

**Fundamental Information Technology  
Engineer Examination**  
**(Level 2)**  
**Syllabus**

— **Details of Knowledge and Skills Required for  
the Information Technology Engineers Examination** —

Version 4.0

**IPA**

INFORMATION-TECHNOLOGY PROMOTION AGENCY, JAPAN

Corporate names or product names used in this syllabus are trademarks or registered trademarks of each company and organization.

® and TM are not used in the syllabus.

## CONTENTS

■ INTRODUCTION .....	1
■ CONFIGURATION OF THE SYLLABUS .....	1

### ◆TECHNOLOGY◆

<b>MAJOR CATEGORY 1: BASIC THEORY</b>	
<b>MIDDLE CATEGORY 1: BASIC THEORY .....</b>	<b>2</b>
1. Discrete mathematics .....	2
2. Applied mathematics .....	3
3. Theory of information .....	4
4. Theory of communications .....	5
5. Theory of measurement and control .....	6
<b>MIDDLE CATEGORY 2: ALGORITHM AND PROGRAMMING .....</b>	<b>8</b>
1. Data structure .....	8
2. Algorithm .....	9
3. Programming .....	10
4. Programming languages .....	11
5. Other languages .....	19
 <b>MAJOR CATEGORY 2: COMPUTER SYSTEM</b>	
<b>MIDDLE CATEGORY 3: COMPUTER COMPONENT .....</b>	<b>20</b>
1. Processor .....	20
2. Memory .....	22
3. Bus .....	23
4. Input/output interface .....	23
5. Input/output device .....	24
<b>MIDDLE CATEGORY 4: SYSTEM COMPONENT .....</b>	<b>26</b>
1. System configuration .....	26
2. System evaluation indexes .....	28
<b>MIDDLE CATEGORY 5: SOFTWARE .....</b>	<b>29</b>
1. Operating system .....	29
2. Middleware .....	31
3. File system .....	32
4. Development tools .....	33
5. Open source software .....	34
<b>MIDDLE CATEGORY 6: HARDWARE .....</b>	<b>35</b>
1. Hardware .....	35
 <b>MAJOR CATEGORY 3: TECHNOLOGY ELEMENT</b>	
<b>MIDDLE CATEGORY 7: HUMAN INTERFACE .....</b>	<b>36</b>
1. Human interface technology .....	36
2. Interface design .....	36
<b>MIDDLE CATEGORY 8: MULTIMEDIA .....</b>	<b>38</b>
1. Multimedia technology .....	38
2. Multimedia application .....	39
<b>MIDDLE CATEGORY 9: DATABASE .....</b>	<b>40</b>
1. Database architecture .....	40
2. Database design .....	41
3. Data manipulation .....	42
4. Transaction processing .....	43
5. Database application .....	44
<b>MIDDLE CATEGORY 10: NETWORK .....</b>	<b>45</b>
1. Network architecture .....	45
2. Data communication and control .....	46
3. Communications protocols .....	47

4.	Network management.....	48
5.	Network application .....	49
<b>MIDDLE CATEGORY 11: SECURITY.....</b>		<b>51</b>
1.	Information security .....	51
2.	Information security management.....	53
3.	Security technology evaluation .....	56
4.	Information security measures .....	56
5.	Security implementation technology.....	58
 <b>MAJOR CATEGORY 4: DEVELOPMENT TECHNOLOGY</b>		
<b>MIDDLE CATEGORY 12: SYSTEM DEVELOPMENT TECHNOLOGY .....</b>		<b>59</b>
1.	System requirements definition.....	59
2.	Systems architecture design .....	60
3.	Software requirements definition .....	61
4.	Software architecture design and software detailed design.....	63
5.	Software construction.....	67
6.	Software integration and software qualification tests.....	69
7.	System integration and system qualification tests.....	70
8.	Installation.....	71
9.	Acceptance support .....	72
10.	Maintenance and disposal .....	73
<b>MIDDLE CATEGORY 13: SOFTWARE DEVELOPMENT MANAGEMENT TECHNIQUES.....</b>		<b>75</b>
1.	Development process and methods .....	75
2.	Intellectual property application management.....	77
3.	Development environment management.....	77
4.	Configuration management and change control.....	78

**◆MANAGEMENT◆**

<b>MAJOR CATEGORY 5: PROJECT MANAGEMENT</b>		
<b>MIDDLE CATEGORY 14: PROJECT MANAGEMENT.....</b>		<b>80</b>
1.	Project management .....	80
2.	Project integration management.....	81
3.	Project stakeholder management.....	82
4.	Project scope management .....	82
5.	Project resource management.....	83
6.	Project time management .....	83
7.	Project cost management.....	84
8.	Project risk management .....	85
9.	Project quality management .....	86
10.	Project procurement management .....	86
11.	Project communications management.....	87
 <b>MAJOR CATEGORY 6: SERVICE MANAGEMENT</b>		
<b>MIDDLE CATEGORY 15: SERVICE MANAGEMENT.....</b>		<b>88</b>
1.	Service management.....	88
2.	Service design and transition.....	89
3.	Service management processes .....	89
4.	Service operation.....	92
5.	Facility management .....	93
<b>MIDDLE CATEGORY 16: SYSTEM AUDIT .....</b>		<b>94</b>
1.	System audit .....	94
2.	Internal control .....	96

◆STRATEGY◆

**MAJOR CATEGORY 7: SYSTEM STRATEGY**

<b>MIDDLE CATEGORY 17: SYSTEM STRATEGY .....</b>	<b>97</b>
1. Information systems strategy.....	97
2. Business process.....	100
3. Solution business.....	100
4. System utilization promotion and evaluation .....	101
<b>MIDDLE CATEGORY 18: SYSTEM PLANNING .....</b>	<b>103</b>
1. Computerization planning .....	103
2. Requirements definition .....	103
3. Procurement planning and implementation .....	104

**MAJOR CATEGORY 8: BUSINESS STRATEGY**

<b>MIDDLE CATEGORY 19: BUSINESS STRATEGY MANAGEMENT.....</b>	<b>106</b>
1. Business strategy techniques .....	106
2. Marketing .....	107
3. Business strategy and goal/evaluation.....	108
4. Business management system .....	109
<b>MIDDLE CATEGORY 20: TECHNOLOGICAL STRATEGY MANAGEMENT .....</b>	<b>110</b>
1. Planning of technology development strategy.....	110
2. Technology development plan.....	110
<b>MIDDLE CATEGORY 21: BUSINESS INDUSTRY .....</b>	<b>112</b>
1. Business system.....	112
2. Engineering system .....	113
3. e-business .....	114
4. Consumer appliances.....	115
5. Industrial devices.....	116

**MAJOR CATEGORY 9: CORPORATE AND LEGAL AFFAIRS**

<b>MIDDLE CATEGORY 22: CORPORATE ACTIVITIES .....</b>	<b>117</b>
1. Management and organization theory .....	117
2. OR and IE.....	119
3. Accounting and financial affairs.....	120
<b>MIDDLE CATEGORY 23: LEGAL AFFAIRS.....</b>	<b>123</b>
1. Intellectual property rights .....	123
2. Laws on security .....	124
3. Laws on labor and transaction.....	126
4. Other laws, guidelines, and engineer ethics .....	128
5. Standardization.....	131

This page is intentionally left blank.

## ■ Introduction

The syllabus (subtitled as “details of the knowledge and skills required for the Information Technology Engineers Examination”) for the Fundamental Information Technology Engineer Examination, in which “the scope of exam questions”<sup>1</sup> is described in more detail and the breadth and depth of the knowledge and skills required for Level 2 are organized and clarified, has been defined and then published here.

It is expected that this syllabus will be used effectively as learning guidelines for examinees who aim to pass the examination, and also as instructional guidelines in the educational process within companies and schools.

Please note that the detailed information in this syllabus might be added, changed, or deleted, based on technology trends and other factors.

## ■ Configuration of the Syllabus

This syllabus is intended to show the scope of the morning and afternoon questions on the Fundamental Information Technology Engineer Examination according to the knowledge structure (BOK: Body of Knowledge) of the Common Career/Skills Framework<sup>2</sup> as shown in Figure 1, along with the learning targets and descriptions on a minor category basis.

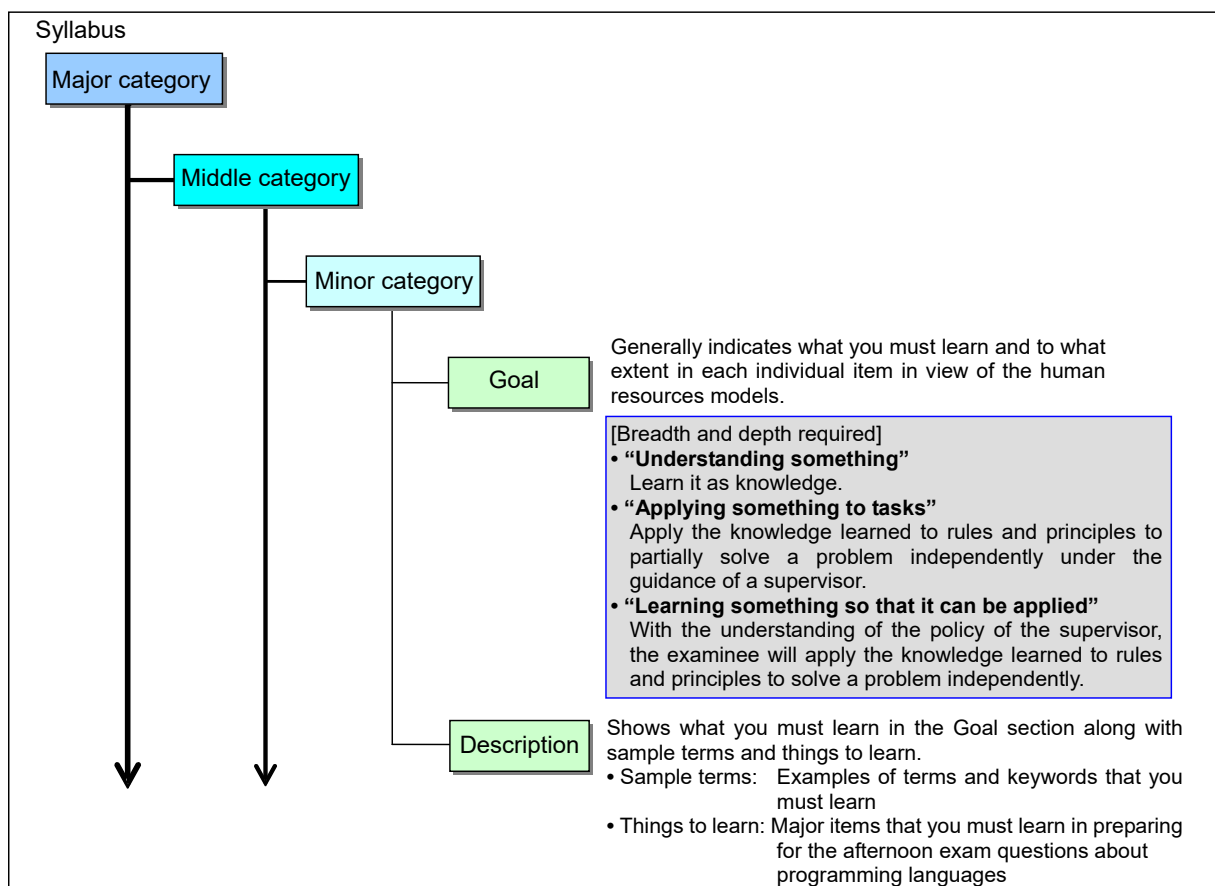


Figure 1 Configuration of the syllabus

<sup>1</sup> “Outline of IT Engineers Examination” 7. Scope on the test  
[http://www.jitec.ipa.go.jp/1\\_04hanni\\_sukiru/\\_index\\_hanni\\_skill.html](http://www.jitec.ipa.go.jp/1_04hanni_sukiru/_index_hanni_skill.html)

<sup>2</sup> Common Career/Skills Framework <http://www.ipa.go.jp/jinzai/itss/csfv1.html>

# Technology

## Major Category 1: Basic Theory Middle Category 1: Basic Theory

### 1. Discrete mathematics

#### [Goal]

- Understand the numeric representations handled by the computer, including the radix, radix conversion, numeric representation, and arithmetic operations and precision so that you can apply them to your tasks.
- Understand the basic rules of and techniques for sets and logical operations so that you can apply them to your tasks.

#### (1) Radix

Understand how the binary, octal, decimal, hexadecimal, and base-n numbers are represented and how you can convert the radices between binary and decimal numbers, for example.

#### (2) Numeric representation

Understand how negative numbers (complement representation) and fractions are represented.

**Sample terms** fixed point number, single-precision floating point number, double-precision floating point number, mantissa, exponent, BCD (Binary Coded Decimal), packed decimal number

#### (3) Arithmetic operations and their precisions

Understand the arithmetic operations performed on the computer, including addition, subtraction, multiplication, and division; range of numbers that can be represented; shift operations; and operation precision (errors and measures against them).

**Sample terms** logical shift, arithmetic shift, cancellation of significant digits, loss of trailing digit, overflow, underflow, single precision, double precision

#### (4) Sets and proposition

Understand the sets and proposition along with the technique and concept of the Venn diagram.

**Sample terms** union sets, product set (intersection set), complement set, subset, true, false, propositional logic

#### (5) Logical operations

Understand the logical expression representation, logical operations, and basic laws including De Morgan's laws and the technique of the truth table.

**Sample terms** negation, logical sum, logical product, exclusive logical sum, negative logical sum, negative logical product, logical function, distributive property



## 2. Applied mathematics

### **[Goal]**

- Understand the techniques for calculating and analyzing probability and statistics so that you can apply them to your tasks.
- Understand fundamental mathematical principles, including numerical analysis, graph algorithms, and queuing theory so that you can apply them to your tasks.

### **(1) Probability and statistics**

#### **(a) Probability**

Understand the permutation, combination, number of cases, and probability and its basic theorems, probability distributions and expected values, and the overview of the Markov process.

**Sample terms** factorial, addition theorem, multiplication theorem, normal distribution, Poisson distribution, exponential distribution

#### **(b) Statistics**

Understand the statistical techniques, including the frequency distribution table, histogram, average, dispersion, correlation, and regression line.

**Sample terms** median, mean, standard deviation, variance, correlation coefficient, estimation, regression analysis

### **(2) Numeric calculation**

Understand the basics of numerical calculations, including solution of simultaneous linear equations.

**Sample terms** matrix, logarithm

### **(3) Numerical analysis**

Understand the techniques for obtaining approximate solutions, including the bisection method and interpolation, along with errors resulting during the calculation process.

**Sample terms** Newton's method, absolute error, relative error, rounding error, truncation error

### **(4) Formula manipulation**

Understand the concept of formula manipulation, which symbolically and algebraically manipulates formulas using a computer.

**Sample terms** factorization, differentiation, integration

### **(5) Graph theory**

Understand the basic concept of the graph theory and how to read graphs.

**Sample term** directed graph

### (6) Queueing theory

Understand the components and concept of the queueing model along with simple calculations in the M/M/1 model.

**Sample terms** service time, waiting time, arrival interval, average arrival rate, average service rate

### (7) Optimization problems

Understand optimization problems and the concepts of the linear programming, PERT, and shortest path problem.

**Sample term** dynamic programming

## 3. Theory of information

### **[Goal]**

- Understand the overview of information and coding theories.
- Understand the overview of theories about information, including predicate logic, formal language, and automaton.
- Understand the overview of AI (artificial intelligence).
- Understand the overview of the compiler and programming language theories along with semantics.

### (1) Information theory

Understand the concept of information contents and the relationship between event occurrence probability and information contents.

### (2) Coding theories

Understand the characteristics of analog and digital representations, quantization, sampling, encoding including A/D conversion, purposes of encoding, and the effects of improvement of various factors such as reliability, efficiency, and security in information transmission.

**Sample terms** channel encoding, Huffman code, data compression

### (3) Character representation

Understand typical character codes including zoned decimal designed for representing decimal data.

**Sample terms** ASCII code, EUC (Extended UNIX Code), JIS code, shift JIS code, Unicode, UCS

### (4) Predicate logic

Understand the basic concept of predicate logic and the difference between deductive inference and inductive inference.

**Sample term** relational database

**(5) Formal language**

Understand the concept of formal languages along with the definitions, operations, types, and grammars. In addition, understand notations including the BNF and syntax chart, regular expressions, and the overview of context-free grammar.

**Sample term** reverse Polish notation

**(6) Automaton**

Understand the concept of finite automaton, relationships with formal languages, state transition table, and state transition diagram.

**(7) Computational complexity**

As a technique for evaluating algorithms, understand how to determine computational complexity and the order notation.

**Sample term** time complexity

**(8) AI (Artificial intelligence)**

Understand the overview of artificial intelligence.

**Sample terms** neural network, expert system, knowledge base, inference engine

**(9) Compiler theory**

Understand the role of the compiler and the processes of compilation along with the basic concepts of lexical analysis, syntactic analysis, and optimization.

**Sample terms** semantic analysis, code generation, intermediate language, object program, formal language, automaton

**(10) Programming language theory**

Understand that different programming languages are used in different applications. In addition, understand the application areas of typical programming languages along with an overview of their concepts, syntax and semantics.

**Sample terms** procedural language, functional language, logic language, object-oriented language

**4. Theory of communications**

**[Goal]**

- Understand the basic technologies and typical methods for transmitting information along with their types and characteristics so that you can apply them to your tasks.

**(1) Transmission theory**

**(a) Transmission path**

Understand how data is transmitted over transmission paths.

**Sample terms** simplex, half duplex, full duplex, serial, parallel

(b) Modulation and demodulation techniques

To transmit digital data through an analog transmission path, it must be modulated before it is sent and then demodulated when it is received. Understand the types and characteristics of typical modulation and demodulation techniques.

**Sample terms** AM (Amplitude Modulation), FM (Frequency Modulation), PM (Phase Modulation), PCM (Pulse Code Modulation)

(c) Multiplexing

Multiplexing allows one transmission path to be concurrently used for multiple communications. Understand the characteristics of typical multiplexing techniques.

**Sample terms** FDM (Frequency Division Multiplexing), TDM (Time Division Multiplexing)

(d) Error detection and correction

Understand the mechanisms of the technologies for enhancing reliability, including even and odd parities.

**Sample terms** CRC, Hamming code, parity check, ECC, checksum

(e) Signal synchronization techniques

Signal synchronization control synchronizes transmission and reception between senders and receivers. Understand the characteristics of typical signal synchronization techniques.

**Sample terms** bit synchronization, character synchronization, flag synchronization, start-stop synchronization, start bit, stop bit, SYN synchronization, frame synchronization

## **5. Theory of measurement and control**

**[Goal]**

- Understand the basic mechanism of signal processing.
- Understand the need for and the basic mechanism of control.

### **(1) Signal processing**

Signal processing is intended to analyze analog waveforms for eliminating noise and extract characteristics. Understand the basic mechanism of signal processing.

**Sample terms** filtering, D/A conversion, A/D conversion

### **(2) Theory of control**

(a) Mechanism of control

Understand the need for and concept of control. Understand the basic mechanisms of control techniques, including feedback control and feed-forward control.

**Sample terms** real-time OS, open loop, response characteristics, control stability

(b) Types of sensors and actuators and their operating characteristics

Understand that computer-based control uses a sensor to detect light volumes, temperatures, and pressures of the objects to be controlled, which the computer converts using an actuator to mechanical actions, including electrically-powered, hydraulically-operated, pneumatically-driven actions to control the target objects under certain conditions.

Understand the need for these actions along with the basic mechanism.

**Sample terms** optical sensor, infrared sensor, magnetic sensor, acceleration sensor, gyro sensor, ultrasonic sensor

**Major Category 1: Basic Theory**  
**Middle Category 2: Algorithm and Programming**

**1. Data structure**

**[Goal]**

- Learn the concept and the basic mechanism of data structures so that you can apply them.
- Learn the types of typical data structures and the characteristics so that you can apply them.

**(1) Data structure**

Understand the concept and basic mechanism of the data structure.

**(2) Types of data structures**

(a) Array

Understand the concept and basic manipulation of the array.

**Sample terms** multidimensional array, static array, dynamic array

(b) List

Understand the basic concept of the list along with how to manipulate it.

**Sample terms** linear list, singly-linked list, doubly-linked list, circular list

(c) Stack and queue

Understand the characteristics and basic manipulation of the stack and queue.

**Sample terms** FIFO, LIFO, push, pop

(d) Tree structure

Understand the types and characteristics of tree structures, tree traversing, node addition and removal, and heap reconfiguration.

**Sample terms** root, leaf, branch, binary tree, complete binary tree, balanced tree, ordered tree, n-ary tree, search tree, binary search tree, depth-first search, breadth-first search, pre-order, post-order, in-order

## 2. Algorithm

### **[Goal]**

- Learn the basic concepts and representation techniques of the algorithm and flowchart so that you can apply them.
- Learn the basics of typical algorithms so that you can apply them.
- Learn the basic method for designing algorithms so that you can apply them.

### **(1) Flowchart**

Understand the concepts of the algorithm and flowchart. Understand how to represent processing steps including symbols, sequence, determination, and iteration.

**Sample terms** terminal, process, predefined processing, decision, loop limit, data, line (flowline)

### **(2) Typical algorithms**

#### (a) Algorithms for sorting, merging, and searching

Understand the basic method for designing algorithms for sorting, merging, and searching.

**Sample terms** selection sort, bubble sort, merge sort, insertion sort, shell sort, quick sort, heap sort, linear search, binary search, hash table search

#### (b) Recursive algorithms

Understand the basics of the recursive algorithm.

