Intrusion Prevention System ^{*3} Honey pot: a honey pot is a trap to detect hackers or crackers behavior. ^{*4} NIDS: Network Intrusion Detection System

Unit 11 Secure Programming (Lecture 70 minutes + Hands-on Lab. 20 minutes)			
Learning Goal	Can, understand an outline of secure programming. Can, identify buffer overflow causes, and implement disinfection and preventive measures.		
Content	<ol style="list-style-type: none"> 1. Buffer overflow <ol style="list-style-type: none"> (1) Buffer overflow occurrence mechanism, disinfection measures, preventive measures 2. Secure programming in Web applications <ol style="list-style-type: none"> (1) Measures against cross-site scripting (2) Measures against SQL injections 3. Secure programming in overall applications <ol style="list-style-type: none"> (1) Password handling (2) How to check input values (3) Information leakage from error messages, etc. 4. Hands-on lab. (measures against cross-site scripting, measures against SQL injections) 		
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Security</td> <td style="width: 50%; border: none;">[Minor category] Information security implementation technology</td> </tr> </table>	[Middle category] Security	[Minor category] Information security implementation technology
[Middle category] Security	[Minor category] Information security implementation technology		
Other Special Note			

Unit 12 Cryptography/Signature (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, understand types and an outline of cryptography, and roles and a mechanism of electronic signature. Can, implement appropriate security measures (ensuring confidentiality and integrity).
Content	<ol style="list-style-type: none"> 1. Cryptography outline <ol style="list-style-type: none"> (1) Cryptography outline 2. Common key cryptography, public key cryptography, other cryptography types <ol style="list-style-type: none"> (1) Common key cryptography mechanism and typical algorithm (2) Public key cryptography mechanism and typical algorithm (3) Hybrid schemes (4) Other cryptography types 3. Hash functions <ol style="list-style-type: none"> (1) Hash function features and typical hash functions 4. Electronic signatures <ol style="list-style-type: none"> (1) Importance of authentication (2) Message authentication and entity authentication (3) Features and mechanism of electronic signature 5. Hands-on lab. (file cryptography, file falsification checking)
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Information security
Other Special Note	

Unit 13 PKI (Lecture 70 minutes + Hands-on Lab. 20 minutes)	
Learning Goal	Can, understand how PKI works and what elements are in PKI. Can, propose safe electronic commerce and electronic application systems.
Content	<ol style="list-style-type: none"> 1.Public key certificates <ol style="list-style-type: none"> (1)Public key certificate outline 2.Certification Authority (CA) <ol style="list-style-type: none"> (1)Certification Authority (CA) roles (2)Certification Authority (CA) structure 3.How to use PKI <ol style="list-style-type: none"> (1)Examples of how to use PKI 4.Hands-on lab. (Certification Authority (CA) settings, certificate issuance)
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes
Corresponding Knowledge Item	[Middle category] Security [Minor category] Information security
Other Special Note	Explanations of GPKI *1 and Bridge Certification Authority are included in this unit. *1 GPKI: Government Public Key Infrastructure

Unit 14 Security Protocols (Lecture 70 minutes + Hands-on Lab. 20 minutes)			
Learning Goal	Can, understand security protocol types and roles. Can, select appropriate security protocols to meet security requirements.		
Content	<p>1.Security protocols (1)Scenes where security protocols are required and applied</p> <p>2.Typical security protocols (1)Application layer protocols</p> <ul style="list-style-type: none"> • PGP *¹ • S/MIME *² • SSH *³ <p>(2)Transport layer protocols</p> <ul style="list-style-type: none"> • SSL/TLS *⁴ <p>(3)Network layer protocols</p> <ul style="list-style-type: none"> • IPsec <p>(4)Hands-on lab. (e-mail cryptography and electronic signatures with S/MIME)</p>		
Training and Education Method (Schedule Time)	Lecture 70 minutes Hands-on lab. 20 minutes		
Corresponding Knowledge Item	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">[Middle category] Security</td> <td style="width: 50%; border: none;">[Minor category] Information security measures Information security implementation technology</td> </tr> </table>	[Middle category] Security	[Minor category] Information security measures Information security implementation technology
[Middle category] Security	[Minor category] Information security measures Information security implementation technology		
Other Special Note	<p>*¹ PGP: Pretty Good Privacy *² S/MIME: Multipurpose Internet Mail Extensions *³ SSH: Secure Shell *⁴ SSL/TLS: Secure Sockets Layer/Transport Layer Security</p>		