#### (c) Graph algorithms

Understand the basics of the graph algorithms.

**Sample terms** depth-first search, breadth-first search, shortest path search

#### (d) Algorithms for character string processing

Understand the basics of the algorithms for character string processing.

**Sample term** string pattern matching

#### (e) Algorithms for file processing

Understand the basics of sorting, merging, control break, and editing used in batch processing and the like.

### **(3) Algorithm design**

Understand that algorithms are expressed using pseudo-languages, flowcharts, decision tables, and others. In addition, understand the basic method for designing algorithms.

**Sample terms** recursion, divide-and-conquer approach

### 3. Programming

#### **[Goal]**

- Learn the programming rules and coding conventions so that you can apply them.
- Learn the basic notations for the grammars of programming languages so that you can apply them.

#### **(1) Programming**

##### (a) Programming rules and coding conventions

Understand the purposes, effects, and types of programming rules and coding conventions. Understand what problems arise if the programming styles or coding conventions are not followed.

**Sample terms** indentation, nest depth, nomenclature conventions, prohibited use of instruction, increased functionality efficiency, usability, maintainability of a program

##### (b) Program structure

Understand the basic structures of programs from the viewpoints of the reliability and maintainability.

**Sample terms** module separation, independence, main routine, subroutine

##### (c) Data type

Understand typical data types used in programming languages.

**Sample terms** integer type, real type, Boolean type, character type, abstract data type, structure type

##### (d) Web programming

Understand the basic mechanism of the web servers and clients. Understand the role of programs in web servers and clients and how to create them.

**Sample terms** server-side programming, rich client, Ajax, Apache, HTML5 technology (canvas, etc.)

#### **(2) Grammar notation**

Understand that BNF and other meta-languages are used to define the syntaxes of programming languages.



## 4. Programming languages

### [Goal]

- Learn the types of programming languages and the characteristics along with the basic description methods so that you can apply to assigned tasks.
- Learn how to use C, COBOL, Java, and assembler language to create programs so that you can apply it.
- Learn how to make use of spreadsheet software so that you apply it.

### (1) Programming languages

#### (a) Development and classification of programming languages

Understand that programming languages underwent development from machine languages to assembler languages, and then to high-level languages. Understand the classification of programming languages.

**Sample terms** procedural language, object-oriented language, script language

#### (b) Procedural languages

Understand the characteristics and basic description methods of typical procedural languages.

**Sample terms** Fortran, COBOL, PL/I, Pascal, BASIC, C

#### (c) Object-oriented languages

Understand the characteristics and basic description methods of typical object-oriented languages.

**Sample terms** Java, C++

#### (d) Script languages

Understand the characteristics and basic description methods of typical script languages.

**Sample terms** ECMAScript, Perl, PHP, Python, Ruby

#### (e) CLI (Common Language Infrastructure)

Understand the characteristics of CLI (Common Language Infrastructure) standardized in JIS X 3016 (ISO/IEC 23271).

**Sample term** CLI (Common Language Infrastructure)

### (2) Knowledge and techniques associated with C

### [Subgoal]

- Learn the basics of how to create C-based programs so that you can apply them.
- Learn how to create programs for performing operations and control, and processing characters so that you can apply it.
- Learn how to use library functions so that you can apply it.
- Learn how to create a program for processing files so that you apply it.

#### (a) Basic programs using C

Create basic programs using C.

**Things to learn** main function, printf function, standard output, comment, header, etc.

(b) Numeric calculation

Create a program that uses the four arithmetic operations.

**Things to learn** four arithmetic operators, variable, expression, integer calculation, type conversion (cast), real number calculation, bit width of a data type, increment operator, decrement operator, comparison operator, etc.

(c) Program using selection statements

Create a program that performs conditional branching using conditional expressions.

**Things to learn** equality operator, relational operator, logical operator, assignment operator, *if* statement, *switch* statement, etc.

(d) Program using iteration statements

Create a program that uses iterative statements.

**Things to learn** *while* statement, *do* statement, *for* statement, etc.

(e) Bit operation

Create a program that uses bit-by-bit operators.

**Things to learn** unsigned integer type, bit shift, etc.

(f) Input processing

Create a program that uses standard input.

**Things to learn** *scanf* function, white-space character, address operator, etc.

(g) Array

Create a program that uses arrays.

**Things to learn** one-dimensional array, two-dimensional array, etc.

(h) Character processing

Create a program for processing characters.

**Things to learn** *putchar* function, *puts* function, *getchar* function, *gets* function, input/output of characters, input/output of strings, string literal, null character, etc.

(i) Pointer

Create a program that uses pointers.

**Things to learn** array of pointers, addition/subtraction of address, etc.

(j) Function

Create functions to create a program that uses them.

**Things to learn** function prototype, void type, recursive call, etc.

(k) Library functions

Create a program that uses library functions.

**Things to learn** preprocessor, #include, #define, preprocessing directive, etc.

(l) Storage-class specification

Create a program that uses storage-class specifiers.

**Things to learn** variable with an automatic storage duration, variable with a static storage duration, register, typedef, storage duration, external definition, etc.

(m) Structure

Create a program that uses structures.

**Things to learn** array of structures, self-referential structure, union, etc.

(n) File processing

Create a program for processing files.

**Things to learn** sequential file processing, random file processing, stream, buffering, etc.

**(3) Knowledge and techniques associated with COBOL**

**[Subgoal]**

- Learn the basics of how to create COBOL-based programs so that you can apply them.
- Learn how to create programs for performing operations and control, processing characters, and manipulating tables so that you can apply it.
- Learn how to create a program for processing files so that you can apply it.

(a) Basic programs using COBOL

Create basic programs using COBOL.

**Things to learn** DIVISION, SECTION, IDENTIFICATION DIVISION, ENVIRONMENT DIVISION, DATA DIVISION, PROCEDURE DIVISION, ACCEPT statement, DISPLAY statement, data structure, data item, data moving, data editing, normalization, comment, etc.

(b) Numeric calculation

Create a program that uses the four basic arithmetic operations.

**Things to learn** COMPUTE statement, arithmetic expression, working storage section, etc.

(c) Program using selection statements

Create a program that performs conditional branch using conditional expressions.

**Things to learn** IF statement, comparison operator, sign condition, class condition, logical operator, nested branch, EVALUATE statement, GO TO statement, STOP statement, etc.

(d) Program using iteration statements

Create a program that uses iterative statements.

**Things to learn** iterative execution with specification of the number of executions, iterative execution with specification of conditions, nested iterative execution, PERFORM statement, etc.

(e) Character processing

Create a program for processing characters.

**Things to learn** “reference modification” of character string, “INSPECT” of character string, “REPLACING” of character string, “STRING” of character string, “UNSTRING” of character string, etc.

(f) Table manipulation

Create a program for manipulating tables.

**Things to learn** concept of tables, one-dimensional table, multi-dimensional table, index, INITIALIZE statement, sequential search, non-sequential search, OCCURS clause, SEARCH statement, etc.

(g) Basics of file processing

Create a program for the I/O processing of sequential files.

**Things to learn** file input/output, form output, data tabulation, control break, matching, etc.

(h) Application of file processing

Create a program that uses relative and indexed files.

**Things to learn** record rewriting (REWRITE), record deletion (DELETE), record positioning (START), record sorting (SORT), record merging (MERGE), etc.

**(4) Knowledge and techniques associated with Java**

**[Subgoal]**

- Learn the basics of how to create Java-based programs so that you can apply them.
- Learn how to create programs for performing operations, control, and the like so that you can apply them.
- Learn how to declare classes and how to use classes by instantiating them so that you can apply them.
- Learn how to use inheritance and an interface for efficient programming so that you can apply it.
- Learn how to create exception handling, parallel processing, and the like so that you apply them.

(a) Basic programs using Java

Create basic programs using Java.

**Things to learn** class, method, main method, standard output, comment, javadoc comment, etc.

(b) Numeric calculation

Create a program that performs the four arithmetic operations.

**Things to learn** data type, type conversion (cast), variable, array, four arithmetic operators, expressions, assignment operator, comparison operator, increment operator, decrement operator, shift operator, etc.

(c) Program using selection statements

Create a program that performs conditional branch using conditional expressions.

**Things to learn** *if* statement, *switch* statement, etc.

(d) Program using iteration statements

Create a program that uses iterative control statements.

**Things to learn** *while* statement, *do* statement, *for* statement, extended *for* statement, etc.

(e) Class and instance

Create a program that uses classes by defining and instantiating them.

**Things to learn** instance variable, instance method, access modifier, reference variable, hiding, constructor, overload, *this*, class variable, class method, string class, package, fully qualified name, *super*, simple name, import declaration, class modifier, etc.

(f) Differential/incremental programming

Create a program that extends the functions of the existing classes and adds function using the interface.

**Things to learn** inheritance, *final*, *extends*, superclass, subclass, object, *implements*, *cast*, *upcast*, *downcast*, *instanceof*, *override*, *dynamic bind*, class library, abstract class, abstract method, base class, subclass, etc.

(g) Exception handling

Create a program that performs exception handling.

**Things to learn** *try* statement, *throw* statement, etc.

(h) Parallel processing

Create a program that performs parallel processing.

**Things to learn** thread, synchronized modifier, *wait()*, *notify()*, etc.

(i) Collection and generics

Create a program that uses collections.

**Things to learn** *add()*, *remove()*, List, Set, Map, Stack, type argument, etc.

(j) Nested class

Create a program that uses nested classes.

**Things to learn** member class, member interface, local class, anonymous class, etc.

(k) Enumeration

Create a program that uses the enumeration type.

**Things to learn** enumeration constant, final variable, etc.

**(5) Knowledge and techniques associated with assembler language (CASL II)**

**[Subgoal]**

- Understand the specifications of the computer system COMET II.
- Learn how to use CASL II to create programs so that you can apply it.
- Learn how to create programs for performing operations and control so that you can apply it.
- Learn how to create programs including the processing using tables and the I/O processing so that you can apply it.
- Learn the mechanisms and usage of stacks and subroutine calls based on stacks so that you can apply them.

(a) COMET II

Understand the register, a component of COMET II, along with the instruction format.

**Things to learn** GR0 through GR7, SP, PR, FR, OF, SF, ZF, comment

(b) Basic programs using CASL II

Create basic programs using CASL II.

**Things to learn** START, END, DS, DC, LD, ST, LAD, effective address

(c) Arithmetical and logical operations

Create a program that uses arithmetical and logical operation instructions.

**Things to learn** ADDA, ADDL, SUBA, SUBL, AND, OR, XOR

(d) Selection and iteration processing

Create a selection-type program and a iteration-type program using comparison operation instructions and branch instructions.

**Things to learn** CPA, CPL, JPL, JMI, JNZ, JZE, JOV, JUMP

(e) Shift operation

Create a program that uses shift operation instructions.

**Things to learn** SLA, SRA, SLL, SRL

(f) Processing that uses tables

Create a program that uses tables (arrays).

**Things to learn** GR1 through GR7, index register

(g) Input/output processing

Create a program that uses the macro instructions IN and OUT to perform input/output processing.

**Things to learn** IN, OUT

(h) Stack

Create a program that performs stack manipulation.

**Things to learn** PUSH, POP, RPUSH, RPOP, CALL, RET

## (6) Spreadsheet software

### [Subgoal]

- Learn the capabilities provided by spreadsheet software, including the calculation and tabulation functions, so that you can apply them.
- Learn the types and usage of functions, so that you can apply them.
- Learn the method of creating macros and use them.
- Learn how spreadsheet software can be used in business operations.

(a) Worksheet

Create basic worksheets and then reference and tabulate data between the created worksheets.

**Things to learn** cell, blank cell, cell address, cell range, reference to a worksheet, relative reference, absolute reference, etc.

(b) Expression

Create expressions using constants, cells, operators, functions, and the like in combination.

**Things to learn** arithmetic expression, literal expression, logical expression, unary operators (+, -), arithmetic operators (+, -, \*, /, ^), comparison operators (=, ≠, >, <, ≥, ≤), etc.

(c) Function

Create expressions by combining a function and numeric values, a function and cells, two or more functions, and so on.

**Things to learn** argument, nested function, sum, average, sample standard deviation, population standard deviation, maximum, minimum, IF, count, conditional count, integer part, remainder, root, logical product, logical sum, negation, round-up, round-off, truncation, join, order, random number, table lookup, vertical checkup, horizontal checkup, checkup search, checkup match, conditional sum, etc.

(d) Macro

Create macros using variables, cell variables, arrays, operators, and functions.

**Things to learn** variable, cell variable, absolute representation, relative representation, array, declaration, comment, substitution, selection process, repetitive process, etc.

(e) Application of spreadsheet software

Apply spreadsheet software to perform business operations such as accounting and performance handling. More specifically, identify the target business operations and implement their algorithms on the spreadsheet software.



## 5. Other languages

### [Goal]

- Understand the types of typical markup languages and their characteristics along with the description methods so that you can apply them.
- Understand the characteristics of other languages used in the computer.

### (1) Markup languages

#### (a) HTML

Understand the characteristics and basic description method of HTML, which is used for creating web pages.

**Sample terms** start tag, end tag, DTD (Document Type Definition), SGML (Standard Generalized Markup Language)

#### (b) XML

Providing the capability of defining original tags besides the functions of HTML, XML is mainly used for data exchanges over the Internet. Understand the characteristics and basic description method of XML.

**Sample terms** DOM (Document Object Model), SOAP (Simple Object Access Protocol), SVG (Scalable Vector Graphics), SAX (Simple API for XML), XML Schema

#### (c) XHTML

XHTML is a markup language that re-defined HTML by using XML. Understand the characteristics and basic description method of XHTML.

**Sample terms** XHTML Basic, Modulation of XHTML

#### (d) Style sheet

Understand that the style sheet is intended for separating the structure of HTML, XML, and other markup languages from the display style. Understand the characteristic and basic description method of the style sheet.

**Sample terms** CSS (Cascading Style Sheets), XSL (Extensible Stylesheet Language)

### (2) Other languages

Understand the characteristics of UML, a notation for object-oriented design.

**Sample terms** class diagram, sequence diagram, object diagram, collaboration diagram, statechart diagram, manipulation, attribute, role name

**Major Category 2: Computer System**  
**Middle Category 3: Computer Component**

**1. Processor**

**[Goal]**

- Understand the types of computers and their configurations so that you can apply them to your tasks.
- Understand the types, architecture, structure, scheme, and operating principles of the processor so that you can apply them to your tasks.
- Understand the indexes for processor performance so that you can apply them to your tasks.
- Understand high-speed and high-reliability technologies for processors so that you can apply them to your tasks.

**(1) Types of computers**

Understand the characteristics and intended purposes of the personal computer (PC), workstation, supercomputer, and the other computers.

**Sample terms** desktop PC, notebook PC, server, mobile devices (smartphone, tablet computer, etc.), general purpose computer, control computer, microcomputer

**(2) Computer configuration**

Understand that the computer consists of five components. Understand how basic control and data flows between the components.

**Sample terms** arithmetic and logical unit, control unit, storage unit, input unit, output unit

**(3) Types of processors**

Understand the types of processors, their basic characteristics, and intended purposes.

**Sample terms** CPU, GPU

**(4) Processor architecture**

Understand that the processor architectures include RISC and CISC. In addition, understand the characteristics of the instruction structures on an architecture-by-architecture basis.

**Sample terms** wired logic control, microprogram control

**(5) Processor structure and features**

Understand the roles of the control unit and processing unit as components of the processor; the roles of the accumulator, register, and instruction decoders as components of the control unit and processing unit; and how the processor performance is related to the system performance.

**Sample terms** accumulator, complementer, instruction address register (instruction counter, program counter, and sequential control counter), instruction register, general register, index register, base register, stack pointer

## **(6) Operating principles of the processor**

### **(a) Mechanism of operations**

Understand that combinations of basic logic circuits, such as AND, OR, and NOT, implement half and full adders to perform operations.

**Sample terms** sequential circuit, combinatorial circuit, NAND circuit

### **(b) Instruction and addressing**

Understand the types of typical machine language instructions, the configuration of instruction words, procedure for executing instructions (instruction fetch, instruction decode, data fetch, and instruction execution), and address modification. Understand the binary representation of machine language operations, along with the correspondence to assembler symbol representation.

**Sample terms** arithmetic operation instruction, logical operation instruction, transfer instruction, comparison instruction, branch instruction, shift instruction, input/output instruction

### **(c) Interrupt**

Understand the mechanism of interrupts and the types of interrupts categorized as internal or external interrupts.

**Sample terms** SVC (SuperVisor Call) interrupt, input/output interrupt

## **(7) Processor performance**

Understand the meaning of the words such as clock frequency, CPI (Cycles Per Instruction), and MIPS.

**Sample terms** cycle time, FLOPS, instruction mix

## **(8) High-speed technology for processors**

Understand the overview of typical high-speed technologies for processors.

**Sample terms** pipeline, super-pipeline, superscalar, VLIW, single-core processor, multicore processor

## **(9) Parallel processing**

Understand the types and characteristics of typical parallel processing.

**Sample terms** SISD, SIMD, MISD, MIMD

## **(10) Multiprocessor system**

It is possible to enhance a system in terms of speed and reliability by equipping it with multiple processors. Understand the typical types and characteristics of such systems.

**Sample terms** loosely coupled multiprocessor system, tightly coupled multiprocessor system, Amdahl's law, synchronization, cluster

## 2. Memory

### **[Goal]**

- Understand the types and characteristics of memory so that you can apply them to your tasks.
- Understand the mechanism of main storage including its configuration, memory system configuration, and storage hierarchy so that you can apply them to your tasks.
- Understand the types of storage media and their characteristics so that you can apply them to your tasks.

### **(1) Types of memory and the characteristics**

Understand that memory comes in different types: semiconductor memory circuits, magnetic memory, optical memory, and so on. In addition, understand the types of semiconductor (IC) memory, along with the characteristics (volatility, non-volatility, access speed, capacity, cost, and physical size), and typical purpose.

**Sample terms** RAM, ROM, DRAM, SRAM, flash memory

### **(2) Main memory configuration**

Understand the configuration of main memory along with address selection, access, and other procedures for accessing data within main memory.

**Sample terms** memory unit, address selection mechanism, read/write mechanism

### **(3) Memory system configuration and storage hierarchy**

Understand how the storage hierarchy is configured along with the purpose and concept of combining storage units with different characteristics to form a hierarchy. Understand how data in cache memory is written to main memory.

**Sample terms** auxiliary memory, disk cache, write through, write back

### **(4) Access method**

Understand the memory interleave for speeding up main memory.

**Sample terms** bank

### **(5) Memory capacity and performance**

Understand the relationship between memory capacity and performance, including access time and cycle time, cache memory hit ratio, effective access time, and so on.

### **(6) Types of storage media and their characteristics**

Understand the characteristics of storage media, including the types of removable storage media, storage capacity, portability, usage, and purposes.

**Sample terms** read-only, write-once, rewritable, hard disk, SSD (Solid State Drive), CD (CD-ROM, CD-R), DVD (DVD-ROM, DVD-RAM, DVD-R), Blu-ray disc, flash memory (USB memory, SD card), streamer, RAM file

### 3. Bus

#### [Goal]

- Understand the overview of the types of buses along with their characteristics and configurations.

#### (1) Types of buses and their characteristics

Understand that buses are transmission paths used for exchanging data within the computer. In addition, understand the types and characteristics of buses along with the overview of classifications, such as internal bus (CPU internal bus), external bus, and expansion bus, and the transfer method.

**Sample terms** address bus, data bus, control bus, system bus, memory bus, input/output bus, serial bus, PCI, parallel bus

#### (2) Bus system configuration

Understand that the bus system configuration is available in two types: one architecture separates instruction fetch from data access, and the other uses the same bus for both instruction fetch and data access.

#### (3) Bus capacity and performance

Understand the bus width and clock frequency, which determine the performance of buses.

**Sample term** bus access mode

### 4. Input/output interface

#### [Goal]

- Understand the types of typical input/output interfaces and their characteristics so that you can apply them to your tasks.
- Understand the basic roles and functions of device drivers.

#### (1) Input/output interfaces

##### (a) Types of input/output interfaces and their characteristics

Understand the types of typical input/output interfaces along with the characteristics, including the transfer method, transmission speed, number of connectable units, and usage.

**Sample terms** USB, RS-232C, IEEE 1394, SCSI, serial ATA, HDMI, Bluetooth, Zigbee, IrDA, NFC

##### (b) Data transmission methods and topologies

Understand the difference between the serial and parallel data transmission methods. In addition, understand the types and characteristics of the topologies used for connecting peripherals.

**Sample terms** analog, digital, star connection, cascade connection, hub, daisy chain, terminator, tree connection

(c) Input/output control methods

Understand the DMA (Direct Memory Access) method, which is a transfer method that can transfer data without any intervention of the CPU, and the channel control method.

Understand the roles of the input/output interruptions.

**Sample terms** program control, DMA (Direct Memory Access)

**(2) Device driver**

Understand the basic role of device drivers, the functions of plug and play and hot plug, and synchronization with devices.

## **5. Input/output device**

**[Goal]**

- Understand the types of typical I/O devices along with their characteristics so that you can apply them to your tasks.
- Understand the types of typical auxiliary storage devices along with their characteristics so that you can apply them to your tasks.

**(1) Input devices**

Understand the types of typical input devices along with their characteristics.

**Sample terms** pointing device (mouse, touch panel, touch screen, joystick, trackball, digitizer, pen tablet, etc.), keyboard, sound input device, image input device (scanner, OCR, OMR, digital camera, etc.), biometric authentication device, barcode reader, magnetic card reader, IC card reader, A/D converter

**(2) Output devices**

Understand the types and characteristics of typical display devices as well as the types and characteristics of typical printers. Understand how to calculate the sizes of image data, for example.

**Sample terms** CRT display, liquid crystal display, TFT liquid crystal, STN liquid crystal, OLED (Organic Light Emitting Diode) display, plasma display, interlaced mode, non-interlaced mode, VGA, SVGA, XGA, electronic paper, impact printer, non-impact printer, serial printer, line printer, page printer, laser printer, inkjet printer, 3D printer, plotter, D/A converter, projector, sound output device

**(3) Auxiliary storage devices**

Understand the types of typical auxiliary storage devices and storage media along with their characteristics.

**Sample terms** hard disk drive, SSD (Solid State Drive), SD card, CD-R/RW drive, Blu-ray drive, DVD- R/RW drive, magnetic tape unit, track, cylinder, blocking factor, IBG (Interblock Gap), sector, defragmentation

**(4) Other I/O devices**

Understand the types of typical communication control units, drive units, and imaging devices, along with their characteristics.

**Sample terms** wired LAN interface card, wireless LAN interface card

## 1. System configuration

### **[Goal]**

- Understand the processing modes, usage, and application areas of systems so that you can apply them to your tasks.
- Understand the types and characteristics of typical system configurations so that you can apply them to your tasks.
- Understand the characteristics and configuration of the client/server system so that you can apply them to your tasks.
- Understand the concept of reliability design for systems so that you can apply them to your tasks.

### **(1) Processing modes, usage, and application areas of systems**

Understand the overview of centralized processing and distributed processing along with their characteristics, the types of processing modes, such as batch processing and real-time processing, and which processing mode is suitable for which business task.

**Sample terms** parallel processing, client/server processing, transaction processing, interactive processing

### **(2) System configuration**

Understand the types of typical system configurations and the characteristics. In addition, understand redundant configurations for improving system reliability, load distribution for improving the speed of response, and so on.

**Sample terms** dual system, duplex system, cluster, multiprocessor system, load sharing system, backup site, hot site, warm site, cold site, primary system (currently used system), secondary system (backup system), tight coupling, loose coupling, peer to peer, grid computing, virtualization, VM (Virtual Machine), cloud computing, SaaS, PasS, IaaS

### **(3) High-performance computing**

Understand the characteristics of HPC (High Performance Computing) used in areas that require high-precision, high-speed operations.

**Sample term** massively parallel

### **(4) Client/server system**

Understand the characteristics and configurations of the two-tier and three-tier client/server systems. In addition, understand the characteristics of the associated technologies including the stored procedure for databases.

**Sample terms** presentation layer, function layer, database access layer, client, server, thin client system, RPC (Remote Procedure Call)



**(5) Web system**

Understand the characteristics, basic configuration, and mechanism of the web system.

**Sample terms** web browser, web server

**(6) RAID**

Understand that the RAID technology regards multiple hard disk drives as a single drive to improve reliability and speed. Understand the types of RAID and their typical characteristics, along with NAS, SAN, and other technologies associated with storage.

**Sample terms** RAID0, RAID1, RAID2, RAID3, RAID4, RAID5, RAID6, striping, mirroring, parity

**(7) Reliability design**

Understand the concept of reliability design, including the fault tolerant and human error avoidance technologies for minimizing the effect of system failures.

**Sample terms** fault, fault tolerant system, fault avoidance system, fail safe, fail soft, foolproof, active-standby configuration, active-active configuration

## **2. System evaluation indexes**

### **[Goal]**

- Understand the concept for measuring the performance, reliability, and cost efficiency of systems, the evaluation indexes for them, and the concept of capacity planning so that you can apply them to your tasks.

### **(1) Performance characteristics and evaluation of a system**

#### **(a) System performance indexes**

Understand the concept of evaluation items used for evaluating system performance.

**Sample terms** response time, throughput, benchmark, TPC, SPECint, SPECfp, monitoring

#### **(b) Capacity planning**

Understand that system performance is identified and evaluated on a continuous basis in the following basic procedure: the purpose and concept of capacity planning and the types, amount, and time of processing required for the system are reviewed, and then the performance specifications for the server, storage, and others are estimated based on the performance requirements.

**Sample terms** load, sizing, scale out, scale up, capacity management, provisioning

### **(2) Reliability characteristics and evaluation of a system**

#### **(a) RASIS**

Understand that the evaluation items used for evaluating systems are Reliability, Availability, Serviceability, Integrity, and Security. Understand the concept of the indexes for them.

#### **(b) Reliability indexes and reliability calculation**

Understand the evaluation items used for evaluating system reliability including MTBF, MTTR, and availability, along with their indexes. Understand the basic method for calculating the availability of parallel and serial systems.

**Sample term** bathtub curve

### **(3) Cost efficiency evaluation of a system**

Understand the concepts of evaluating the cost efficiency of a system and evaluating the system in terms of initial cost and TCO. In addition, understand the concept of what expenses the initial and running costs include and of what the difference between the direct and indirect costs is.

## 1. Operating system

### [Goal]

- Understand the types of OSs along with their characteristics, functions, and configurations so that you can apply them to your tasks.
- Understand the management mechanism of typical functions of OSs, including job management, task management, and memory management so that you can apply them to your tasks.

### (1) Types of OSs and their characteristics

Understand the position of OSs as software and the need for them. Understand the types and typical characteristics of OSs for general-purpose computers, PCs, real-time systems.

**Sample terms** system software, UNIX, OS for PCs, open OS, VM (Virtual Machine)

### (2) Functions and configurations of OSs

Understand the basic functions, configurations, and kernels of OSs, along with language processors.

**Sample terms** microkernel, monolithic kernel, middleware, kernel mode (supervisor mode), user mode, compiler, service program, process management, operations management, interrupt, multiprogramming, bootstrap, network boot, multi-boot, flash bootloader

### (3) Job management

A job is a unit of work. Understand the concept of job steps that make up a job and the overview of job management.

**Sample terms** job scheduler, master scheduler, batch processing

### (4) Task management

#### (a) Tasks and state transition

Understand the relationships between tasks and job steps and between tasks and threads; the state transition from initiation of tasks to execution and termination of them; and the basic role of the dispatcher.

**Sample terms** ready state, running state, waiting state, process, thread

(b) Multiprogramming (multitask) and scheduling

Understand the concept of multiprogramming. Understand the scheduling techniques and the characteristics used in typical task scheduling methods.

**Sample terms** preemptive, non-preemptive, time slice, priority scheduling, round robin, time quantum, dispatch

**(5) Data management**

Understand the function which provides application programs with access to auxiliary storage by means of an interface independent of devices.

**(6) Input/output management**

Understand the overview of the functions that execute the I/O processing of physical records in accordance with the directions of data management, including input/output control and fault management during input/output.

**Sample terms** channel, input/output interrupt

**(7) Memory management**

(a) Real memory management

Understand the characteristics of memory management methods such as the fixed partition and variable partition systems, along with the concepts of fragmentation and measures against it. In addition, understand the concepts of swapping and overlays, intended for efficient use of main memory.

**Sample terms** roll-in, roll-out, swap-in, swap-out, overlay (segment), garbage collection, compaction

(b) Virtual memory management

Understand the relationship between real memory and virtual memory, the effectiveness of virtual memory, and the types and characteristics of virtual memory systems. In addition, understand the concept of page replacement procedures used in typical page replacement algorithms for paging systems.

**Sample terms** base address, segment, paged segment, thrashing, DAT (Dynamic Address Translation), page fault, page replacement, LRU, FIFO

**(8) Network control**

Understand the basic functions of network control programs along with the communications interface provided by OSs.

**Sample terms** protocol control, communications protocol, TCP/IP, OSI basic reference model, LAN, WAN

### (9) Operations management

Understand the overview of the functions that provide operations with ease and flexibility including system startup process (OS initialization), system shutdown process, interaction with operators, user management facility, scheduling, and system monitoring.

**Sample terms** profile, user account, right to use a system, right to access a file, right to use a terminal

### (10) User management

Understand the types and characteristics of user accounts along with the concepts of how to create accounts, how to assign and change passwords, and how to add and change privileges. In addition, understand the concept of the directory service for collective management of accounts.

**Sample terms** superuser, root, administrator, guest, administrative privileges, LDAP

### (11) Security control

Understand that OSs provide security control functions such as access control, cryptographic control, and outside-intrusion detection and protection.

**Sample terms** logging function, audit function, accountability, reliability process

### (12) Fault management

Understand the overview of the functions performed when a fault arises, including fault detection, testing and diagnosing, automatic correction, fault recording, reconfiguration, restarting, and cause elimination.

**Sample terms** hardware fault, software fault

## 2. Middleware

### **[Goal]**

- Understand the roles and basic functions of typical middleware so that you can apply them to your tasks.

### (1) Roles and functions of middleware

Understand the roles and basic functions of middleware positioned between the OS and application software.

**Sample terms** linking software between application programs, DBMS, communication management system, software development tool, operations management tool, TP (Transaction Processing) monitor

### (2) Role and functions of shells

Understand that shells are responsible for interpreting commands and directions received from users and for calling kernel functions such as program initiation and control.

**Sample terms** command interpreter

**(3) API**

Understand that APIs allow application programs to send down directions to the OS and middleware.

**(4) Library**

Understand the types and characteristics of libraries for storing programs and macros.

**Sample terms** source library, object library, load library, DLL, class library

**(5) Componentware**

Understand the concept of componentware, a technique for developing software by dividing software into components based on object-oriented technology.

**Sample terms** component, Java Beans, ActiveX, CORBA

**(6) Development framework**

Understand the concept of a development framework as a collection of classes and libraries used for implementing a standard structure of application software.

**3. File system**

**[Goal]**

- Understand the mechanism of managing hierarchical files so that you can apply them to your tasks.
- Understand the types and characteristics of file systems so that you can apply them to your tasks.
- Understand the types and typical characteristics of file organization, access methods, and backup methods so that you can apply them to your tasks.

**(1) Directory management and file management**

Understand the mechanism of managing hierarchical files and the method of identifying files based on absolute and relative paths. In addition, understand the basic concept of directory management, file sharing, and access privilege.

**Sample terms** reference information, symbolic link, shortcut, alias, root directory, current directory, search techniques

**(2) Types and characteristics of file systems**

Understand the overview of how OSs and users can use the areas of hard disk drives and other auxiliary storage devices as file and directories (folders). Understand that each OS is provided with a unique file system. In addition, understand the characteristics of typical file systems.

**Sample terms** FAT file system, NTFS, HFS (Hierarchical File System), volume

**(3) File organization and access methodologies**

Understand file organization and access methods along with the basic processing methods

including how to add, delete, and update records in each file organization.

**Sample terms** sequential access, direct access, dynamic access, sequential organization, partitioned organization, indexed sequential organization, direct organization, VSAM organization, overflow area

#### (4) Backup

Understand the types and typical characteristics of backup methods, including the methods and procedures for getting backup files for the purpose of recovering files and managing generations.

**Sample terms** multiplexed backup, full backup, differential backup

## 4. Development tools

### **[Goal]**

- Understand the types of typical development tools used for developing software along with their characteristics and basic functions so that you apply them to your tasks.

#### (1) Types and characteristics of development tools

Understand the types and characteristics of typical development tools along with the basic functions: for example, tools that support design, programming, and testing; tools intended for automation and efficiency improvement throughout all software development processes; and IDE (Integrated Development Environment) for providing consistent process support throughout the whole development activities.

**Sample terms** design support tool, design tool, building tool, testing tool, tool chain, EUC, EUD, emulator, simulator, ICE (In-Circuit Emulator), tracer, inspector, snapshot, assertion checker, version control tool

#### (2) Types and the characteristics of language processing tools

Understand the types of typical language processing tools along with the characteristics and basic functions.

**Sample terms** generator, source program, preprocessor, assembler, compiler, runtime compiler, cross compiler, interpreter, object program, linker, loader, load module

## 5. Open source software

### [Goal]

- Understand the types of open source software along with their typical characteristics, considerations for use and trends so that you can apply them to your tasks.

#### (1) Types and characteristics of OSS

Understand the overview of open source licensing, including the typical types of widely used OSS (Open Source Software), such as LAMP (Linux, Apache, MySQL, PHP) and LAPP (Linux, Apache, PostgreSQL, PHP), along with their characteristics, free redistribution, and permission of modifications and derived works.

**Sample terms** Linux kernel, Perl, Python, Ruby, open source library, CPAN, PEAR, jQuery, copyleft, dual license, GPL (General Public License), BSD (Berkeley Software Distribution License), MPL (Mozilla Public License), Apache license

#### (2) Unix-family OSs

Understand the types and typical characteristics of Unix-family OSs, including Unix and Unix compatible OSs, as typical OSS.

**Sample terms** NetBSD, IRIX, Linux, FreeBSD (Free Berkeley Software Distribution), OpenBSD, the Open Group

#### (3) Open source community

Understand the concept of software development in the open source community.

#### (4) Considerations in the use and utilization of OSS

Understand the basic considerations in the use of OSS, including the scope of licenses, costs associated with support for use, and handling of problems.

**Sample terms** security, reliability

#### (5) Trends in OSS

Understand the trends in development and dissemination of OSS.



**Major Category 2: Computer System**  
**Middle Category 6: Hardware**

**1. Hardware**

**[Goal]**

- Understand the concept of electric and electronic circuits, which are components of the computer.
- Understand the characteristics of typical methods for electronically controlling machines.
- Understand the characteristics of components and the important points in performing logic design.
- Understand the importance of power consumption in developing embedded devices.

**(1) Electric and electronic circuits**

Understand the operating principles of the basic computer logic circuits, such as the AND, OR, and NOT circuits.

**Sample terms** NAND circuit, flip-flop

**(2) Machines and their control**

Understand the basic operating principles of typical electronic control of machines

**Sample terms** open loop control, closed loop control, sequence control, feedback control, PWM (Pulse Width Modulation) control

**(3) Components/elements and their implementation**

Understand typical components and elements along with their implementation.

**Sample terms** diode, LED, transistor, IC, LSI, VLSI (Very Large Scale Integration), FPGA (Field Programmable Gate Array)

**(4) Logical design**

Understand that logic circuits are designed in consideration of performance, design efficiency, cost, and so on.

**Sample term** circuit design

**(5) Power consumption**

Understand the importance of hardware power consumption in developing embedded devices.

## 1. Human interface technology

### **[Goal]**

- Understand the concept and purpose of the information architecture so that you can apply them to your tasks.
- Understand the types and characteristics of typical human interface technologies so that you can apply them to your tasks.
- Understand the characteristics and components of GUI along with the important points of GUI screen design so that you can apply them to your tasks.

### **(1) Information architecture**

Understand the concept and purpose of information architecture, along with organization (e.g., alphabetical order, categorization) and structuring (e.g., hierarchization, tagging) of information.

**Sample terms** label, chunk, navigation

### **(2) Human interface**

Understand the requirements that determine the interface, along with the types and characteristics of technologies for providing interfaces.

**Sample terms** usability, accessibility, interactive system, voice recognition, image recognition, moving image recognition, feature extraction, selective perception, analysis of user operation, physical adaptability, non-verbal interface, natural-language interface

### **(3) GUI**

Understand the characteristics of GUI: visual display based on graphics and intuitive operation based on pointing devices. Understand the components used in GUI and the important points in designing GUI screens.

**Sample terms** window, icon, radio button (radio box), checkbox, list box, pull-down menu, pop-up menu, text box

## 2. Interface design

### **[Goal]**

- Understand the concepts and basic procedures of screen design, form design, and code design so that you can apply them to your tasks.
- Understand desirable interfaces based on application of the concept of universal design along with the basic techniques so that you apply them to your tasks.

## **(1) Screen design and form design**

### **(a) Screen design**

Understand the concept of and basic procedure for screen design, along with typical methods for checking input.

**Sample terms** screen layout, information relationship, numeric check, format check, limit check, combination check, matching check, balance check, check character

### **(b) Form design**

Understand the concept of and basic procedure for form design.

**Sample term** form overlay

## **(2) Code design**

Understand the types and characteristics of code. Understand the concepts of and basic procedures for code design according to the purpose of use and application area.

**Sample terms** sequence code, block code (classification code), group classification code, mnemonic code, synthetic code

## **(3) Web design**

Understand that the web design should be done in consideration of the following: the concept of usability in web design; techniques for improving usability; unified design throughout the website using style sheets; and design to support multiple types of web browsers.

**Sample terms** frame, navigation, in-site search function, cross browser, progressive enhancement

## **(4) Human centered design**

Understand the concept of human centered design, intended for improving usability.

**Sample terms** ISO 13407

## **(5) Universal design**

Understand appropriate interfaces and basic techniques based on universal design, which aims at enabling as many people as possible to comfortably use information systems, regardless of age, culture, disability, capability, or any other factor.

**Sample terms** WAI (Web Accessibility Initiative), WCAG 1.0 (Web Content Accessibility Guidelines 1.0)

## **(6) Usability evaluation**

Understand the concept and basic method of usability evaluation.

**Sample terms** heuristic evaluation

## **1. Multimedia technology**

### **[Goal]**

- Understand the mechanisms of how characters, sound, and images are handled in the computer, along with the methods for handling them in an integrated way, so that you can apply them to your tasks.
- Understand the purposes and typical characteristics of compressing and decompressing information so that you can apply them to your tasks.

### **(1) Multimedia**

Understand the digitization of information, integration of multiple media, such as characters, sound, and images, and the characteristics of multimedia, including interactivity. In addition, understand methods for processing multimedia, including authoring for editing and combining multiple media.

**Sample terms** web content, hypermedia, streaming, authoring environment, PDF

### **(2) Sound processing**

Understand the mechanism of sound data digitization and the characteristics of typical sound files.

**Sample terms** PCM (Pulse Code Modulation), MIDI, WAV (Waveform Audio Format), MP3

### **(3) Static image processing**

Understand the basic mechanism of image representation in the computer, including the three primary colors of light (red, green, and blue) and three primary colors of pigment (cyan, magenta, and yellow), picture element (pixel), resolution, and gray scale, along with the characteristics of typical static image file formats.

**Sample terms** JPEG, GIF, PNG, BMP, TIFF, Exif (Exchangeable Image File Format)

### **(4) Moving image processing**

Understand the mechanism of moving image representation in the computer, including frame and frame rate, and the characteristics of typical moving image file formats.

**Sample terms** MPEG, QuickTime, AVI

### **(5) Compression and decompression of information**

Understand that information is compressed and decompressed according to the type of media. Understand the purposes (efficient data storage and network load reduction) of compression along with the characteristics of typical compression methods. In addition, understand that the appropriate compression method should be selected and used according to each purpose.

**Sample terms** JPEG, MPEG, ZIP, LZH, compression rate, lossless compression, lossy

compression, MR (Modified Read), MMR (Modified Modified Read)

## **2. Multimedia application**

### **[Goal]**

- Understand the characteristics of multimedia systems and example applications of multimedia.

### **(1) Multimedia application**

Understand the characteristics of multimedia systems and example applications of multimedia, including VR (Virtual Reality), Internet broadcasting, and nonlinear image editing systems.

**Sample terms** CG, CAD, simulator, video game, AR (Augmented Reality), video on demand, 3D video, motion capture, virtual surround

## 1. Database architecture

### **[Goal]**

- Understand the types of databases along with their characteristics, database models, and the basic concept of the three-level schema so that you can apply them to your tasks.
- Understand the purpose and typical functions of database management systems (DBMS) so that you can apply them to your tasks.

### **(1) Database**

#### (a) Types and characteristics of databases

Understand the types of typical databases and their typical characteristics, including the data representation structure and method for associating a record with another.

**Sample terms** relational database, structured database, HDB (Hierarchical Database), NDB (Network Database), OODB (Object Oriented Database), hypertext database, multimedia database, XML database

#### (b) Database models

Understand that databases provide data independence by separating the following three levels: data definitions seen from system users and programs, logical data structure, and physical data structure. Understand the types of data models and the concept of the three-schema structure.

**Sample terms** conceptual data model, logical data model (external model), relational model, hierarchical model, network model, physical data model (internal model), conceptual schema, external schema (subschema), internal schema (storage schema)

#### (c) Relational data model

Understand how data is represented in a relational data model. Understand the configuration of tables and their concept and association of multiple tables.

**Sample terms** relation, tuple (row, pair), attribute (column, field), occurrence, domain, E-R diagram

### **(2) Database management system**

Understand that a DBMS provides functions of storing data according to the target data model, keeping its consistency, and efficiently retrieving it.

**Sample terms** database definition function, database manipulation function, database control function, maintenance function, data security protection function, exclusive control, failure recovery, data security

## 2. Database design

### [Goal]

- Understand the concept of data analysis and database design so that you can apply them to your tasks.
- Understand the purpose of and procedure for data normalization so that you can apply them to your tasks.
- Understand the considerations in performing the physical design of database so that you can apply them to your tasks.

### (1) Data analysis

Understand the concept in analyzing data: identification, analyses, and organization of the data required for the target tasks and the meaning and relation of each data item; and standardization of the data items for preventing occurrences of synonyms and homonyms.

**Sample terms** elimination of data duplication, metadata, data dictionary

### (2) Database design

#### (a) Conceptual design of databases

Understand the techniques for representing data relations independent of DBMS along with the design concepts: how to represent the components, attributes, and relationships using E-R diagrams; and cardinality (one to one, one to many, many to many).