Unit 15 Final Wrap Up (Lecture 90 minutes)	
Learning Goal	This final wrap up enables the attendees to establish security skills by reviewing the contents they complete through performing exercises.
Content	1. Final wrap up (1) Information security management (2) Risk analysis and evaluation (3) Laws on information security and guidelines (4) Unauthorized access (5) Viruses (6) Authentication technology (7) OS security (8) Application security (9) Firewalls (10) Intrusion detection (IDS, IPS) (11) Secure programming (12) Cryptography/signature (13) PKI (14) Security protocols
Training and Education Method (Schedule Time)	Lecture 90 minutes
Corresponding Knowledge Item	
Other Special Note	

Chapter 4 Subject Details – Corresponding With Personal Skill Fundamentals Course Group -

- 1. Subject Corresponding With Personal Skill Fundamentals Course B3-1
 - 1.1 Personal Skill Fundamentals..... B3-1

1. Corresponding with Personal Skill Fundamentals course

1.1 Personal Skill Fundamentals

(1) Subject details

a) Subject description

Subject	Personal Skill Fundamentals
Subject Code	Common job category
Level Classification (Attendees)	Those who aim to acquire the knowledge of ITSS level 2
Precondition	Have already completed IT Fundamentals 1 and IT Fundamentals 2 course groups, or possess equivalent knowledge
Training Road Map (Course Group)	Personal Skill Fundamentals (leadership, negotiation, and communication)
Training Road Map (Course Name)	Personal Skill Fundamentals
Outline	This subject is designed for attendees to learn basic knowledge related to personnel skills, such as key success factors of any projects (setting goals, organizing teams, communication, clarifying and promoting items in project implementation), basic skills related to leadership (i.e., motivation), effective and efficient communication skills, basic negotiation skills in any business scenes and situations.
Learning Goal	Can, apply the basic knowledge related to basic personal skills that are required of IT professionals to perform business activities as a team member under a supervision of a superior.
Training and Education Method	Lecture, Exercise in Group
Evaluation	The attendees are evaluated by following methods Reports, quantitative questionnaires, knowledge tests, and attitude and effort towards exercises.
Curriculum Structure	1 unit 90 minutes x 15 times (Total number of hours: 22.5 hours)

(2) Unit details

a) Unit title list

	Title	Outline
Unit 1	Orientation Personal Skills Required of IT Professionals	Can, explain an outline of personal skills required of IT professionals demanded by business enterprises.
Unit 2	Communication Skills Required of IT Professionals	Can, apply basic communication skills for practical purposes required of IT professionals demanded by business enterprises.
Unit 3	Communication Basics (Application of Information Passing) (1)	Can, explain communication management as information passing methods that IT professionals should use in business fields.
Unit 4	Communication Basics (Application of Information Passing) (2)	Can, create reports by using communication skills required of IT professionals.
Unit 5	Communication Basics (Information Management)	Can, explain communication management that IT professionals should perform in business fields.
Unit 6	Negotiation Outline	Can, explain principles of negotiation skills required of IT professionals.
Unit 7	Use of Logical Thinking	Can, explain an outline and usage of logical thinking which is important in negotiation.
Unit 8	Use of Problem Solving Technique	Can, explain an outline and usage of problem solving skills which are important in negotiation.
Unit 9	Negotiation Practice (1)	Can, create negotiation planning documents as IT professionals.
Unit 10	Negotiation Practice (2)	Can, negotiate with customers based on negotiation planning documents as IT professionals.
Unit 11	Leadership Basics	Can, explain an outline of leadership required of IT professionals in business enterprises.
Unit 12	Leadership When Projects Start	Can, explain important aspects of leadership bases (keeping motivation, accountability, communication) to motivate team members when projects start.
Unit 13	Leadership When Projects Promoted	Can, solve problems occurred by using leadership skills (defining visions, adjustment skills, relationship building capabilities) when projects are promoted.
Unit 14	Leadership When Projects Executed	Can, solve problems with team members by using leadership skills (resource management, mind).
Unit 15	Feedback and Final Wrap Up	Can, provide feedback to team members by using leadership. The attendees establish personal skills by reviewing the contents they complete.