**Sample terms** entity, attribute, relationship

#### (b) Logical design of databases

Understand the concept of table design that causes no data duplication or conflict, concepts such as prime key and foreign key, and constraints such as reference constraint.

**Sample terms** field (item), record, file, NULL, unique constraint

### (3) Data normalization

Understand the purpose and procedure for normalization, along with first, second, and third normalizations.

**Sample terms** full functional dependency, partial functional dependency, transitive functional dependency

### (4) Physical design of databases

Understand the considerations in designing the physical structure of a database, including the formats stored on hard disks.

**Sample terms** disk capacity estimation, logical data structure mapping, performance evaluation

### 3. Data manipulation

#### **[Goal]**

- Understand the typical data manipulation of relational databases so that you can apply it to your tasks.
- Understand the basics of typical database languages and SQL statements so that you can apply them to your tasks.

#### **(1) Database manipulation**

Understand the typical data manipulation of relational databases such as operations of inserting or updating data, set operations (sum, difference, intersection, and direct product) and relational operations (selection, projection, join, and quotient).

**Sample term** relational algebra

#### **(2) Database language**

##### **(a) Types of database languages**

Understand that database languages are broadly divided into DDLs (Data Definition Languages) and DMLs (Data Manipulation Languages). Understand that they are categorized as self-contained languages, which use SQL statements separately, or host languages, which uses SQL statements from another language.

**Sample terms** interactive SQL, embedded SQL, module language, command driven, form, query

##### **(b) Database language (SQL)**

###### **(i) Data definition language**

Understand the SQL statements for defining schemas, tables, views, and processing rights. Understand the data types, how to define column constraints and table constraints, and view update (updatable and non-updatable views).

**Sample terms** base table, character type, numeric type, date type, unique constraint, referential constraint, check constraint, non-NULL constraint, access right

###### **(ii) Data manipulation language (SELECT statement)**

Understand the basic manipulations to select required data: how to make a query using a SELECT statement; how to select a specific row or column by specifying criteria; how to join tables; how to specify predicates such as BETWEEN and IN; set functions; grouping; sorting; sub query; correlation sub query; and so on.

**Sample terms** aggregate function, pattern character, correlation name

###### **(iii) Other data manipulation languages**

Understand basic SQL statements, including INSERT, UPDATE, and DELETE statements.



(iv) Embedded SQLs

Understand the overview of data manipulation based on embedded SQLs, including cursor manipulation, non-cursor manipulation, and connection with the host language.

Understand basic SQL statements that perform a cursor declaration, initiation and termination of manipulation, and reading.

**Sample term** cursor

## **4. Transaction processing**

### **[Goal]**

- Understand the basic mechanisms of database exclusive control and failure recovery so that you can apply them to your tasks.
- Understand the concepts of transaction management and access efficiency improvement so that you can apply them to your tasks.
- Understand the need for controlling access to data and typical access rights.

### **(1) Exclusive control**

Understand the need for exclusive control, intended for preventing multiple transactions from updating a database concurrently to maintain the data consistency. In addition, understand the basic mechanisms of the lock, semaphore, and commitment control.

**Sample terms** exclusive lock, shared lock, lock granularity, deadlock, one-phase commitment, two-phase commitment

### **(2) Failure recovery**

Understand backup as a provision for failures, the basic mechanism of recovery processing for recovering the state immediately before the failure occurrence, preparation of the environment for the usage of database, the concept of reorganization for improving access efficiency.

**Sample terms** journal file (log file), checkpoint, roll forward, roll back, warm start, cold start

### **(3) Transaction management**

Understand that databases are accessed by multiple users concurrently and therefore ACID characteristics are required in transaction processing. Understand the basic concept of the four characteristics.

### **(4) Database performance improvement**

Understand the concept of making effective use of indexes to improve the efficiency of access to databases.

## (5) Data control

Understand that accesses to data must be controlled on a user-by-user basis, and that access rights include the authorizations to connect to the database, to search for data, to add new data, and to update data.

**Sample terms** “reference” right, “insert” right, “delete” right

## 5. Database application

### **[Goal]**

- Understand how databases are used in data analyses, business systems, software development and maintenance, and other applications.
- Understand the characteristics, advantages, and considerations of distributed databases, along with the mechanism of data synchronization.
- Understand the overview of data resource management.

### (1) Application of databases

Understand the characteristics of the technologies for analyzing data for effective use of it, including data warehouse, data mart, and OLAP (Online Analytical Processing). Understand that these technologies are used in enterprise accounting systems, inventory control systems, and so on.

**Sample terms** OLTP (Online Transaction Processing), ETL (Extract/Transform/Load), data cleansing, big data, documentation management system, SFA (Sales Force Automation)

### (2) Distributed database

Understand the characteristics and advantages of distributed databases placed at multiple sites, along with the considerations in using them and the mechanism of data synchronization between sites.

**Sample terms** transparency, commitment control, replication

### (3) Data resource management

Understand the overview of the data dictionary used to collect and manage information (metadata) – attributes, meanings and contents, and locations of data, for example – for managing data, and repository used to consolidate and unify management of a wide range of information in software development and maintenance.

**Sample terms** IRDS (Information Resource Dictionary System)

## **1. Network architecture**

### **[Goal]**

- Understand the definitions of LAN and WAN and their typical characteristics, along with the typical services provided by common carriers so that you can apply them to your tasks.
- Understand wired and wireless LANs and the mechanisms and typical characteristics of their switching methods so that you can apply them to your tasks.
- Understand the relationships among line speed, data amount, and transfer time so that you can apply them to your tasks.

### **(1) Types and characteristics of networks**

Understand the definitions of LAN and WAN along with the typical characteristics, components, and running costs. In addition, understand that a WAN-based network uses the Internet connection service and other services provided by common carriers.

**Sample terms** Internet service provider, metered rate, flat monthly fee, IDF (Intermediate Distribution Frame), packet switched network, circuit switched network, frame relay service, ATM (Asynchronous Transfer Mode) service, sensor network

### **(2) Wired LAN**

Understand the mechanism, components, and typical characteristics of wired LAN.

**Sample terms** coaxial cable, twisted pair cable, optical fiber cable

### **(3) Wireless LAN**

Understand the mechanism, components, and typical characteristics of wireless LAN.

**Sample terms** electromagnetic wave, infrared ray, wireless LAN access point

### **(4) Switching system**

Understand the mechanisms of circuit switching and packet switching along with their typical characteristics.

**Sample terms** packet, VoIP (Voice over Internet Protocol)

### **(5) Calculations associated with line**

Understand the relationships among the line speed, data amount, and transfer time, and how to calculate the transfer time from a given line speed, data amount, and line utilization rate.

**Sample terms** transfer (transmission) rate, bps (bit per second), circuit capacity, bit error rate, traffic intensity, erlang

## (6) Internet technology

Understand that the Internet is based on the TCP/IP protocol and that web and other services are provided based on communications between hosts (servers, clients, routers, and others) to which IP addresses are assigned. In addition, understand the overview of IP packet routing.

**Sample terms** IPv4, IPv6, address class, global IP address, private IP address, NAT (Network Address Translation), overlay network, DNS, domain, TLD, proxy server, QoS (Quality of Service), firewall, RADIUS

## 2. Data communication and control

### **[Goal]**

- Understand the basic concept and configuration of network architecture so that you can apply them to your tasks.
- Understand the types of transmission methods and lines along with their typical characteristics so that you can apply them to your tasks.
- Understand the types of network connecting devices and their typical characteristics so that you can apply them to your tasks.
- Understand the basic mechanisms and characteristics of typical control functions in networks so that you can apply them to your tasks.

### (1) Network architecture

#### (a) Network topology

Understand the types and characteristics of typical network configurations along with how terminals and control devices are connected.

**Sample terms** point to point (point-to-point connection), tree, bus, star, ring

#### (b) OSI basic reference model

Understand the basic functions of each layer of the OSI basic reference model, which is a seven-layer network architecture developed by ISO, along with the relationships among the layers.

**Sample terms** physical layer, data link layer, network layer, transport layer, session layer, presentation layer, application layer

### (2) Transmission methods and lines

Understand the types of lines, along with the types and typical characteristics of communication methods and switching methods used for networks.

**Sample terms** simplex, half duplex, full duplex, WDM (Wavelength Division Multiplexing), circuit switching, packet switching, ATM switching, frame relay, cell relay, public line, leased line

### (3) Network connecting devices

Understand the types of intra-LAN, inter-LAN, and LAN-to-WAN connection devices and their typical characteristics. Understand which function of each device corresponds to which layer of the OSI basic reference model.

**Sample terms** repeater, hub, cascade connection, switching hub, router, digital service unit, Layer-2 (L2) switch, Layer-3 (L3) switch, bridge, gateway, proxy server, spanning tree

### (4) Transmission control

Understand the basic mechanism and characteristics of transmission control, which is a control function designed for ensuring data transmission between the sender and receiver.

**Sample terms** data link control, routing control, flow control, basic mode data transmission control procedure, contention, polling/selection, HDLC, multilink procedure, switching method, connection method, connection-less, parity check, CRC, SYN synchronization, flag synchronization, frame synchronization

### (5) Media access control

Understand the basic mechanism of MAC (Media Access Control), designed for defining how to transmit and receive data and detect errors.

**Sample terms** TDMA (Time Division Multiple Access), CSMA/CD, CSMA/CA, token passing, collision

## 3. Communications protocols

### **[Goal]**

- Understand which layer function of the OSI basic reference model is implemented by TCP/IP – one of the typical protocols – so that you can apply them to your tasks.

### (1) Protocols and interfaces

#### (a) TCP/IP

Compare TCP/IP, a protocol widely used for LANs and the Internet, with the seven layers of the OSI basic reference model to understand the basic roles of each layer.

**Sample terms** packet, header

#### (b) Data link layer protocols

Understand the basic roles and functions of ARP and other protocols for data link layer levels used in TCP/IP networks.

**Sample terms** PPP, PPPoE (Point to Point Protocol over Ethernet), VLAN

(c) Network layer protocols

Understand the basic role and functions of IP.

**Sample terms** IP address, subnet address, subnet mask, physical address, routing, unicast, broadcast, multicast, ICMP (Internet Control Message Protocol), CIDR (Classless Inter Domain Routing), IPv6

(d) Transport layer protocols

Understand the basic roles and functions of TCP and UDP.

**Sample term** port number

(e) Application layer protocols

Understand the basic roles and functions of HTTP, SMTP, POP, FTP, DNS and other protocols.

**Sample terms** TELNET, DHCP, IMAP, NTP (Network Time Protocol)

(f) Interfaces for LAN and WAN

Understand the types and typical characteristics of typical interfaces for LAN and WAN, including Ethernet, wireless LAN, ISDN (Integrated Services Digital Network), and ATM.

**Sample terms** 10BASE-T, 100BASE-TX, 1000BASE-T, IEEE 802.11a/b/g/n/ac

(g) CORBA

Understand the overview of CORBA, which is a specification that enables programs distributed on a network to link to one another.

**Sample term** distributed object technology

## **4. Network management**

**[Goal]**

- Understand the overview of the points to be managed in network operations management.
- Understand the overview of network management tools and protocols.

### **(1) Network operations management**

(a) Configuration management

Understand the overview of configuration management, which involves maintenance of configuration information and recording of the modifications.

**Sample terms** network configuration, version, SDN (Software Defined Networking), OpenFlow

(b) Fault management

Understand the overview of fault management, which involves fault detection, analysis, and correction.

**Sample terms** information collection, fault isolation, fault cause identification, recovery action, record

(c) Performance management

Understand the overview of network performance management by, for example, analyzing the relationship between the traffic volume and transfer time.

**Sample term** traffic monitoring

**(2) Network management tools**

Understand the overview of typical tools used for network management.

**Sample terms** ping, ipconfig, arp, netstat

**(3) SNMP**

Understand the overview of SNMP – a protocol for collectively managing the devices that compose the network.

**Sample terms** SNMP agent, SNMP management station, MIB (Management Information Base)

## **5. Network application**

**[Goal]**

- Understand the mechanisms of e-mail used over the Internet and web so that you can apply them to your tasks.
- Understand the characteristics of intranets and extranets so that you can apply them to your tasks.
- Understand the characteristics of network OSs so that you can apply them to your tasks.
- Understand the overview of typical communication services.
- Understand the mechanisms and the overview of the characteristics of mobile systems.

**(1) Internet**

(a) E-mail

Understand that the e-mail system consists of mail servers and clients and that mail messages transmitted are relayed from one mail server to another.

**Sample terms** SMTP, POP3, IMAP4, MIME

(b) Web

Understand that the WWW is a hypertext system provided over the Internet, which is accessed using web servers and clients (web browsers) and that web pages are written in HTML, XML, or other markup languages, which use hyperlinks to allow users to view different pages.

**Sample terms** HTTP, CGI, cookie, URL, session ID

(c) File transfer

Understand the mechanisms of the FTP server and client.

**Sample terms** upload, download

(d) Search engine

Understand the characteristics of typical search engines used in the web environment.

**Sample terms** full text search, directory type, robot type

**(2) Intranet**

Understand the characteristics of the intranet, which is an in-house network built based on the Internet technology.

**Sample terms** VPN, permanent virtual connection,

**(3) Extranet**

Understand the characteristics of the extranet, in which enterprise intranets are interconnected.

**Sample terms** EC (Electronic Commerce), EDI

**(4) Network OS**

Understand the characteristics of the network OS, which is software specifically designed to provide network management and communication services.

**Sample term** NetWare

**(5) Communication services**

Understand the types and characteristics of typical communication services.

**Sample terms** leased line service, circuit switching service, packet switching service, frame relay, cell relay, ATM, IP telephone, ADSL, FTTH, satellite communication service, international communication service, wide-area Ethernet, IP-VPN

**(6) Mobile systems**

(a) Mobile communication services

Understand the types and the overview of the characteristics of mobile communication services.

**Sample terms** mobile network operator, mobile virtual network operator (MVNO), LTE, VoLTE, carrier aggregation, SIM card

(b) Mobile system components

Understand the components and the overview of the characteristics of mobile systems.

**Sample terms** mobile devices (cell phone, smartphone, tablet computer, etc.), tethering



**Major Category 3: Technology Element**  
**Middle Category 11: Security**

**1. Information security**

**[Goal]**

- Understand the purpose, concept, and importance of information security so that you can apply them to your tasks.
- Understand the basic concepts of threat and vulnerability to information assets and the main attack methods.
- Understand the information security technologies required in developing information systems so that you can apply them to your tasks.

**(1) Purpose and concept of information security**

Understand that by ensuring and maintaining the confidentiality, integrity, and availability of information, information systems and information are protected from various threats, and information systems are improved in reliability.

**Sample terms** confidentiality, integrity, availability, authenticity, accountability, non-repudiation, reliability, OECD Security Guidelines (Guidelines for the Security of Information Systems and Networks)

**(2) Importance of information security**

Understand the importance of information security through the facts that in the current network society, the level of information security leads to an increase of the corporate value and that accidents/incidents associated with information systems threaten the continuation of businesses.

**Sample terms** information asset, threat, vulnerability, cyberspace, cyber attack

**(3) Threat**

**(a) Types of threat**

Understand the presence of physical threat, technical threat, and human threat to information assets.

**Sample terms** physical threat (accident, disaster, fault, destruction, theft, unauthorized intrusion, etc.), technical threat (unauthorized access, eavesdropping, spoofing, falsification, error, cracking, etc.), human threat (operational error, loss, damage, peep, unauthorized use, social engineering, etc.), information leakage, intentional act, negligence, mistake, fraudulent behavior, sabotage, denial of service

**(b) Malware and malicious program**

Understand the overview of the types of malware and malicious programs and their behavior.

**Sample terms** computer virus, macro virus, worm, bot(botnet, remote operated virus, C&C server), trojan horse, spyware, ransomware, keylogger, rootkit, back door,

fake security software

#### **(4) Vulnerability**

Understand the basic concept of vulnerability, such as defects in information security in information systems and deficiencies against threats such as incomplete adoption or arrangement of conduct codes in business, organization, and individual.

**Sample terms** bug, security hole, human vulnerability, shadow IT

#### **(5) Mechanisms of fraud**

Understand the factors that cause fraud, and the basic concept of developing the environment to prevent the occurrence of information security accidents and incidents due to internal fraud.

**Sample terms** fraud triangle (opportunity, motivation, rationalization), situational crime prevention

#### **(6) Types of attackers and motives of attacks**

Understand the overview of the types of malicious attackers and the main motivations causing attackers to carry out fraud, criminal acts, and attacks.

**Sample terms** insider, criminal who takes delight in people's reaction to his crimes, swindler, person who performs a deliberate crime, money stealing, cyberterrorism

#### **(7) Attack method**

Understand fraudulent behaviors to information systems from outside and their methods.

**Sample terms**

- dictionary attack, brute force attack, password list-based attack
- cross site scripting, cross-site request forgeries, clickjacking, drive by download, SQL injection, directory traversal
- Man-in-the-middle attack, third-party relay, IP spoofing, cache poisoning, session hijacking
- DoS (Denial of Service) attack, DDoS attack, email bomb
- targeted attack (APT (Advanced Persistent Threats), watering hole attack, interaction-type attack, etc.)
- phishing (one-click fraud, etc.), zero-day attack, side-channel attack, footprinting

#### **(8) Technologies associated with information security**

##### **(a) Cryptography**

Understand the use of cryptography to be used for threat prevention. In addition, understand the types of encryption methods and the characteristics of typical cryptographies.

**Sample terms** CRYPTREC cyphers list, cryptography (encryption (encryption key), decryption (decryption key), deciphering, symmetric key cryptography (symmetric key), public key cryptography (public key, private key)), AES

(Advanced Encryption Standard), RSA (Rivest, Shamir, Adleman), S/MIME (Secure MIME), PGP (Pretty Good Privacy), hybrid encryption, hash function (SHA-256, etc.), block encryption use mode, key management, disk encryption, file encryption, compromise

(b) Authentication technology

Understand the need for authentication along with what authentication technologies are required for threat prevention and what they prove.

**Sample terms** digital signature (signature key, verification key), XML signature, timestamp (time authentication), message authentication, MAC (Message Authentication Code), challenge-response authentication

(c) User authentication

Understand the types and characteristics of technologies used for user authentication.

**Sample terms** login (user ID and password), access management, IC card, PIN code, one time password, multi-factor authentication, security token, single sign-on, CAPTCHA

(d) Biometric authentication technology

Understand the types and characteristics of biometric authentication technologies, which are used for user verification.

**Sample terms** vein authentication, iris authentication, voice authentication, face authentication, retina authentication, signature authentication, false rejection rate, false acceptance rate

(e) Public key infrastructure

Understand the overview of the PKI (Public Key Infrastructure) along with typical applications of it.

**Sample terms** PKI (Public Key Infrastructure), digital certificate (public key certificate), root certificate, server certificate, client certificate, CRL (Certificate Revocation List), OCSP, CA (Certification Authority), GPKI (Government Public Key Infrastructure), BCA (Bridge Certification Authority)

## **2. Information security management**

**[Goal]**

- Understand the basic concept of information security management.
- Understand the method and procedure for analyzing and evaluating risks.
- Understand the basic concept of the information security continuity.
- Understand the basic concept of information security regulations (regulations in the organization including information security policy).
- Understand the mechanism of the Information Security Management System (ISMS) and the activities of information security organizations.

## **(1) Information security management**

Understand the concept of information security management in order to comprehensively and continuously implement organizational information security measures. Understand which information assets should be protected.

**Sample terms** information security policy-based information management, information, information asset, physical asset, software asset, human asset (people, and their qualifications, skills, and experience), intangible asset, service, risk management (JIS Q 31000), monitoring, information security event, information security incident

## **(2) Risk analysis and assessment**

### **(a) Information asset review**

Understand that information assets (information systems, data, documents, etc.) are reviewed and identified prior to assessing and responding to information security risks.

### **(b) Classification by importance of information assets**

Understand that the importance of information assets is reviewed in terms of confidentiality, integrity, and availability for classification in order to create the criteria for protecting information assets and define the required information security level.

**Sample terms** confidentiality, integrity, availability, information assets ledger

### **(c) Risk type**

Understand the risk types of the threats to the information assets reviewed.

**Sample terms** loss of property, loss of responsibility, loss of net earnings, human cost, risk types (operational risk, supply chain risk, external service use risk, risk of information dissemination through SNS, etc.), peril, hazard, moral hazard, estimated annual loss, scoring method, cost factors

### **(d) Information security risk assessment**

Understand that the risk level is determined by identifying risks, gaining a quantitative or qualitative understanding of the likelihood of occurrence and potential consequences of occurrence, and then the assessment is carried out based on organization-defined risk acceptance criteria.

**Sample terms** risk criteria (risk acceptance criteria, criteria for implementing an information security risk assessment), risk level, risk matrix, risk owner, risk source, risk assessment process (risk identification, risk analysis, risk assessment), qualitative risk analysis method, quantitative risk analysis method

### **(e) Information security risk treatment**

Understand that appropriate information security risk treatment options are selected in

consideration of risk assessment results, and then controls necessary to implement the options are determined.

**Sample terms** risk control, risk hedge, risk financing, risk avoidance, risk sharing (risk transfer, risk diversification), risk retention, risk aggregation, residual risk, risk treatment plan, risk register, risk communication

### **(3) Information security continuity**

Understand the need to incorporate information security continuity (a process for ensuring continuous information security operations) into the organization's business continuity management system in preparation for the organization encountering a difficult situation (for example, a crisis or disaster).

**Sample terms** classification of emergency category, emergency response plan (contingency plan), recovery plan, disaster recovery, backup measure, investigation method of damage status

### **(4) Information security regulations (regulations in the organization including information security policy)**

Understand the basic concept of the information security policy in managing information security, and how an organization should be managed according to the information security policy. In addition, understand the purpose and details of information security regulations that are systematically developed based on risk analysis and the evaluation results, systematizing information security policy, information security of the organization, classification and management of assets, human/technical/physical security, and so on.

**Sample terms** information security policy, information security purposes, information security measures criteria, information control regulations, security control regulations, documentation control regulations, information security incident response regulations (measures to be taken against computer virus infection, etc.), information security education regulations, privacy policy (personal information protection policy), office regulations, penal provisions, outward explanation regulations, regulations for exceptions, regulations for updating rules, procedures for approving regulations

### **(5) Information security management system (ISMS)**

Understand the basic mechanism of the ISMS (Information Security Management System), intended to enhance, maintain, and improve the information security level in an organization.

**Sample terms** ISMS scope, leadership, planning, operation, performance evaluation, improvement, control objectives, controls (information security incident management, information security education and training, compliance with legal and contractual requirements, etc.), ISMS conformity assessment system, ISMS certification, JIS Q 27001 (ISO/IEC 27001), JIS Q 27002

(ISO/IEC 27002), information security governance (JIS Q 27014)

#### **(6) Information security organization**

Understand the activities of information security organizations, which accept reports of damages caused by unauthorized access, make suggestions to avoid a repetition of problems, and carry out educational activities associated with information security.

**Sample terms** information security committee, information security-related organizations (CSIRT, SOC (Security Operation Center)), Cybersecurity Strategic Headquarters, National Center of Incident Readiness and Strategy for Cybersecurity (NISC), IPA Security Center, CRYPTREC, JPCERT/CC, unauthorized computer access report system, computer virus report system, report system for vulnerability-related information for software and systems, Information Security Early Warning Partnership, J-CSIP (Initiative for Cyber Security Information sharing Partnership of Japan), JVN (Japan Vulnerability Notes), white hacker

### **3. Security technology evaluation**

#### **[Goal]**

- Understand the basic concept of security technology evaluation.

#### **(1) Security evaluation criteria**

Understand that ISO/IEC 15408 (common criteria) or the like can be used as criteria to evaluate the security level of each information system.

**Sample terms** evaluation procedure, security functional requirements, security assurance requirements, assurance level, JISEC (IT security evaluation and certification system), JCMVP (encryption module test and certification system), PCI DSS, CVSS (Common Vulnerability Scoring System), vulnerability inspection, list of security requirements in procurement of IT products, penetration test, tamper resistance

### **4. Information security measures**

#### **[Goal]**

- Review measures for information security from the viewpoints of human, technical, and physical security so that you can apply them to your tasks.

#### **(1) Types of information security measures**

##### **(a) Human security measures**

Understand that there are the following human security measures: educational and training programs for reducing risks, such as human errors, thefts, and fraudulent conducts; measures for minimizing the damages caused by incidents and accidents; and so on.

**Sample terms** Guidelines for the Prevention of Internal Improprieties in Organizations,

information security enlightenment (education, training, handouts, use of media), password management, user access management (account management, management of privileged access rights, need-to-know (least privilege), etc.), log management, monitoring

(b) Technical security measures

Understand that technical measures are implemented for software, data, networks, and so on, to prevent damage to system development and business operations.

**Sample terms**

[Types of technical security measures]

measures against cracking, measures against unauthorized access, measures against information leakage, measures against malware and malicious programs (introduction of anti-virus software, updating of virus definition files, etc.), computer virus detection method (behavior method, etc.), exit control, entrance control, defense in depth, cryptographic processing, privatization, access control, vulnerability management (OS updating, application of vulnerability fixes (security patches), etc.), network monitoring, assignment of network access rights, intrusion detection, intrusion prevention, DMZ (demilitarized zone), quarantine network, email and web security (measure against spam, SPF, URL filtering, content filtering), security of mobile devices (cell phone, smartphone, tablet computer, etc.), wireless LAN security, cloud computing security, cloud service security, digital watermarking, digital forensics (preservation of evidence, etc.)

[Security products and services]

anti-virus software, SIEM (Security Information and Event Management), firewall, WAF (Web Application Firewall), IDS (Intrusion Detection System), IPS (Intrusion Prevention System), UTM (Unified Threat Management), SSL/TLS accelerator, MDM (Mobile Device Management)

(c) Physical security measures

Understand that physical security measures ensure the reliability and availability of information systems by protecting them from outside intrusions, theft, water damage, lightning, earthquakes, polluted air, explosions, fire, and so on.

**Sample terms**

RASIS (Reliability, Availability, Serviceability, Integrity, Security), RAS technology, quakeproof, fireproof equipment, UPS, dual redundancy technology, mirroring, monitoring camera, security gate, locking management, entrance access control, clear desk and clear screen, remote backup, USB key, security wire

## 5. Security implementation technology

### [Goal]

- Understand the overview of what security measures are implemented in networks and databases.
- Understand the overview of application security measures.

#### (1) Secure protocol

Understand the types and advantages of secure protocols for preventing communication data tapping and unauthorized connections.

**Sample terms** IPsec, SSL/TLS, SSH, HTTPS (HTTP over TLS), WPA2

#### (2) Authentication protocol

Understand the types and advantage of authentication protocols for preventing unauthorized connection or unauthorized use of services by spoofing.

**Sample terms** SPF, DKIM, SMTP-AUTH, OAuth, DNSSEC, EAP, EAP-TLS, PEAP, RADIUS

#### (3) Network security

Understand the overview of network security measures implemented to prevent systems within an intranet connected to the Internet from being attacked by malicious Internet users.

**Sample terms** packet filtering, MAC (Media Access Control) address filtering, authentication server, NAT (Network Address Translation), IP masquerade, VLAN, VPN (Virtual Private Network), security monitoring, OP25B, honey pot, reverse proxy

#### (4) Database security

Understand the overview of measures against threats, such as unauthorized access to databases, unauthorized use of databases, and destruction of databases.

**Sample terms** database encryption, database access control, database backup, logging

#### (5) Application security

Understand the overview of application security measures intended for controlling attacks on e-mail and other services used over intranets and the Internet.

**Sample terms** security measures for web systems, secure programming, vulnerability reduction technology (source code static inspection, dynamic inspection of program, fuzzing, etc.), measures against password cracking (salt, etc.), measures against buffer overflow, measures against cross-site scripting, measures against SQL injection (escape processing, etc.)



## 1. System requirements definition

### [Goal]

- Understand the overview of system requirements definition.

#### (1) System requirements definition tasks

Understand the overview of the system requirements definition process, in which the following are performed: definition of system requirements; evaluation of system requirements; and joint reviews of system requirements.

#### (2) Definition of system requirements

##### (a) Objectives and scope of computerization

Understand the overview of how the objectives and scope (affected business operations and business units) of computerization are put together.

##### (b) Definition of functions and performance

Understand the overview of how functional requirements and performance definition of a system are put together.

**Sample terms** system functional specifications, response time, throughput

##### (c) Requirements from tasks, organizations, and users

Understand the overview of how requirements from tasks, organizations, and users, including business processing procedure for users, input/output information requirements, and operating requirements (system operations image), are clearly defined in accordance with system development items.

**Sample terms** database requirements, security requirements, migration requirements, testing requirements, operational requirements, maintenance requirements, failure handling, education, training, cost

##### (d) Other requirements

Understand the overview of how system configuration requirements, design constraints, and qualification requirements (criteria for verifying that the developed system is usable in terms of quality) are defined and how the development environment is reviewed.

**Sample terms** execution environment requirements, peripheral interface requirements, quality requirements

### (3) Evaluation and review of system requirements

Understand the basic criteria for evaluating system requirements. Understand the overview of how the system acquirer conducts joint reviews with the supplier after system requirements are documented.

**Sample terms** review participants, review method

## 2. Systems architecture design

### **[Goal]**

- Understand the overview of systems architecture design.

### (1) Systems architecture design tasks

Understand the overview of the systems architecture design process, in which the architecture at the top level of the system is established, (preliminary) user documentation is prepared, the systems architecture is evaluated, and the joint review of systems architecture design is conducted.

**Sample terms** hardware configuration item, software configuration item, manual operation

### (2) Establishing the architecture at the top level of the system

#### (a) Purpose of systems architecture design

Understand that in systems architecture design, all system requirements are divided into hardware requirements, software requirements, or manual operation to determine the system configuration items required to implement them. Understand the overview of the considerations in selecting the systems architecture, including whether or not system requirements specifications can be implemented, whether or not options that take risks into account can be suggested, and whether or not the system can be efficiently operated and maintained.

#### (b) Functional decomposition of hardware, software, and manual operation functions

Understand the overview of how the functional decomposition of hardware, software, and manual operation is reviewed and determined in terms of operating effectiveness, workload, work cost and others.

**Sample term** user work scope

#### (c) Hardware architecture design

Understand the overview of how redundant and fault tolerant design, server function allocation, reliability allocation, and others are reviewed based on the reliability and performance requirements, to determine the hardware architecture.

(d) Software architecture design

Understand the overview of the software architecture decision process: when the software architecture is determined, it is reviewed whether the system supplier develops everything or uses some software packages and what middleware should be selected.

(e) System processing architecture design

Understand the overview of how centralized or distributed processing is selected according to the business operations and how the processing modes for web systems and client/server systems are reviewed and determined.

(f) Database architecture design

Understand the overview of how the type of database used in the system is determined.

**Sample terms** relational database, NDB (Network Database), OODB (Object Oriented Database), XML database

**(3) System integration test design**

Understand the overview of how the specifications of the system integration test should be prepared to verify that the system meets all functional requirements by reviewing the policies including the scope, plan, and procedure of the system integration test, for the systems architecture design.

**Sample term** test requirements

**(4) Evaluation and review of systems architecture**

Understand the overview of how the criteria for evaluating the systems architecture, including verification of whether or not the systems architecture satisfies the system requirements and it is feasible, is prepared so that the system acquirer can conduct joint reviews with the supplier.

**Sample terms** review participant, review method

### **3. Software requirements definition**

**[Goal]**

- Understand the techniques required in defining software requirements so that you can apply them to your tasks.

**(1) Software requirements definition tasks**

Understand that the following are conducted in the software requirements definition: establishment of software requirements; evaluation of software requirements; and joint reviews of software requirements.

**Sample terms** software configuration item

## **(2) Establishment of software requirements**

Understand that in the software requirements definition, business operations models and logical data models are created to determine the functions, performance, interfaces, and others required for the software, which composes the system, and to define the software qualification requirements. In addition, understand that analysis and representation techniques such as DFDs and E-R diagrams are used to analyze business operations for requirements definition.

**Sample terms** interface design, security implementation method, business operations modeling, form design, data modeling, maintainability

## **(3) Evaluation and review of software requirements**

Understand the criteria for evaluating software requirements, including verification that the determined software requirements are in line with the system requirements and systems architecture and that they are feasible. In addition, understand that after software requirements are documented, the system acquirer conducts joint reviews with the supplier.

**Sample terms** review participant, review method

## **(4) Techniques used for analyzing business operations and defining requirements**

### **(a) Hearing**

Understand that interviews with users are effective in identifying and understanding what is required of the software. Understand the procedure and concept of interviews.

**Sample terms** hearing planning, hearing minutes

### **(b) Use case**

Understand that a use case defines the interaction between users and the system for the purpose of achieving a target.

**Sample term** actor

### **(c) Mock up and prototype**

Understand that in the software requirements analysis process, the effectiveness of external specification, missing specifications, feasibility, and so on are assessed and, in some cases, a mock up and a prototype are created to prevent rework at a later stage. Understand the characteristics of mock up and prototyping.

**Sample term** prototype evaluation

### **(d) DFD**

Understand that if a business process must be represented with attention focused on the data flow, then DFD is used.

**Sample terms** activity, data store, data flow, process

(e) E-R diagram

Understand that if information handled in business operations must be abstracted to represent the relationship between entities, then an E-R diagram is used.

(f) UML

Understand that UML is one of the standardized, object-oriented notations. Understand the types and characteristics of diagrams used in UML along with the basic method to represent system mechanisms using UML.

**Sample terms** class diagram, operation, attribute, role name, use case diagram, state machine diagram, sequence diagram, communication diagram

(g) Other techniques

Understand the characteristics and representation methods of other techniques used for analyzing business operations and defining requirements.

**Sample term** decision table

#### **4. Software architecture design and software detailed design**

**[Goal]**

- Understand the techniques required for software architecture design so that you can apply them to your tasks.
- Learn the techniques required for software detailed design so that you apply them.

**(1) Software architecture design tasks**

Understand that the following are conducted in the software architecture design; architecture design of software structure and components; architecture design of external and component-to-component interfaces; design of the top level of the database; creation of (preliminary) user documents; test requirements definition for software integration; evaluation of software architecture design; and joint reviews of software architecture design.

**Sample terms** software component, software component partitioning, software component-to-component interface design, test requirements for software integration

**(2) Software detailed design tasks**

Understand that software detailed design tasks include the following: detailed design of the software components, software interfaces, and database; updating of user documentation; definition of test requirements for software units; updating of test requirements for software integration; evaluation of software detailed design and requirements; and joint review of software detailed design.

**Sample terms** software component unit, functional hierarchy diagram, software unit, unit partitioning, component detailed design, software component interface detailed design, software component-to-component interface design, database detailed design

### **(3) Software architecture design**

Understand that in software architecture design, the software structure and components are designed based on the software requirements definition document from a developer's point of view. In addition, understand that software is divided into software components (programs) to define the functions of each software component and the processing procedure between software components and relationships between them.

**Sample terms** structuring, decision of software component functional specifications, component, input/output design, partitioning into components, reuse

### **(4) Software detailed design**

Understand that in software detailed design, each software component is detailed and documented based on the software architecture specifications at the level of software units (unit, class, module), which are coded, compiled, and tested.

**Sample terms** modular partitioning, module specifications, program design

### **(5) Interface design**

Understand that in interface design, the physical design of data handled through input/output devices is performed based on the software requirements definition document in consideration of operability, responsiveness, viewability, hardware and software functions, and processing methods.

**Sample terms** input/output detailed design, GUI, screen design, form/slip design, interface design standards

### **(6) Design of tests for software units**

Understand that in order to verify that the requirements presented in the detailed software specifications are met, the test specifications for software units should be created, including the definitions of the test scope, test plan, and test method.

**Sample terms** test requirements, checklist, white box test

### **(7) Software integration test design**

Understand that in order to verify that the requirements presented in the detailed software specifications are met, the software integration test specifications should be created, including the definitions of the test scope, test plan, and test method.

**Sample terms** test requirements, checklist, black box test

### **(8) Evaluation and review of software design**

Understand the basic criteria for verifying that the details of the software design agree with the software requirements and evaluating the software design, including the internal consistency between software components and between software units. In addition, understand that the prepared software architecture specifications and detailed specifications are reviewed.

**Sample terms** review participant, review method

## **(9) Software quality**

Understand the quality characteristics for system and software products defined in JIS X 25010 (ISO/IEC 25010). Understand that the quality characteristics are taken into account in defining requirements and designing.

**Sample terms** JIS X 25010 (ISO/IEC 25010), ISO 9000

### **(a) Quality in use model**

Understand the quality in use model's five characteristics related to outcomes of interaction with a system.

**Sample term** effectiveness, efficiency, satisfaction, freedom from risk, context coverage

### **(b) Product quality model**

Understand the product quality model, which specifies eight quality characteristics of the system and/or software product (measurable quality-related characteristics and their associated quality measures).

**Sample term** functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, portability

## **(10) Software design technique**

### **(a) Process-oriented design**

Understand the basic concept and procedure for designing software based on the process-oriented design technique.

### **(b) Data-oriented design**

Understand the basic concept and procedure for designing software based on the data-oriented design technique.

**Sample terms** E-R diagram, entity, relation, normalization, one fact in one place

### **(c) Structured design**

#### **(i) Functional decomposition and structuring**

Understand the following: the procedure for functional decomposition and structuring (arrangement of the functions, definition of the data flow, grouping of the functions, hierarchical structuring, decision of the program functions, and documentation of the functional specifications) and the advantages and considerations of functional decomposition based on structured design.

**Sample terms** hierarchy, stepwise refinement

#### **(ii) Structured design techniques**

Understand that the techniques used for structured design include the flowchart, DFD, structured chart, and state transition diagram.

**Sample terms** sequence, selection, iteration, NS (Nassi-Shneiderman) chart, HIPO

(Hierarchy, plus Input, Process, Output), Jackson method, Warnier method

(iii) Structured design of programs

Understand the purpose, basic concept, and procedure of the structured design of programs.

**Sample terms** quality characteristics, modular partitioning

(d) Object-oriented design

Understand the basic concept, procedures and techniques for object-oriented design.

**Sample terms** class, instance, attribute, method, encapsulation, subclass, inheritance, partitioning into components, reuse, class diagram, polymorphism, package, association, generalization, specialization, decomposition, aggregation

**(11) Design of components**

(a) Concept of component splitting

Understand that the criteria for partitioning components include the processing pattern application, difference in processing timing, difference in processing efficiency, concurrently usable resources, and characteristics of input/output devices. In addition, understand the characteristics of each criterion.

**Sample terms** file merging, file partitioning, record processing, processing cycle

(b) Program partitioning criteria

Understand the criteria for partitioning programs.

**Sample terms** understandability, security, productivity in development, operability, throughput, maintainability, reusability

**(12) Module design**

(a) Partitioning technique

Understand that the partitioning techniques are divided into those that focus attention on the flow of data and those that focus attention on the data structure, and then multiple partitioning techniques are used in combination according to the type of the internal processing. Understand the types and characteristics of typical partitioning techniques.

**Sample terms** STS (Source Transform Sink) partitioning, TR (Transaction) partitioning, common functional partitioning, subroutine

(b) Partitioning criteria

Understand that the criteria for evaluating module independency include the concept of the module strength and degree of coupling along with the relationship between them and independency. Understand the criteria for evaluating amounts of partitioning along with partitioning into components and reuse of them.

**Sample terms** scope of control of a module, scope of effect of a module, amounts of



partitioning, module repartitioning, dependent module

(c) Preparation of module specifications

Understand the concept and procedure of module specifications preparation and typical techniques used in preparing module specifications.

**Sample terms** flowchart, decision table, NS (Nassi-Shneiderman) chart, Jackson method, Warnier method

**(13) Partitioning into components and reuse**

Understand the following: the necessity of partitioning software into components and reusing them; the types of components and their characteristics; considerations in designing components; and basic usage of software packages.

**Sample term** componentware

**(14) Architecture pattern**

Understand the advantages and points to note on the use of an architecture pattern while considering the characteristic that the architecture pattern is a software structure pattern.

**Sample term** MVC model

**(15) Design patterns**

Understand the advantages and considerations in using design patterns based on the fact that design patterns are mainly used for object-oriented design and that they are classified into three different groups: creational patterns, structural patterns, and behavioral patterns.

**(16) Review**

Understand the types and purposes of reviews for evaluating the status and deliverables of project activities on a timely and coordinated manner. Understand that the review process is carried out in a procedure where a document is first prepared, then a review is conducted (the review method is determined, the review evaluation criteria are determined, the review participants are selected), and finally the review results are incorporated into the document.

**Sample terms** design review, inspection, moderator, documentation method, review participant, walk-through, code review, joint review

## **5. Software construction**

**[Goal]**

- Learn the techniques required for software construction so that you can apply them.

**(1) Tasks for software coding and testing**

Understand that in the software construction process, software units are created, the test procedure and data are prepared, the software units are tested, the user documentation and software integration test requirements are updated, and the software coding and test results are evaluated.

**Sample terms** coding, programming language

**(2) Creation of software units**

Understand that software programming is performed in accordance with the prescribed coding conventions and the specifications of the programming language and based on the detailed software specifications.

**Sample terms** algorithm, data processing, structured programming

**(3) Criteria for evaluating software code and test results**

Understand the criteria for evaluating software code and test results. In addition, understand that reviews are conducted after the coding and testing of software units.

**Sample terms** traceability, external consistency, internal consistency, test coverage, appropriateness of coding method and work standards, software integration and test feasibility, feasibility of operation and maintenance

**(4) Coding conventions**

Understand the purpose of coding standards. Understand what specific contents coding conventions should include and what problem may arise if coding conventions are not followed.

**Sample terms** indentation, nest, naming convention, use prohibition instruction

**(5) Coding support method**

Understand the characteristics of a coding support method and its advantages and points to note on the use of the coding support method.

**Sample terms** code supplement, code auditor, syntax highlight

**(6) Code review**

Understand the purpose and method for code reviews. In addition, understand that it should be verified whether or not coding conventions are followed, coding is based on the detailed software design specification, and the efficiency and maintainability are appropriate.

**Sample terms** metrics measurement, code inspection, peer code review

**(7) Debugging**

Understand the debugging methods, considerations, characteristics of desk checking and actual debugging performed by running software, and debugging methods based on development tools.

**Sample terms** debugging environment, static analysis, dynamic testing, assertion, debugger

**(8) Software unit testing**

(a) Test purpose

Understand that software units are tested in accordance with the test specifications defined in software detailed design in order to verify that the requirements are satisfied.

**Sample terms** failure, defect, failure analysis

(b) Test procedure

Understand a series of the following test steps: planning of the tests by determining the test schedule, and framework, along with test tools to be used; preparation of the tests, including creation of the test data and preparation of the test environment; execution of the tests; and evaluation of the test results.