b) Unit description

Unit 1 Orientation Personal Skills Required of IT Professionals (Lecture 90 minutes)	
Learning Goal	Can, explain an outline of personal skills required of IT professionals demanded by business enterprises.
Content	1.Orientation 2.What is a personal skill required of an IT professional? (1)Circumstances of IT professionals in business fields (2)Why are personal skills important? (3)Personal skills required of IT professionals <ul style="list-style-type: none"> • Business manners • Communication • Leadership • Negotiation (4)Business scenes where personal skills are used <ul style="list-style-type: none"> • To become an IT professional (5)Importance of communication importance in business fields <ul style="list-style-type: none"> • What is communication? • Communication importance • Business scenes where communication skills are used (6)Importance of leadership in business fields <ul style="list-style-type: none"> • What is leadership? • Leadership importance • Business scenes where leadership skills are used (7)Importance of negotiation in business field <ul style="list-style-type: none"> • What is negotiation? • Negotiation importance • Business scenes where negotiation skills are used
Training and Education Method (Schedule Time)	Lecture 90 minutes
Other Special Note	

Unit 2 Communication Skills Required of IT Professionals (Lecture 30 minutes + Exercise in Group 60 minutes)	
Learning Goal	Can, apply basic communication skills for practical purposes required of IT professionals demanded by business enterprises.
Content	<p>1.What is communication required in IT companies? (1)What is communication that IT professionals face? (2)Utilization of communication skills in various business scenes</p> <p>2.What is two-way communication? (1)Communication mechanism (2)Importance of consensus building oriented communication (3)Communication skills that IT professionals should have</p> <p>3.Communication mechanism and processes (1)Communication processes (2)Listening practice in business scenes [Exercise in Group] Listening for problems (Theme) Listening to customers' problems (How) One-on-one (Output) Role playing (3)How to extract information effectively (4)How to ask questions tailored to customers' characteristics [Exercise in Group] Creating interview sheets (Theme) Creating interview sheets to extract customers needs (How) Individual (Output) Interview sheets [Exercise in Group] Extracting information from customers by using questioning skills. (How) One-on-one (Output) Role playing (5)Comprehensible speaking practice in business scenes (reporting/communicating/consulting) (6)Speaking clearly (speaking processes/information gathering, organizing, and conveying) [Exercise in Group] Organizing information (Theme) Organizing information extracted from customers (How) Group (Output) Discussion and presentation on a group basis (7)Consensus building</p> <p>4.Communication skills required of IT professionals (1)Smooth communication practice for purposes [Exercise in Group] Consensus building among team members (Theme) Discussing important actions taken when attendees consider customers' problems (How) Group (Output) Role playing, presentation</p>
Training and Education Method (Schedule Time)	Lecture 30 minutes Exercise in Group 60 minutes
Other Special Note	

Unit 3 Communication Bases (Application of Information Passing) (1) (Lecture 90 minutes)	
Learning Goal	Can, explain communication management as information passing methods that IT professionals should use in business fields.
Content	<p>1.Information passing that IT professionals utilize</p> <p>(1)Importance of information passing in business (2)What is an information passing method? (business documents/presentation) (3)Information passing for purposes (4)How to use information passing skills</p> <p>2.Steps for smooth information passing</p> <p>(1)Information passing processes (2)Notes on when information is conveyed</p> <ul style="list-style-type: none"> • Clarifying purposes • Importance of advance preparation and follow up <p>3.Business documents as communication media</p> <p>(1)What is a business document? (2)Business documents types that IT professionals create (internal/external documents) (3)In order to create trusted business documents</p> <p>4.In order to make high-quality business documents</p> <p>(1)Elements and features of high-quality business documents (reports/minutes/proposals) (2)Elements that improve business document quality (3)Points to make business documents comprehensible (4)Importance of review and its points (5)Notes on IT technical documents creation</p> <p>5.Presentation as information passing</p> <p>(1)Quality requested for presentation (2)IT professional presentation types (sharing/reports/proposals) (3)In order to make trusted presentations</p> <p>6.In order to make high-quality presentations</p> <p>(1)What is a high-quality presentation? (2)Presentation processes (3)Presentation components (scenarios/delivery) (4)Points on when presentations are made</p> <p>7.In order to convey trusted information</p> <p>(1)Importance of information passing in business scenes (2)Conveying high-value information</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Other Special Note	