**Sample terms** test methodology, test scope, test preparation (e.g., test environment, test data), person in charge of the tests

(c) Test execution and evaluation

Understand the purpose of tests, implementation methods, considerations, and the roles of the tools used in the tests. Understand that after tests are implemented, the test results are recorded and analyzed, and the program is changed and/or improved.

**Sample terms** driver, stub, test data generator, test design and management technique, bug curve, error removal, bug control chart, experimental design

(d) Test techniques

Understand how test data is prepared in the black box and white box methods used for tests.

**Sample terms** metrics measurement, test case, statement coverage, condition coverage, decision condition coverage, multiple-condition coverage, boundary value analysis, equivalence partitioning, cause-effect graph method, error embedding method

## **6. Software integration and software qualification tests**

**[Goal]**

- Learn the basic concept of the software integration and qualification tests, along with the procedure and techniques so that you can apply them.

**(1) Software integration tasks**

Understand that the following are included in software integration: creation of software integration plan; execution of software integration test; update of user documents; preparation of software qualification test; evaluation of software integration; and joint review of software integration.

**Sample terms** test requirements, test procedure, test data

**(2) Tasks for software qualification test**

Understand that the following are included in software qualification test: execution of software qualification test; update of user documents; evaluation of software qualification test; joint review of software qualification test; audit support; and preparation of software products to be delivered.

**Sample terms** software requirements, audit

**(3) Software integration test**

Understand that a software integration test is conducted in accordance with the test specifications defined in the software architecture design to check software operations.

**Sample terms** test plan, test preparation (e.g., test environment and test data), software integration test report, top-down testing, bottom-up testing, driver, stub

**(4) Software qualification test**

Understand that a software suitability test is conducted in accordance with the software qualification requirements defined in the software requirements definition to verify that the software is implemented according to the software requirements.

**Sample terms** test types (function test, non-functional requirements test, performance test, load test, security test, regression test, etc.)

**(5) Test result evaluation**

Understand that the following are conducted after test execution: recording of test results; analysis and evaluation of test results, change and improvement of programs; and, as required, update of software architecture design specifications and user documents.

## **7. System integration and system qualification tests**

**[Goal]**

- Understand the techniques required for system integration and system qualification tests so that you can apply them to your tasks.

**(1) System integration tasks**

Understand that the following are included in system integration: creation of system integration plan; execution of system integration; update of user documents; preparation of system qualification test; evaluation of system integration test; and joint reviews of system integration.

**Sample terms** hardware configuration item, software configuration item, manual operation

**(2) Tasks for system qualification test**

Understand that the following are included in system qualification test: execution of system qualification test; evaluation of the system; joint review for system qualification test; update of user documents; audit support; preparation of deliverable system; and preparation of system to be inherited to operation and maintenance.

**Sample term** system requirements

**(3) System integration test**

Understand that the system integration test is conducted in accordance with the test

specifications defined in systems architecture design to verify that the system implemented by combining software configuration items, hardware configuration items, manual operation, and other systems, if any, satisfy the requirements.

**Sample terms** test plan, test preparation (e.g., test environment and test data)

#### **(4) System qualification test**

Understand that the system qualification test is conducted in accordance with the qualification requirements defined in system requirements definition to verify that the system is implemented according to the requirements.

**Sample terms** test types (e.g., functional test, non-functional requirements test, performance test, load test, security test, regression test)

#### **(5) Test result evaluation**

Understand that the following are conducted after test execution: recording of test results; analysis and evaluation of test results, system tuning; and, as required, update of documents.

## **8. Installation**

### **[Goal]**

- Understand the overview of system or software installation.

#### **(1) System or software installation tasks**

Understand the overview of the system or software installation, where a system or software installation plan is created and then installation is performed.

#### **(2) Creation of a system or software installation plan**

Understand the overview of installation planning and documentation prior to system or software installation, including how the system or software should be installed in the actual environment, how the old system or software should be migrated to the new system or software, what should be considered besides the effects on the data integrity and business operations, and how the schedule and system should be planned.

**Sample terms** installation requirements, migration requirements, criteria for determining whether or not an installation can be performed, creation of installation plan, installation operation

#### **(3) Execution of system or software installation**

Understand that an installation is performed in accordance with the system or software installation plan. Understand the considerations at the installation. In addition, understand the overview of how system or software and databases are initialized as prescribed by the agreement to build an execution environment and how actual result of installation operations is documented.

**Sample terms** installation procedure, installation framework, user department, system

operations department

#### (4) User support

Understand the overview of the tasks for supporting the users prior to the system or software installation.

### **9. Acceptance support**

#### **[Goal]**

- Understand the overview of system acceptance support or software acceptance support.

#### (1) Tasks for system or software acceptance support

Understand the overview of the system or software acceptance support: acceptance review of the acquirer; support of acceptance test; delivery; and execution of education, training, and support for the acquirer.

**Sample term** delivery

#### (2) Acceptance review and acceptance test for system or software

Understand the overview of how the system or software supplier supports acceptance review and tests by the acquirer, along with the purposes of the acceptance review and test and how they are carried out. In addition, understand the overview of how the acquirer receives acceptance support from the supplier, prepares for the acceptance, conducts an acceptance review and test, and documents the results.

**Sample terms** acceptance procedure, acceptance criteria, acceptance test, receiving inspection, receiving inspection criteria

#### (3) Delivery and acceptance of system or software

Understand the overview of how the system or software supplier and acquirer mutually verify that the system or software is completed as per the agreement before delivering and accepting it.

**Sample term** preparedness for acceptance

#### (4) Education and training

Understand the overview of how the system or software supplier provides the acquirer with educational/training programs and support for initial and continuous operation and how the acquirer builds a framework, and plans and implements educational/training programs based on support from the supplier.

#### (5) User manuals

Understand the overview of how the business operations of the system or software acquirer and the procedures for operating the computer and using the business application programs or systems are documented as user manuals.

**Sample terms** operations regulations, user manual, system usage document, software usage

## **10. Maintenance and disposal**

### **[Goal]**

- Understand the basic concept, types and styles, and procedure of maintenance so that you can apply them to your tasks.
- Understand the basic concept, and procedure of disposal so that you can apply them to your tasks.

### **(1) Maintenance task**

Understand that maintenance requirements must be determined in consideration of the requirements from the organization that receives the maintenance, including the purpose and service level of the maintenance, and the feasibility and the cost of the maintenance from the maintenance provider's point of view. In addition, understand that in the maintenance process, the existing system or existing software is corrected or changed to resolve problems, improve the software, and respond to requests to expand functions while keeping its security.

**Sample terms** maintenance procedure, maintenance framework, feasibility of maintenance, maintenance test, regression test, reverse engineering

### **(2) Disposal task**

Understand that in disposal, support by the operation and maintenance organizations is ended, or the affected system or software proceeds to the final state where operations are not influenced by disposal, and after that, the system or software is deactivated, scrapped, or removed.

**Sample terms** integrity of organizational operations

### **(3) Types of maintenance**

Understand how the maintenance is performed along with the types and styles of maintenance and considerations in maintaining software. Understand what is performed in maintenance and how each maintenance method is different from the others.

**Sample terms** maintenance agreement, maintenance requirements definition, hardware maintenance, daily check, corrective maintenance, preventive maintenance, adaptive maintenance, perfective maintenance, on-site maintenance, remote maintenance, life cycle evaluation

### **(4) Maintenance procedure**

#### **(a) Preparations for initiating the maintenance process**

Understand that preparations are made for initiating maintenance tasks.

**Sample terms** taking over the deliverables that is required for maintenance from the development process, creation of a plan and procedure, procedure

establishment for problem management, preparation of maintenance documentation

(b) Identification of problems and analyses of changes

Understand the process of resolving problems in the system or software to be maintained and addressing requests for improvement.

**Sample terms** analyses of problem report or change requests, reproduction or verification of problems, preparation of options for change implementation

(c) Implementation of changes

Understand how changes are implemented after the implementation parts are determined.

**Sample terms** determination of the system or software and associated documents to be changed, function addition, performance improvement, correction of problems

(d) Maintenance review and/or acceptance

Understand the operational check and completion approval of the changed system or software.

(e) Implementation of preventive measures against recurrence

Understand that in order to prevent recurrence of problems, cause and effect analyses are performed to extract the root causes, the possibility of similar accidents is reviewed, and then system or software is improved or manuals are revised.

(f) Migration

Understand the system migration or software migration procedure, system or software integrity retention, and the considerations in system migration, including the effect on business operations.

**Sample terms** documentation and verification of the migration planning, notification of migration plans to all concerned, parallel operation of the old and new environments and cessation of the old environment, notification of migration to all concerned, verification of the migration, evaluation of the migration, retaining associated old environment data and ensuring its security

**(5) Disposal**

Understand the procedure for disposing of the systems or software that becomes unnecessary because new systems or software has been installed or the existing system or software has been updated.

**Sample terms** disposal planning, notification of disposal plans to the users, parallel operation of the old and new environments and education and training for users, disposal notification to all concerned, retaining disposal associated data and ensuring its accessibility



**Major Category 4: Development Technology**  
**Middle Category 13: Software Development Management Techniques**

**1. Development process and methods**

**[Goal]**

- Understand the basic concepts of typical techniques associated with the software development process so that you can apply them to your tasks.

**(1) Software development methods**

(a) Software development model

Understand the concept of and the need for software development models used for improving software development in efficiency and quality. Understand the concepts of typical software development models.

**Sample terms** waterfall model, spiral model, prototyping model, RAD (Rapid Application Development), agile, software product line, iterative mode, incremental model, evolutionary model

(b) Agile

Understand the characteristics of agile, which is a lightweight development approach capable of developing software quickly and adaptively.

**Sample terms** XP (extreme programming), test driven development, pair programming, refactoring

(c) Reuse of software

Understand that in order to improve the productivity and quality of software development, software must be divided into components so that they can be reused; that software components must be designed and created on the precondition that they are reused; and that in some cases, software packages can improve the productivity and quality of development.

**Sample terms** module independence, standardization, customization

(d) Reverse engineering

Understand that reverse engineering is an approach that analyzes existing software to understand the basic design policy; that software developed and sold based on the result obtained through reverse engineering, without permission from the entity that holds the rights to the original software, may infringe the intellectual property rights to the original product; and that some license agreements prohibit reverse engineering.

**Sample terms** compatibility, call graph

(e) Mashup

Understand that mashup is a technique for building new services by combining APIs from multiple providers. In addition, understand the productivity of mashup along with its characteristics in quality.

**Sample term** Web 2.0

(f) Mobile application software development

Understand the basic procedure and points to note of mobile application software development.

**Sample term** mobile web application software, native application software, hybrid application software, User-Agent, permission request, application software review, application software distribution

**(2) Structured methods**

Understand that for large systems and complicated processing, structured methods are used to secure proper quality and facilitate program maintenance. Understand the procedure and effect of structured methods.

**Sample terms** hierarchical structuring, stepwise detailing, structured chart, state transition diagram, HIPO (Hierarchy, plus Input, Process, Output), DFD, software structure

**(3) Formal method**

Understand that the formal method uses a formal specification description language instead of a traditionally used natural language to strictly describe the formal specifications according to specific rules for the purpose of improving the quality of software.

**Sample term** VDMTools

**(4) Development process**

(a) Software life cycle process

Understand the purpose and overview of SLCP (Software Life Cycle Process).

**Sample terms** SLCP-JCF (Japan Common Frame), JIS X 0160

(b) Process maturity level

Understand that CMMI, an approach that models the system development organization and process maturity levels, can be used in evaluating and improving the development and maintenance processes. Understand the basic concept of CMMI, which defines five process maturity levels, for example.

**Sample terms** initial, managed, defined, quantitatively managed, optimizing

## 2. Intellectual property application management

### [Goal]

- Understand the overview of intellectual property rights along with the characteristics, coverage, and management.

#### (1) Copyright management

Understand the concept as to the ownership of the copyright of the software to be developed.

**Sample terms** author of the program, employee work

#### (2) Patent management

Understand the concepts of how inventions created during the software development process are protected and how a patent held by a third party is licensed if it must be used.

**Sample terms** patent right, exclusive license, non-exclusive license

#### (3) License management

Understand that if a company must develop software using another software for which the company does not hold the rights, then that software must be licensed to the company, and that the obtained license must be managed so that the use and the number of users can comply with the license agreement.

**Sample terms** licensor, licensee

#### (4) Technical protection

Understand the characteristics, advantages, and points to note of the method for technically protecting intellectual properties such as software and content.

**Sample terms** copy guard, DRM, activation, CPRM

## 3. Development environment management

### [Goal]

- Understand the overview of the need for development environment management along with the objects to be managed and the details of the management.

#### (1) Development environment construction

Understand that for efficient development activities, development tools, including hardware, software, a network, and a simulator for development, must be prepared according to the development requirements.

**Sample terms** configuration item, software license

#### (2) Objects to be managed

##### (a) Development environment operation status management

Understand that for efficient development activities, an appropriate development environment, including computer resources and development support tools, must be prepared, and that the

operation status of the resources must be properly identified and managed.

**Sample terms** resources management, operations management

(b) Design data management

Understand the need for design data management: version control of the data associated with the design, shared data management in a project, security management, and so on. In addition, understand that the data with trade secret and personal information must be stringently managed, including who used the data for what purposes and whether or not the data has been taken out or falsified.

**Sample terms** change history control, access right control, search

(c) Tool management

Understand that if many people are involved in development activities, then problems associated with compatibility between the developed software programs may arise because they may use different versions and tools for the development. In addition, understand that the tools must be managed by unifying the tools and versions because the reliability of the software to be developed may be affected by the selection of tools, which may cause bugs and security holes.

**Sample terms** configuration item, version control

(d) License management

Understand that a violation of license requirements is unauthorized use of the license, which is regarded as illegal for which a penalty is imposed. In addition, understand why it must be verified that the license is correctly understood and properly used by regularly checking the number of programs installed and licenses held against the license requirements.

**Sample terms** unauthorized copying, version control, inventory taking

#### **4. Configuration management and change control**

**[Goal]**

- Understand the overview of configuration management and change control.

**(1) Configuration management**

Understand the overview of the configuration management process, where configurations are managed by establishing a configuration identification system for identifying what configuration items compose entire software and defining the method for managing the configuration identification system.

**Sample terms** SCM (Software Configuration Management), SCI (Software Configuration Item), SLCP (Software Life Cycle Process), configuration management plan

**(2) Change control**

(a) Configuration status recording

Understand the importance of managing and documenting the status and history information of the reference software items. In addition, understand the overview of recording the number of changes in the project, latest version, and migration status in the appropriate documents.

(b) Assurance of the completeness of items

Understand the necessity for determining and assuring the functional completeness and physical completeness of software items.

**Sample terms** consistency, accuracy

(c) Release management and shipment

Understand the overview of performing a series of procedures, such as the shipment of the new version of software and its related documents, after the integrity assurance of the configuration items. In addition, understand the overview of maintaining the software code and documents until the end of the software life.

**Sample terms** version control, retention period

# Management

**Major category 5: Project Management**  
**Middle category 14: Project Management**

## 1. Project management

### [Goal]

- Understand the overview of the purpose, approach, processes, process groups, and subject groups of projects and project management.
- Understand the overview of the types and characteristics of project frameworks along with the details of self-management.

### (1) Purpose and concept of projects and project management

#### (a) What are projects and what is project management?

Understand that a project is a time limited activity that is carried out in order to achieve a purpose, and that it has a start date and end date. In addition, understand the overview where smooth promotion of a project for achieving a purpose requires a management cycle called PDCA: planning (Plan), doing activities as planned (Do), checking the differences between the plan and real accomplishments (Check), and acting against the causes of the differences (Act).

**Sample terms** project, project management, project environment, project governance, project life cycle, project constraints, ISO 21500, PMBOK (Project Management Body of Knowledge)

#### (b) Three types of processes used in projects

Understand the overview of the three types of processes used in projects.

**Process types** project management process, delivery process, support process

#### (c) Five process groups in project management

Understand the overview of the five process groups in project management.

**Process groups** initiating process group, planning process group, executing process group, controlling control process group, closing process group

#### (d) Ten subject groups in project management

Understand the overview of ten subject groups in project management.

**Subject groups** integration subject group, stakeholder subject group, scope subject group, resource subject group, time subject group, cost subject group, risk subject group, quality subject group, procurement subject group, communication subject group

## **(2) Project frameworks and self-management**

### **(a) Project frameworks**

Understand the overview of the types and characteristics of project frameworks

**Sample terms** functional organization, matrix organization, projectized organization

### **(b) Self-management**

Understand the points, plans, activities, reports, notifications, and consultations to be self-managed in a project framework.

**Sample terms** activity planning, progress management, quality management, cost management, risk management, change control, problem discovery, problem reporting, measures planning, documentation, communication

## **2. Project integration management**

### **[Goal]**

- Understand the overview of the purpose and concept of project integration management
- Understand the overview of the processes included in project integration management.
- Understand the overview of the documentation and methods necessary to understand and manage an entire project.

### **(1) Purpose and concept of project integration management**

Understand that project integration management is intended for managing and adjusting all processes of the project management activities in an integrated manner.

**Sample terms** project charter, scope

### **(2) Processes in project integration management**

Understand the overview of the processes included in project integration management.

**Processes** preparation of project charter, preparation of a project plan, direction of project activities, control of project activities, control of change, closing of project phase or project, collection of learned lessons

### **(3) Understanding and management of an overall project**

Understand the overview of the documents required to understand the entire project, possible changes to the specifications and schedule during the project implementation, the problem management techniques, etc.

**Sample terms** project activity scope description document, preparation of a project management plan, request for change, change register, project completion report, closing report of project phase or project, documentation of lessons learned, CCB (Change Control Board)

### **3. Project stakeholder management**

#### **[Goal]**

- Understand the overview of the purpose and concept of project stakeholder management.
- Understand the overview of the processes in project stakeholder management.
- Understand the purposes of documenting information concerning the advantages and disadvantages for, and involvement of, a specific stakeholder.

#### **(1) Purpose and concept of project stakeholder management**

Understand that the purpose of project stakeholder management is to identify individuals, groups, and organizations who have an effect or be affected.

**Sample term** stakeholder

#### **(2) Processes in project stakeholder management**

Understand the overview of the processes in project stakeholder management.

**Sample terms** identification of stakeholders, management of stakeholders

#### **(3) Documentation of information concerning project stakeholders**

Understand the documenting of information concerning the advantages and disadvantages for, and involvement of, a stakeholder.

**Sample terms** stakeholder register

### **4. Project scope management**

#### **[Goal]**

- Understand the purpose and concept of project scope management.
- Understand the overview of the processes in project scope management.
- Understand the purpose of WBS creation.

#### **(1) Purpose and concept of project scope management**

Understand that project scope management aims to ensure that a project properly includes all necessary activities so that it can be successfully accomplished.

**Sample terms** scope, WBS, activity, baseline

#### **(2) Processes in project scope management**

Understand the overview of the processes included in project scope management.

**Sample terms** scope definition, WBS creation, activity definition, scope control

#### **(3) Purpose of WBS creation**

Understand that it performs step-by-step, hierarchical element decomposition of the deliverables and activities of a project and that it is used for planning and managing the budget, processes, quality, etc.

**Sample terms** WBS dictionary, work package, scope creep



## **5. Project resource management**

### **[Goal]**

- Understand the purpose and concept of project resource management.
- Understand the overview of the processes in project resource management.

### **(1) Purpose and concept of project resource management**

Understand that project resource management aims to ensure that a project properly includes all necessary physical resources and that they are provided appropriately so that it can be successfully accomplished.

**Sample terms** staff (project manager, project member, project management team), PMO (Project Management Office), device, equipment, material, software, hardware

### **(2) Processes in project resource management**

Understand the overview of the processes included in project resource management.

**Processes** project team formation, resource estimation, project organization decision, project team development, resource control, project team management

## **6. Project time management**

### **[Goal]**

- Understand the purpose and concept of project time management so that you can apply them to your tasks.
- Understand the purposes, basic roles, and functions of the processes in project time management so that you can apply them to your tasks.
- Understand the types of schedules along with techniques for schedule development and schedule management so that you can apply them to your tasks.

### **(1) Purpose and concept of project time management**

Understand that project time management aims to ensure that a project is completed at a given time period. In addition, understand the importance of progress management performed by individual project members.

**Sample term** activity list

### **(2) Processes in project time management**

Understand the overview of the processes included in project time management.

**Processes** ordering of activities, estimate of activity period, schedule creation, schedule control

### (3) Typical types of schedules, and their creation and management techniques

#### (a) Types of schedules

Understand that there are several types of schedules in accordance with the purpose.

**Sample terms** master schedule, intermediate schedule, detailed schedule

#### (b) Techniques for schedule development

Understand that a schedule of your task is developed based on the estimation of the resources, workload, and duration required for each activity. In addition, understand typical techniques for developing schedules along with the characteristics and basic usage.

**Sample terms** analogous estimating, parametric estimating, three-point estimate, reserve analysis, schedule network analysis, PERT, CPM (Critical Path Method), PDM (Precedence Diagramming Method), critical chain, arrow diagram, Gantt chart, trend chart, milestone, resource leveling, crashing, fast-tracking, lag, lead

#### (c) Techniques for managing schedules

Understand the characteristics of typical techniques for developing and managing schedules along with the basic usage.

**Sample terms** progress report, EVM (Earned Value Management)

## 7. Project cost management

### **[Goal]**

- Understand the purpose and concept of project cost management so that you can apply them to your tasks.
- Understand the purposes, basic roles, and functions of the processes in project cost management so that you can apply them to your tasks.
- Understand typical techniques for estimating and managing costs so that you can apply them to your tasks.

### (1) Purpose and concept of project cost management

Understand that project cost management aims to ensure that a project is completed within the planned budget. In addition, understand the importance of the cost management, including the self-management of person-hours, performed by individual project members.

**Sample terms** cost baseline, cost of resources

### (2) Processes in project cost management

Understand the overview of the processes included in project cost management.

**Processes** cost estimate, budgeting, cost control

### (3) Typical techniques for estimating and managing costs

Understand typical techniques for estimating and managing costs along with the characteristics and basic usage. Also, understand that costs are summarized using a cost estimation technique and given conditions and that costs generated within the scope of your tasks are recorded and summarized.

**Sample terms** three-point estimate, top-down estimate, bottom-up estimate, analogous estimate, FP (Function Point) method, LOC (Lines of Code) method, COCOMO (Constructive Cost Model), COCOMO II (Constructive Cost Model II), development productivity, EVM (Earned Value Management)

## 8. Project risk management

### **[Goal]**

- Understand the purpose and concept of project risk management.
- Understand the overview of the processes in project risk management.
- Understand methods for identification of typical risks, analysis methods, and responses to risk, and apply them to your tasks.

### (1) Purpose and concept of project risk management

Understand that the purpose of project risk management is to identify latent phenomena that bring pros and cons to a project, evaluate them, decide on countermeasures, and then control to increase favorable opportunities and decrease threats.

**Sample term** risk

### (2) Processes in project risk management

Understand the overview of the processes included in project risk management. In addition, from a project member's standpoint, understand that the project members contribute to project risk management through regular meetings, status reporting, and others.

**Sample terms** risk identification, risk evaluation, response to risk, risk control

### (3) Methods for identification of typical risks, analysis methods, and responses to risk

Understand methods for the identification and analysis of typical risks, and responses to such risks.

**Sample terms** brainstorming, Delphi method, qualitative risk analysis, quantitative risk analysis

## **9. Project quality management**

### **[Goal]**

- Understand the purpose and concept of project quality management so that you can apply them to your tasks.
- Understand the purpose, basic roles, and functions of project quality management so that you can apply them to your tasks.
- Understand typical quality management techniques so that you can apply them to your tasks.

### **(1) Purpose and concept of project quality management**

Understand that project quality management aims to define a quality policy, objectives, and commitment to quality for the purpose of satisfying the needs addressed by the project and to ensure that the required processes are performed to achieve the defined quality policy, objectives, and commitment to quality. In addition, understand the importance of the quality management performed by individual members.

**Sample term** JIS Q 9000 family standards, JIS X 25010, CMMI

### **(2) Processes in project quality management**

Understand the overview of the processes included in project quality management.

**Processes** quality planning, implementation of quality assurance, implementation of quality control

### **(3) Typical quality management techniques**

Understand typical quality management techniques.

**Sample terms** benchmark, quality management, review, walk-through, inspection, test, failure report, quality index, control chart, cause and effect diagram, Pareto chart, scatter diagram, corrective action, preventive action

## **10. Project procurement management**

### **[Goal]**

- Understand the purpose and concept of project procurement management.
- Understand the overview of the processes in project procurement management.
- Understand the overview of utilization method of external resources.

### **(1) Purpose and concept of project procurement management**

Understand that project procurement management aims to properly settle and manage the contracts required for purchasing and obtaining the resources and services required for carrying out activities.

**Sample terms** buyer, supplier, RFP (Request For Proposal)

**(2) Processes in project procurement management**

Understand the overview of the processes included in project procurement management.

**Processes** procurement planning, supplier selection, procurement management

**(3) Utilization method of external resources**

Understand the overview of utilization method of external resources.

**Sample terms** outsourcing, co-sourcing, system integrator, IDC (Internet Data Center)

**11. Project communications management**

**[Goal]**

- Understand the purpose and concept of project communications management so that you can apply them to your tasks.
- Understand the processes in project communications management so that you can apply them to your tasks.
- Understand typical information distribution methods and apply them to your tasks.

**(1) Purpose and concept of project communications management**

Understand that project communications management aims to connect information with people by properly creating, distributing, and disposing of project information. In addition, understand the importance of the communications management performed by individual members.

**Sample term** communication

**(2) Processes in project communications management**

Understand the overview of the processes included in project communications management.

**Sample terms** communications planning, information distribution, communication management

**(3) Typical information distribution methods**

Understand typical information distribution methods.

**Sample terms** push, pull, feedback, e-mail, voicemail, video conference, paper

## 1. Service management

### **[Goal]**

- Understand the purpose and concept of service management.
- Understand the concept of service management system establishment and improvement.

#### **(1) Purpose and concept of service management**

Understand that in order to fulfill service requests and perform service planning, transition, provision, and improvement, service management is a series of capabilities and processes that control and manage the activities and resources of a service provider. In addition, understand that the JIS has defined the service management processes.

**Sample terms** service, service quality, service component, service management, service management system, service requirements, customer, service provider, JIS Q 20000 standards (ISO/IEC 20000)

#### **(2) Establishment and improvement of service management system**

Understand that the PDCA (Plan-Do-Check-Act) methodology is applied to service management processes as well as service and improvement processes. In addition, understand the overview of the service management construction.

**Sample terms** process approach, continuous improvement, gap analysis

#### **(3) ITIL**

Understand the overview of ITIL (Information Technology Infrastructure Library), a framework for service management, globally used as the de facto standard.

**Sample terms** ITIL, service life cycle, stages of the service life cycle (strategy, design, transition, operation, continuous improvement)

#### **(4) SLA**

Understand that an SLA (Service Level Agreement) defines a service and service target, and is an agreement between a customer and a service provider. In addition, understand typical clauses in an SLA.

**Sample terms** SLA, availability, reliability, service time, response time, service and process performance

## 2. Service design and transition

### [Goal]

- Understand the concept of design and transition of services so that you can apply them to your tasks.

#### (1) Design of service

Understand that requirements for service quality are converted into tangible forms when new services or changes in services, which are proposed to meet business needs or improve the effectiveness of services, are designed on the basis of the change management policy.

**Sample terms** design and development, service acceptance criteria, service design document, non-functional requirements, service pipeline

#### (2) Transition of service

Understand the following procedure when implementing transition to new services or changes in services: using an acceptance test environment to perform a test prior to deployment in an operational environment; verifying on the basis of service acceptance criteria; deploying approved new services or changes in services to an operational environment; etc.

**Sample terms** transition, operational service level agreement, activity and system transition, transition planning, transition rehearsal, transition judgment, notification of transition, transition evaluation, operational test, acceptance test, handover of operations

## 3. Service management processes

### [Goal]

- Learn each process of service management so that you can apply them.

#### (1) Service level management

Understand that SLM (Service Level Management) involves an SLA being signed between a customer and a service provider, and defines, agrees, and manages service levels. Also understand that it is a series of activities for maintenance and improvement of services through the PDCA management cycle, and that it reviews SLAs and processes on the basis of the results of service level monitoring.

**Sample terms** service level management, service target, review of SLA, service improvement plan, service catalogue

#### (2) Service reporting

Understand the creation of reliable and accurate reports in a timely manner, according to agreement with customers to promote decision-making and effective communication based on sufficient information.

**Sample terms** service reporting, trend information

### **(3) Service continuation and availability management**

Understand the activities to reliably implement the requests concerning availability and service continuation agreed with customers both under normal circumstances and after a service interruption.

**Sample terms** service continuation and availability management, business continuity plan (BCP), RTO, RPO, service continuation planning, recovery, cold standby, hot standby, availability, reliability, maintainability, MTBF, MTTR

### **(4) Budgeting and accounting services for IT services**

Understand that financial conditions are managed efficiently through following activities: performing budgeting services to plan and manage the budgeting for service provision cost; performing accounting as an accounting service.

**Sample terms** budgeting and accounting for IT services, financial management, budgeting, accounting, total cost of ownership (TCO)

### **(5) Capacity management**

Understand that capacity management is a series of activities for ensuring that the service provider has sufficient capability in order to manage the required capacities, including volume and capabilities, for the purpose of providing the current and future stable services.

**Sample terms** capacity management, capacity planning, monitoring, management index (CPU utilization, memory utilization, disk utilization, network utilization, etc.), threshold

### **(6) Management of information security**

Understand that information security management measures are implemented in order to maintain the confidentiality, integrity, and accessibility of information assets.

**Sample terms** information security management, information assets, physical access management, network security solution, user access management, user authentication, user password management, privilege management, access control, protection of log information, information security incident, malware

### **(7) Business relationship management**

Understand the overview of the required activities in order to establish a favorable relationship between a service provider and a customer.

**Sample terms** business relationship management, user, customer satisfaction, complaint



## **(8) Supplier management**

Understand the overview of management activities for when a supplier is used by a provider to implement and operate service management processes. Also understand operational level agreements with internal groups that are a part of a service provider's organization.

**Sample terms** supplier management, contract, OLA (Operational Level Agreement), use of cloud services such as SaaS, PaaS, and IaaS

## **(9) Management of incidents and service requests**

Understand that management of incidents and service requests is a process for handling incidents or service requests in order to restore the service agreed with the customer as swiftly as possible.

**Sample terms** management of incident and service requests, incident, service request, escalation, impact, workaround

## **(10) Problem management**

Understand that problem management is a series of activities for identifying the root causes of problems to present solutions to prevent a recurrence of such problems.

**Sample terms** problem management, problem, known error, root cause

## **(11) Configuration management**

Understand that configuration management is a series of activities for defining the information about CIs (Configuration Items) such as hardware, software, and documents that make up IT services to retain accurate configuration information.

**Sample terms** configuration management, configuration item, CMDB (Configuration Management Database), version, asset management

## **(12) Change management**

Understand that change management is a series of activities for reliably performing evaluation, decisions for acceptance of change requests, deployment of changes in accordance with a change schedule, and reliable post-implementation reviews to avoid risks and make every change efficiently in a controlled manner.

**Sample terms** change management, RFC (Request For Change), emergency change, change request record

## **(13) Release and deployment management**

Understand that release and deployment management is a series of processes for deploying the changes, which are approved in the change management process, into an operational environment as a release.

**Sample terms** release and deployment management, release, emergency release, deployment

## 4. Service operation

### [Goal]

- Learn the roles of system operations management such as operation planning and resource management, and apply them.
- Learn the roles and functions of operations such as system operations and scheduling, and apply them.
- Learn the roles and functions of the service desk, and apply them.

### (1) System operations management

Understand that in system operations management there are activities that are implemented in line with policies for capacity management, information security management, service continuation, and availability management in addition to daily operation plans, plans for the appropriate implementation of operation when a failure occurs, and improvement plans to reduce operational load. In addition, understand that the management of operational resources is a series of activities for ensuring that the facilities, computer systems, data, manuals, created deliverables, and system operations staff are maintained and managed so that they can properly conform to the goals of the organization.

**Sample terms** system operations management, operational resource management (human resources such as staff, and technological resources for infrastructure such as hardware, software, data, and networks), operations management of virtual environments, job management, data management, user management

### (2) Operation

Understand that for stable system operations, the systems are monitored and operated, and the situations are communicated in accordance with the prescribed procedure. Understand that the systems are operated in accordance with documented work instructions and that a log of operations is kept. In addition, understand the details of operations such as job scheduling, output management, and backup.

**Sample terms** operation, schedule design, job scheduling, backup, system monitoring and operation, output management, job recovery and rerun, operations support tools (monitoring tools, diagnostic tools), business operations manual

### (3) Service desk

Understand that a service desk performs a series of the following activities: providing a single point of contact to the inquiries from service users; handing over the inquiries to appropriate departments; recording the handling results; manages these records; and so on.

**Sample terms** service desk, SPOC (Single Point Of Contact), call center, CTI (Computer Telephony Integration), FAQ, response manual, knowledge base, primary support

## 5. Facility management

### [Goal]

- Learn the purpose and concept of facility management along with the considerations in managing, maintaining, and protecting facilities so that you can apply them.

### (1) Facility management

#### (a) Purpose and concept of facility management

Understand the overview of facility management in managing and operating the design and foundation of the facility infrastructure for computer systems and networks.

**Sample term** facility management

#### (b) Facility management

Understand that data centers and other facilities and computers, networks, and other equipment are managed to reduce costs and to ensure comfort and security.

**Sample terms** facilities management, building management (quake-absorbing unit, arresters and other surge protection devices, accident prevention, crime prevention facility and safety management-related knowledge, etc.), electrical equipment (UPS, private power generator, etc.), air conditioning (air conditioning equipment, cold aisle, hot aisle, etc.), communication equipment (MDF, IDF, etc.)

#### (c) Maintenance and protection of facilities

Understand that the facilities must be maintained and protected in a proper state.

**Sample term** maintenance and protection of facilities

#### (d) Environmental aspects

Understand the eco-friendly IT products and infrastructure and the use of IT for environmental preservation and effective use of resources.

**Sample terms** environmental aspects, green IT

**Major category 6: Service Management**  
**Middle category 16: System Audit**

**1. System audit**

**[Goal]**

- Understand the purposes and types of audits.
- Understand the purposes, procedures, and target business tasks of system audits along with the concept of system auditability.
- Understand the concepts of system audit planning, implementation, and reporting.
- Understand the overview of system audit standards.

**(1) Audit tasks**

Understand the types and purposes of audits associated with information systems.

**Sample terms** accounting audit, operations audit, system audit, information security audit, statutory audit, voluntary audit, internal audit, external audit

**(2) Purpose and procedure of system audits**

**(a) Purpose of system audits**

Understand that a system audit aims to ensure that an independent, professional system auditor verifies or evaluates whether or not the control for the risks associated with the information systems in an organizational entity is properly maintained and managed based on a risk assessment in order to assure it or give advice for the purpose of contributing to IT governance.

**Sample terms** list of companies providing auditing services

**(b) System audit procedure**

Understand that a system audit is based on a given audit plan in the following order: comprehensive inspection and evaluation of the information system; explanation of audit results to the client; recommendation of items to be improved; verification of improved status; and guidance for improvement.

**Sample terms** qualifications for system auditor, system audit standards, audit evidence

**(3) Targeted business operations of system audits**

Understand that system audits target the whole lifecycle, covering system planning, development, operations, and maintenance. In addition, understand that the purpose and targeted business operations of system audits must be clearly defined by documented regulations, agreements, or the like.

**Sample term** internal audit charter

**(4) System auditability**

Understand that for smooth system audit implementation, the information systems must be constructed and maintained with an awareness of auditability.

**Sample terms** log, trace

**(5) System audit planning**

Understand that for effective, efficient audit implementation, the system auditor drafts an audit plan that defines the details of the audit procedure, and the timing and scope of the audit.

**Sample term** documented system audit plan

**(6) System audit implementation (preliminary audit, main audit, evaluation, and conclusion)**

Understand that the system auditor conducts a sufficient study based on the audit plan to verify or evaluate the system.

**Sample terms** system audit technique, audit evidence, audit work papers

**(7) System audit reporting**

Understand that the system auditor reports the audit results to the client and takes necessary follow-up actions to ensure that required measures are implemented.

**Sample terms** system audit report, assurance opinion, advisory opinion, recommendations, findings

**(8) System audit quality evaluation**

Understand why the validity of system audits needs to be evaluated.

**(9) Other system-related audits**

Understand the overview of information security audit, personal information protection audit, and compliance audit, and so on.

**Sample terms** Information Security Audit Standards, Information Security Management Standards, list of companies providing auditing services, JIS Q 15001, Privacy Mark System, JIS Q 19011 (Guidelines for auditing management systems), Copyright Act, Unfair Competition Prevention Act, Labor Standards Act

**(10) Laws and regulations concerning system-related audits**

Understand that the procedure and details of system audits are defined by the Information Security Audit Standards established by the Ministry of Economy, Trade and Industry. In addition, understand that system auditors are required to have basic knowledge about the related regulations and standards according to the business operations as well as information security.

## 2. Internal control

### **[Goal]**

- Understand the purposes and concepts of internal control and IT governance at corporations and other organizations.

### **(1) Internal control**

Understand that internal control is a mechanism for corporations and other organizations to take the initiative in building and operating a framework that delivers healthy, efficient organizational operations and that the actualization of this framework requires the defining of the business process, segregation of duties, development of enforcement rules, and establishment of a check system. In addition, understand what role IT plays in performing internal control.

**Sample terms** defining of business process, segregation of duties, development of enforcement rules, establishment of a check system, mutual checks and balances (separation of duties), role IT plays in performing internal control, compliance, COSO (Committee of Sponsoring Organizations of the Treadway Commission) framework, internal control report system, response to IT, IT general control, IT application control

### **(2) IT governance**

Understand that IT governance (JIS Q 38500) is an effort by corporations and other organizations to develop an information systems strategy and control the implementation for the purpose of improving competitiveness. Understand the efforts that are made to achieve IT governance, including system audits, information security audits, and software asset management.

**Sample terms** JIS Q 38500, CIO (Chief Information Officer), CISO (Chief Information Security Officer), IT control, corporate governance

### **(3) Evaluation and improvement of compliance**

Understand that information systems must be constructed and operated in compliance with the applicable laws and regulations concerning relevant business systems. In addition, understand that the compliance with the laws and regulations must be evaluated and improved in a timely and proper manner.

**Sample terms** Companies Act, Financial Instruments and Exchange Law, CSA (Control Self Assessment)

# Strategy

**Major category 7: System Strategy**  
**Middle category 17: System Strategy**

## 1. Information systems strategy

### [Goal]

- Understand the overview of the purpose and concept of information systems strategies along with the procedure for establishing an information systems strategy.
- Understand the overview of the enterprise architecture technique.
- Understand the overview of program management and its framework, quality control, and information systems strategy management.

### (1) Information systems strategy

#### (a) Purpose and concept of information system strategy

Understand the purpose and concept of the information systems strategy in corporate activities.

**Sample terms** information systems strategy evaluation, CIO (Chief Information Officer), total computerization planning

#### (b) Procedure for developing information systems strategy

Understand the overview of the steps for developing an information systems strategy.

[Examples of steps]

(i) Checking the business strategy; (ii) Examining and analyzing the business operations environment; (iii) Examining and analyzing the business operations, information system, and information technology; (iv) Developing the fundamental strategy; (v) Creating the new image of the business operations; (vi) Selecting the targets for the information systems and developing an investment goal; (vii) Developing a proposed information systems strategy; (viii) Approving the information systems strategy

#### (c) Organization form

Understand that the organizations that plan, develop, operate, and maintain information systems include functionalized organizations, divisional organizations, matrix organizations, and project organizations.

#### (d) Total computerization planning

##### (i) Total optimization policy

Understand that a total optimization plan is a policy that indicates the direction in which the business operations and the systems in the entire organization should go.

**Sample terms** total optimization goal, IT governance policy, ideal information system (to-be model), information security policy

(ii) Total optimization planning

Understand that total optimization planning is intended to integrate the rules and information systems established by the individual business units in a business and to improve efficiency and effectiveness based on the total optimization plan.

**Sample terms** standardization policy and quality policy for system construction and operations, system management standards

(e) Computerization investment planning

Understand that computerization investments are planned in consideration of consistency with the business strategy and that when a computerization investment plan is developed, multiple options must be reviewed from the viewpoints of the impact, effect, duration, and feasibility.

**Sample terms** computerization investment policy, IT investment management

(f) Computerization planning

Understand that each individual computerization plan is made up according to the total computerization planning and that the systems for improving corporate strategic characteristics include the system that provides integrated management of the entire corporation or business activities and the system that helps integrated operation between corporations.

**Sample terms** mission critical system, ERP (Enterprise Resource Planning), SCM, CRM (Customer Relationship Management), SFA, KMS (Knowledge Management System)

(g) Model

Understand the overview of the models for corporate management systems.

**Sample terms** business model, business operations model, information systems model

**(2) Enterprise architecture**

(a) Purpose and concept of enterprise architecture

Understand that EA (Enterprise Architecture) is a technique for designing and managing an organization for the purpose of modeling business operations and systems across the organization using a unified technique to improve business operations and systems at the same time. Understand that it is necessary to create an architecture model for total optimization and to define objectives clearly. Understand that the architecture model involves the components of the business operations and systems to represent the current and ideal states of the entire systems by summarizing across the organization the business processes, information used in the business operations, components of the information systems, and the architectures for the areas (business, data, application, and technology) of the information technologies to be used.

**Sample terms** Zackman framework, business operations and system optimization, as-is



model, to-be model

(b) Business architecture

Understand that BA (Business Architecture) represents the systematized goals and business operations of an organization.

**Sample terms** business description, DMM (Diamond Mandara Matrix), DFD, WFA (Work Flow Architecture), UML

(c) Data architecture

Understand that DA (Data Architecture) represents the systematized structures and the relationships between the data items required by the goals and business operations of an organization.

**Sample terms** data definition table, information systemization summary chart (UML class diagram), E-R diagram

(d) Application architecture

Understand that AA (Application Architecture) is an architecture that systematically describes the relationships business operations for achieving the goal as an organization and applications for actualizing those business operations.

**Sample terms** information system relationship diagram, information system function configuration diagram, SOA (Service Oriented Architecture)

(e) Technology architecture

Understand that TA (Technology Architecture) represents the systematized technologies, including the hardware, software, and network, for actualizing business operations.

**Sample terms** hardware configuration diagram, software configuration diagram, network configuration diagram

**(3) Program management**

Understand that a program is a set of organically combined projects. Understand that program management is a practical ability to flexibly adapt the implementation performance of an organization while adapting to changes in external environments for the purpose of achieving the total mission, and is a set of activities for integration to enhance the total value by optimizing the relationships and bindings between the projects for achieving the total mission.