Unit 4 Communication Bases (Application of Information Passing) (2) (Exercise in Group 90 minutes)	
Learning Goal	Can, create reports by using communication skills required of IT professionals.
Content	[Exercise in Group] Creating reports (Theme) Creating business reports (How) Individual, one-on-one (Output) Creating business reports by individuals, reviewing them one-on-one, and submitting them and their evaluation
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 5 Communication Bases (Information Management) (Lecture 90 minutes)	
Learning Goal	Can, explain communication management that IT professionals should perform in business fields.
Content	<p>1. Communication management</p> <p>(1) What is communication management?</p> <p>(2) Importance of communication management</p> <p>(3) Communication management elements</p> <ul style="list-style-type: none"> • Response capabilities to specific circumstances • Capabilities to judge specific circumstances • Meeting management <p>(4) In order to become a trusted business person</p> <p>2. Response to specific circumstances</p> <p>(1) What is response to specific circumstances?</p> <p>(2) Essential points of situation response capabilities used in business scenes</p> <p>3. Situation judgment capabilities to build consensus</p> <p>(1) What are situation judgment capabilities?</p> <p>(2) Points of situation judgment capabilities used in business scenes</p> <p>4. Organizing effective meetings</p> <p>(1) Clarifying purposes of various meetings</p> <ul style="list-style-type: none"> • Debrief sessions • Place to provide new values • Meetings for solving problems <p>(2) What is a facilitator who leads a meeting efficiently?</p> <p>(3) Facilitator skills</p> <ul style="list-style-type: none"> • Management of group process • Activation of discussion • Consensus building • Understanding of individual characteristic
Training and Education Method (Schedule Time)	Lecture 90 minutes
Other Special Note	

Unit 6 Negotiation Outline (Lecture 90 minutes)	
Learning Goal	Can, explain principles of negotiation skills required of IT professionals.
Content	<p>1.Negotiation skill principles requested in business scenes</p> <p>(1)Various problems that occur in business fields</p> <p>(2)Importance of negotiation</p> <p>(3)What is negotiation?</p> <ul style="list-style-type: none"> • Negotiation bases • Negotiation principles <p>(4)In order to become a trusted negotiator</p> <p>2.Negotiation that IT professionals should practice</p> <p>(1)Value that negotiation generates</p> <p>(2)Negotiation processes</p> <ul style="list-style-type: none"> • Setting goals • Preparation for negotiation • Negotiating processes <p>(3)Negotiation methods</p> <p>3.In order to facilitate smooth negotiation</p> <p>(1)Having mutual ultimate goal images</p> <p>(2)Building strong human relationships</p> <p>(3)Negotiating logically</p> <p>(4)Consensus building by problem solving approaches</p> <p>4.Aiming for ultimate goals</p> <p>(1)Steps after negotiation</p> <p>(2)Performing action items</p>
Training and Education Method (Schedule Time)	Lecture 90 minutes
Other Special Note	

Unit 7 Use of Logical Thinking (Lecture 50 minutes + Exercise in Group 40 minutes)	
Learning Goal	Can, explain an outline and usage of logical thinking which is important in negotiation.
Content	<p>1. Use of logical thinking in negotiation</p> <p>(1) Differences between persuasion and consent</p> <p>(2) Negotiation to make others understand</p> <p>2. What is logical thinking to make others agree?</p> <p>(1) What is logical thinking?</p> <p>(2) Advantages brought by logical thinking</p> <p>(3) Business scenes where logical thinking is used</p> <p>(4) Logical thinking skills</p> <p>(5) Tools for logical thinking</p> <p>(6) Information completeness improvement</p> <p>(7) How to use logic trees</p> <p>[Exercise in Group] Analyzing logically</p> <p>(Theme) Clarifying troubles that occur in business operations and investigating their causes</p> <p>(How) Group</p> <p>(Output) Clarifying troubles and constructing logic trees</p>
Training and Education Method (Schedule Time)	Lecture 50 minutes Exercise in Group 40 minutes
Other Special Note	

Unit 8 Use of Problem Solving Technique (Lecture 30 minutes + Exercise in Group 60 minutes)	
Learning Goal	Can, explain an outline and usage of problem solving skills which are important in negotiation.
Content	<p>1. Problem solving skills in negotiation</p> <p>(1) What is negotiation that involves stakeholders?</p> <p>(2) Problem solving skills to reach consensus building</p> <p>2. Problem solving skills to reach consensus building</p> <p>(1) Problem solving processes</p> <p>(2) Problem definition</p> <p>(3) Problem analysis</p> <p>(4) Selecting a solution</p> <p>(5) Information sharing</p> <p>(6) Importance of consensus building</p> <p>[Exercise in Group] Leading solutions</p> <p>(Theme) Considering solutions for problems occurred in business operations</p> <p>(How) Group</p> <p>(Output) Group discussion using logic trees, presentation</p>
Training and Education Method (Schedule Time)	Lecture 30 minutes Exercise in Group 60 minutes
Other Special Note	

Unit 9 Negotiation Practice (1) (Exercise in Group 90 minutes)	
Learning Goal	Can, create negotiation planning documents as IT professionals.
Content	[Exercise in Group] Negotiation planning documents to negotiate with customers (Theme) Negotiation with customers for system delivery date and price (How) Group (Output) Creating planning documents, presentation
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 10 Negotiation Practice (2) (Exercise in Group 90 minutes)	
Learning Goal	Can, negotiate with customers based on negotiation planning documents as IT professionals.
Content	[Exercise in Group] Negotiation experience (Theme) Negotiation with customers for system delivery date and price (How) Group (customer/person in charge/reviewer) (Output) Negotiation role playing based on negotiation planning documents
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 11 Leadership Basics (Lecture 70 minutes + Exercise in Group 20 minutes)	
Learning Goal	Can, explain an outline of leadership required of IT professionals in business enterprises.
Content	<p>1. Leadership bases and principles requested in business scenes</p> <p>(1) Various problems that occur in business fields</p> <p>(2) Importance of leadership</p> <p>(3) What is leadership?</p> <p>(4) Differences between management and leadership</p> <p>(5) In order to become a trusted leader</p> <p>2. Leadership that IT professionals should have</p> <p>(1) Importance of leadership in projects</p> <p>(2) Performing leadership in projects</p> <ul style="list-style-type: none"> • Setting goals and planning how to proceed projects • Promoting, executing, and managing projects <p>3. Leadership for smooth project management</p> <p>(1) In order to achieve project goals</p> <ul style="list-style-type: none"> • Values generated from teamwork • Actions to achieve goals <p>(2) Communication with team members</p> <ul style="list-style-type: none"> • Understanding individual characteristics • Encouraging actions suited to characteristics • Using teaching and coaching techniques • Importance of feedback <p>(3) In order to maintain and improve motivation</p> <p>(4) Aims for ultimate goals</p> <p>[Exercise in Group] Setting up project goals (Theme) Making plans to hold internal debrief sessions (How) Individual (Output) Creating and submitting project plan worksheets</p>
Training and Education Method (Schedule Time)	Lecture 70 minutes Exercise in Group 20 minutes
Other Special Note	

Unit 12 Leadership When Project Start (Exercise in Group 90 minutes)	
Learning Goal	Can, explain important aspects of leadership bases (keeping motivation, accountability, communication) to motivate team members when projects start.
Content	[Exercise in Group] Offering team members motivation (Theme) Considering notes on when attendees assign tasks to team members in internal debrief sessions (How) Group discussion (Output) Creating and submitting project plan worksheets
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 13 Leadership When Project Promoted (Exercise in Group 90 minutes)	
Learning Goal	Can, solve problems occurred by using leadership skills (defining visions, adjustment skills, relationship building capabilities) when projects are promoted.
Content	[Exercise in Group] Problems solving on a projects (Theme) Occurrence of problems, such as neglecting equipment or making improper venue arrangement during internal brief sessions (How) Group (Output) Discussion, presentation
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 14 Leadership Bases When Project Executed (Exercise in Group 90 minutes)	
Learning Goal	Can, solve problems with team members by using leadership skills (resource management, mind).
Content	[Exercise in Group] Solving problems occurred in projects with team members (Theme) Solving problems occurred when preparing internal report meetings (How) Group discussion (Output) Concrete solutions, problem causes, presentation
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

Unit 15 Feedback and Final Wrap Up (Exercise in Group 90 minutes)	
Learning Goal	Can, provide feedback to team members by using leadership. The attendees establish personal skills by reviewing the contents they complete.
Content	<p>[Exercise in Group] Providing feedback to team members by using virtual cases assuming projects</p> <p>(Theme) Providing feedback to team members after internal debrief sessions</p> <p>(How) 3 persons (superior/person in charge/reviewer)</p> <p>(Output) Reviewing feedback contents, roll playing</p> <p>1. Final wrap up</p>
Training and Education Method (Schedule Time)	Exercise in Group 90 minutes
Other Special Note	

ITSS Model Curriculum - To get level 2 -

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