**Sample term** PMO (Program Management Office)

**(4) Framework**

Understand that the entire organizational structure must include an organization responsible for information systems, that the position and mission of that organization must be clearly defined, and that the requirements for information systems control must be defined and clarified.

**Sample terms** COBIT (Control Objectives for Information and related Technology), ITIL (Information Technology Infrastructure Library), System Management Standards, SLCP-JCF (Japan Common Frame), KGI (Key Goal Indicator), KPI (Key Performance Indicator)

#### (5) Quality control

Understand that quality control is an organization, framework, and a set of activities for ensuring the compliance with the standards associated with information systems, monitoring continuous compliance, and assuring the quality of the information systems.

**Sample terms** quality control framework, management process

#### (6) Information systems strategy implementation management

Understand that information systems strategy implementation management is a series of activities for monitoring the implementation status of the information systems strategy to ensure that it is implemented.

**Sample terms** monitoring indicator, variation analysis, response to risk

## 2. Business process

### [Goal]

- Understand the overview of business improvement and problem solving.

#### (1) Business improvement and problem solving

Understand the concept that the existing organizational structure and business processes are reviewed to make effective use of systems and optimize business operations and systems.

**Sample terms** BPR (Business Process Reengineering), BPMS (Business Process Management System), BPO (Business Process Outsourcing), offshore, workflow system, SFA

## 3. Solution business

### [Goal]

- Understand the basic concept and typical services of solution business.

#### (1) Solution business

Understand that the progression of information technology and the management environments that are increasing in complexity have developed the solution business, which proposes and provides services that solve the management issues of customers, and that in conducting the solution business, it is important to provide solutions based on the identification of the issues of customers and to build and maintain a relationship of trust with customers.

**Sample terms** solution, solution provider, business system proposal, business package, problem solving support, systems integration

## (2) Types of solution services

Understand that a variety of solution services, intended for specific industries, business operations, and issues are provided. In addition, understand what are typical services, along with their types and characteristics.

**Sample terms** cloud service (SaaS, PaaS, IaaS, etc.), public cloud, private cloud, hybrid cloud, ASP, outsourcing service, hosting service, housing service, SOA (Service Oriented Architecture), on-premise, CRM solution, security solution

## 4. System utilization promotion and evaluation

### [Goal]

- Understand the concept of information systems utilization promotion and evaluation.
- Understand how important it is to objectively evaluate and verify the utilization of information systems for the purpose of improving them.
- Understand the concept of information systems disposals.

### (1) System utilization promotion and evaluation

#### (a) Purpose and concept of system utilization promotion and evaluation

Understand that in order to make effective use and take advantage of information systems in business management, activities for promoting the utilization, popularization, and raising the awareness of information systems are continuously conducted, even during the construction of such systems, to evaluate and verify actual use for the purpose of improvements. In addition, understand the purposes and concepts of these activities.

#### (b) Information literacy

Understand how important it is to establish information literacy to make safe, effective, and efficient use of information toward the business objectives.

#### (c) Data utilization

Understand how important it is to analyze the data stored in the information systems so that it can be used for future business development strategies.

**Sample terms** KM (Knowledge Management), data mining, BI (Business Intelligence) tool, big data, BYOD (Bring Your Own Device)

#### (d) Popularization and awareness raising

Understand how important it is to conduct popularization and awareness-raising activities, including educational/training programs for utilizing information systems.

**Sample terms** system usage manual, business operations manual, e-Learning, seminar, human resource development planning, gamification, digital divide

#### (e) Evaluation and verification of information system utilization

Understand how important it is to identify and evaluate the operation status and the actual usage of the information systems, including changes to business operations and job flows and the performance and reliability of the information systems, for the purpose of defining the improvement guideline and goal.

**Sample terms** log analysis, log monitoring, learning management system

(f) Information system disposal

Understand that if an information system or software is deemed to be at the end of its useful life as a result of evaluating and verifying it from the viewpoints of functionality, performance, serviceability, expandability, and cost; it must then be disposed of and the installation of a new information system must be considered.

**Sample terms** system life cycle, information security policy, data erasing

## **1. Computerization planning**

**[Goal]**

- Understand the overview of the purposes and basic concepts of the computerization initiative and planning along with the procedures.

### **(1) Computerization initiative**

Understand the purposes and basic concepts of computerization initiative. Also, in the computerization initiative process, understand the following: clarifying the purpose and required result (goal) of computerization based on the business strategies and information systems strategies; clarifying the target business operations; creating the total target picture of business operations; selecting a system investment target and setting the goal; and obtaining approval.

**Sample terms** system optimization technique, shared computerization initiative, system design, BABOK (Guide to the Business Analysis Body of Knowledge)

### **(2) Computerization planning**

Understand the purpose and basic concept of computerization planning. In addition, understand that in the computerization planning process, the target business operations and system issues are defined, the target business operations and systems are examined and analyzed, the computerization planning is summarized, and approval is obtained. Furthermore, understand the overview of the steps for developing an information systems development plan.

**Sample terms** total computerization planning, individual computerization planning, system application scope, total development schedule, project promotion framework, staff education plan, return on development investment, IT portfolio, system life cycle, information systems installation risk analysis

## **2. Requirements definition**

**[Goal]**

- Understand the purposes and basic concepts of requirements analysis and requirements definition along with the procedures so that you can apply them to your tasks.

### **(1) Requirements analysis**

Understand the basic steps consisting of the identification and analysis of the requirements, arrangement of the computerization needs, arrangement of the preconditions and constraint conditions, reviewing of solutions, analysis of the feasibility, and proposal of a new business model and workflow.

**Sample terms** user needs study, current state analysis, definition of problems/issues, requirements specification

## **(2) Requirements definition**

### **(a) Purpose of requirements definition**

Understand that requirements are defined for the purpose of clarifying the framework of the systems and entire business operations and the scope and functions of computerization.

### **(b) Definition of requirements**

Understand that requirements definition is divided into three types: operational requirements definition for defining the requirements to be satisfied in terms of business operations; functional requirements definition for defining the functions necessary to satisfy the operational requirements; and non-functional requirements definition for defining the requirements associated with the performance, reliability, migration, and others. In addition, understand that different stakeholders have different requirements, which are different in importance.

### **(c) Requirements definition method**

Understand the structured analysis method and object-oriented analysis method.

**Sample terms** DFD, decision table, UML DOA (Data Oriented Approach)

### **(d) Verification of stakeholder requirements**

Understand that the feasibility and validity of the defined requirements along with consistency with the information system strategy are verified, and then the requirements are agreed upon and approved by the stakeholders.

**Sample terms** stakeholder, facilitation

## **3. Procurement planning and implementation**

### **[Goal]**

- Understand the overview of procurement planning and the purpose and concept of procurement implementation.

### **(1) Procurement and procurement planning**

Understand the overview of the procurement procedure, where procurement is planned by selecting a procurement method from among purchase of ready-made products and/or services, system development at an internal organization, and outsourcing system development to an external organization, based on the requirements definition, and then defining the procurement targets, requirements, and conditions. In addition, understand how important it is to manage system and software assets to maintain the appropriateness of procurement.

**Sample terms** internal and external manufacturing criteria, software supply chain management, license management

## (2) Procurement implementation

### (a) Procurement methods

Understand typical procurement methods along with the basic concepts.

**Sample terms** proposal-based competitive bidding, open bidding

### (b) Request for information

Understand that the purpose of the computerization and the details of business operations are presented to the vendor to prepare an RFI (Request For Information).

### (c) Request for proposal

Understand that an RFP (Request For Proposal) and RFQ (Request For Quotation) that indicate the system to be procured, requested items to be proposed, and procurement conditions must be presented to the vendor to request that it should submit proposals and written quotations.

### (d) Request for proposal and quotation

Understand that based on the request for proposal, the vendor considers the system configuration and development techniques to prepare proposals and written quotations and submit them to the client.

### (e) Vendor selection

Understand that before selecting vendors, the procedure, including the weight assignments to the proposal evaluation criteria and conformity to the requirements, for selecting vendors is established to compare and evaluate the certainty, reliability, cost breakdown, schedule on a process-by-process basis, final delivery, and others of the development based on the proposals and quotations from each vendor.

### (f) Procurement risk analysis

Understand that procurement requires the knowledge about risk management in terms of internal control, compliance, CSR (Corporate Social Responsibility) procurement, and green procurement, and measures based on the analyses and evaluations of risks.

### (g) Conclusion of a contract

Understand that negotiations are conducted with each of the selected vendors to verify the delivered system, cost, delivery time, and role sharing between the client and vendor before a contract is closed.

**Sample terms** software development outsourcing model contract, information system/model transaction contract, (quasi-)mandate contract, underpinning contract, intellectual property right license agreement, software license agreement, license agreement

**Major category 8: Business Strategy**  
**Middle category 19: Business Strategy Management**

**1. Business strategy techniques**

**[Goal]**

- Understand the basic concept of business strategies.
- Understand the overview of the corporate strategy and enterprise strategy along with typical business strategy techniques.

**(1) Business strategy**

Understand the basic concept about business strategies.

**Sample terms** corporate philosophy, diversification, synergy effect, economies of scale, economies of scope, innovation, change management, benchmarking, best practice

**(2) Corporate strategy**

Understand the concept of corporate strategies along with the overview of typical strategies and techniques.

**Sample terms** competitive superiority, experience curve, CS (Customer Satisfaction), group management, core competence, outsourcing, M&A (Mergers and Acquisitions), alliance, PPM (Product Portfolio Management), shared service, venture business, crowdfunding

**(3) Enterprise strategy**

**(a) Competition strategy**

Understand what factors determine the competitive conditions in a given industry.

Understand the concepts of the three basic strategies for overcoming competitors or the like.

**Sample terms** basic strategy (cost leadership strategy, differentiation strategy, focus strategy), blue ocean strategy

**(b) Enterprise strategy techniques**

Understand the overview of typical techniques for developing enterprise strategies, intended for evaluating the strengths and weaknesses of the company by analyzing the external and internal environments.

**Sample terms** SWOT (Strength, Weakness, Opportunity, Threat) analysis, value chain analysis, growth matrix



## 2. Marketing

### [Goal]

- Understand the basic concept of marketing and typical marketing techniques.

#### (1) Marketing theory

##### (a) Marketing analysis

Understand that a marketing analysis targets the market size, customer needs, and the management resources, performance, and competitors of the company. In addition, understand the overview of typical techniques used for market research.

**Sample terms** 3C (Customer, Competitor, and Company) analysis, market research, segmentation, targeting, positioning, sampling, questionnaire, observation method, experimental technique

##### (b) Marketing mix

Understand the basic concept of marketing mix.

**Sample terms** merchandising

##### (c) CS (Customer Satisfaction)

Understand that as the economy matures and consumption activities become more sophisticated, it is more important for businesses to provide their customers with mental and subjective satisfaction.

**Sample terms** customer loyalty, brand strategy, UX (User Experience), conversion rate, retention rate

#### (2) Marketing strategy

##### (a) Product strategy

Understand the characteristics of each stage of the PLC (Product Life Cycle), marketing strategy to be conducted, concept of product mix, and typical product strategy.

**Sample terms** introduction stage, growth stage, maturity stage, decline stage, product line, product portfolio, brand strategy, commoditization

##### (b) Price strategy

Understand a technique for setting the price of a commercial product along with its concept and effect.

**Sample terms** price setting method (cost-plus pricing, etc.), value pricing

##### (c) Distribution strategy

Understand a method for classifying distribution channels along with a concept for selection and a technique for optimization.

**Sample terms** franchise chain, channel integration, omni-channel

(d) Promotion strategy

Understand a communication means for enabling consumers to recognize commercial products and a method for using the means.

**Sample terms** advertisement, sales promotion, publicity

**(3) Marketing techniques**

Understand the overview of typical marketing techniques

**Sample terms** mass marketing, one-to-one marketing, relationship marketing, direct marketing, market testing (test marketing), push strategy/pull strategy

### **3. Business strategy and goal/evaluation**

**[Goal]**

- Understand the overview of the development/evaluation of a business strategy and its goal along with the procedure for it.
- Understand the overview of typical information analysis techniques for developing and evaluating goals.

**(1) Development and evaluation of business strategy and its goals**

Understand the overview of the purpose and concept of the development of business strategies and their goals and evaluations along with the steps for them.

[Examples of steps]

(i) Analyzing the business environment and planning a business strategy based on the corporate philosophy, corporate vision to set specific strategic targets; (ii) Defining on which CFS (Critical Success Factors) importance should be placed to achieve the goals; and (iii) Setting the indicators for measuring the goal achievement levels and evaluating them

**Sample terms** KGI (Key Goal Indicator), KPI (Key Performance Indicator), monitoring

**(2) Techniques for setting and evaluating targets**

Understand the overview of typical information analysis techniques used for setting and evaluating business strategy targets.

**Sample terms** BSC (Balanced Scorecard), needs/wants analysis, competition analysis, value engineering, six sigma, TQM (Total Quality Management)

#### 4. Business management system

##### [Goal]

- Understand the overview of typical business management systems.

##### (1) Business management system

Understand that the business management systems include corporate systems, division-specific systems, and so on. In addition, understand that the typical business management systems for accomplishing business strategies include a system that helps management with decisions making and a system that provides integrated management of business activities.

**Sample terms** ERP, SFA, KM (Knowledge Management), CRM, SCM, EIP (Enterprise Information Portal)

**Major category 8: Business Strategy**  
**Middle category 20: Technological Strategy Management**

**1. Planning of technology development strategy**

**[Goal]**

- Understand the purpose and basic concept of technology development strategies.

**(1) Technology development strategy**

(a) Purpose and concept of technology development strategies

Understand that for sustainable development of a business, it is important to establish a technology development strategy that promotes innovation in parallel with investments in technology development to combine technologies with market needs so that the business can achieve success.

**Sample term** MOT (Management of Technology), R&D (Research and Development), CVC (Corporate Venture Capital)

(b) Planning of technology development strategy

Understand the basic concept of technology development strategy planning, including analyses of the product trend and technology trend, determination of the core technologies, and flexible use of external resources.

**Sample terms** core technology, technology research, contract research, joint research, technology acquisition, technology licensing, technological tie-up, cooperation among government, industry-academia-government collaboration, standardization strategy

**2. Technology development plan**

**[Goal]**

- Understand the purpose and basic concept of technology development plans.

**(1) Technology development plan**

Understand the purpose and basic concept of technology development planned on the basis of business strategy and technology development strategy.

**Sample terms** technology development investment planning, technology development site planning, human resources planning, optimal distribution of management resources, return on investment, concurrent engineering, pilot production, intellectual property right management, market needs

## (2) Technology development road map

Understand the purpose and basic concept of road maps, intended for indicating the scientifically supported, agreed-upon future visions on the time series as concrete scenarios for technology development

**Sample terms** technology road map, product application road map, patent acquisition road map, market needs

## **1. Business system**

### **[Goal]**

- Understand the types and characteristics of typical information systems used in business areas.

#### **(1) Internal operations support system**

Understand the types and characteristics of typical information systems used for internal operations.

**Sample terms** bookkeeping/accounting/financial system, XBRL, human resource/payroll system, SFA (Sales Force Automation), groupware, workflow system, web conference system

#### **(2) Mission-critical task support systems and business packages**

Understand the types and characteristics of typical software packages for information systems and business systems intended for supporting business operations.

**Sample terms** distribution information system, logistics information system, over-the-counter sales management, sales management, ordering management, inventory control, customer management, financial information system, medical information system, POS system, production management system, CDN (Contents Delivery Network), ERP package, operations-specific package, industry-specific package, ubiquitous computing, IoT (Internet of Things)

#### **(3) Administration system and public information system**

Understand the types and characteristics of typical information systems used for administrative activities and public information systems.

**Sample terms** e-Japan initiative, e-Gov, electronic government, LGWAN (Local Government Wide Area Network), Basic Resident Register Network, EDINET (Electronic Disclosure for Investors' Network), public information system, smart grid, EMS (Energy Management System), GPS (Global Positioning System) application system, emergency alert, My Number (Social Security and Tax number), universal design, digital divide

## **2. Engineering system**

### **[Goal]**

- Understand the purpose and basic concept of engineering system development and design.
- Understand the purposes and basic mechanisms of automatic production control, production systems, production management, and computer-aided systems.

### **(1) Purpose and concept of engineering systems**

Understand the purpose and basic concept of using information technology in development and design.

### **(2) Automatic production control**

Understand the purpose and basic mechanism of automatic control of production processes.

**Sample terms** production system, production line organization, JIT (Just In Time), NC (Numerical Control), automatic monitoring equipment, automated guided vehicle, automatic warehouse

### **(3) Production system**

Understand that as a system intended for automating production processes, an FA (Factory Automation) system efficiently automates processes ranging from equipment control to factory management by incorporating a production management system and the tools that support production planning for the purpose of streamlining such processes as design, assembly, inspection, shipment, and inventory control.

**Sample terms** CAP (Computer Aided Planning), CAPP (Computer Aided Process Planning), MRP, FMS (Flexible Manufacturing System), FMC (Flexible Manufacturing Cell), productivity indicator

### **(4) Computer-aided system**

Understand the overview of computer-aided systems for computer-based analyses, design, and development; support systems for supporting project planning and management for the purpose of improving the productivity; and systems for providing integrated management of production, distribution, and the supply and distribution of products.

**Sample terms** CAD, CAE, CAM, PDM (Product Data Management), CIM

### **3. e-business**

#### **[Goal]**

- Understand the mechanism and characteristics of e-business, including EC and EDI, performed over the Internet.
- Understand typical standards for data exchange.

#### **(1) EC (Electronic Commerce)**

##### **(a) Electronic ordering system**

Understand the mechanisms and characteristics of electronic ordering and procurement systems.

**Sample terms** on-line mall, on-line shopping, electronic bidding

##### **(b) Electronic payment system**

Understand the mechanism and characteristics of electronic payment systems. In addition, understand the electronic money types and the relationships to financial trading.

**Sample terms** financial trading, Internet banking, EFT (Electronic Fund Transfer), smart card, IC card/RFID application system

##### **(c) How to promote e-business**

Understand the concept of promoting e-business

**Sample terms** internet business, BtoB (Business to Business), BtoC (Business to Consumer), CtoC (Consumer to Consumer), GtoB (Government to Business), GtoC (Government to Citizen), OtoO (Online to Offline), e-marketplace, SEO (Search Engine Optimization), recommendation system, long tail, affiliate advertising, listing advertisement (search advertising)

#### **(2) EDI**

##### **(a) Mechanism and characteristics of EDI**

Understand the system configuration for EDI and the ordering and settlement mechanisms of EDI along with their characteristics.

**Sample term** web-EDI

##### **(b) Standards used in data exchange**

Understand typical standards associated with data exchange, which are intended to efficiently support a variety of transaction forms and several slip formats in interchanging electronic transaction data.

**Sample terms** JIS X 7011-1, JIS X 7012-1, STEP (Standard for the Exchange of Product Model Data), Japanese Bankers Association protocol, XML-EDI, XBRL, information communication protocol, information representation convention, task operation convention, basic transaction convention, JCA (Japan Chain



Stores Association) protocols

### (3) Social media

Understand the concepts, types, and technical background of social media.

**Sample terms** SNS, electronic bulletin board, blog, mini-blog, CGM (Consumer Generated Media)

## 4. Consumer appliances

### [Goal]

- Understand the overview of embedded systems.
- Understand the characteristics, trends, and typical examples of consumer appliances.

### (1) Embedded system

Understand that computers are embedded into consumer appliances and industrial devices. In addition, understand the mechanism for controlling these appliances and devices along with the overview of embedded systems.

**Sample terms** microcomputer, embedded OS, real-time OS, real-time control, event, sensor, robotics, firmware

### (2) Consumer appliances

#### (a) Characteristics and trends of consumer appliances

Understand that computers are embedded into a wide range of products, which provides exacting control and functions. In addition, understand the trends in recent years, including downsizing, weight reduction, networking, personalization of information equipment, and enhanced interactivity.

**Sample terms** intelligent home appliance, ubiquitous computing, IoT (Internet of Things)

#### (b) Examples of consumer appliances

Understand that examples of consumer appliances are household electrical appliances, such as rice cookers, washing machines, and air conditioners; audio and visual equipment, such as digital TV sets, and DVD players; personal information appliances, such as cell phones and smartphones; and industrial terminal equipment, such as educational/entertainment devices, POS terminals, handy terminals, and banking terminals.

**Sample terms** computer peripheral/OA equipment, consumer communications terminal, home network, wearable computer, sensor network, DLNA, HEMS (Home Energy Management System)

## 5. Industrial devices

### [Goal]

- Understand the characteristics, trends, and typical examples of industrial electronic devices.

#### (1) Industrial devices

##### (a) Characteristics and trends of industrial devices

Understand that computers are embedded into a wide range of products, which provides exacting analyses, measurements, and control based on the embedded systems. In addition, understand the trends in recent years, including labor saving, automation, networking, and enhanced interactivity.

**Sample terms** MtoM (Machine to Machine)

##### (b) Examples of industrial devices

Understand that examples of industrial devices are communications devices such as routers, transport equipment such as vessels, analytical/measurement instruments for detecting drugs, and equipment items such as air conditioners.

**Sample terms** industrial robots, automated warehouse, vending machines, ATM (Automated Teller Machine), medical devices, patient monitoring equipment

**Major category 9: Corporate and Legal Affairs**  
**Middle category 22: Corporate Activities**

**1. Management and organization theory**

**[Goal]**

- Understand the overview of corporate activities, business management, and management organizations.
- Understand the changes in and issues to the business environment.
- Understand the need for and effectiveness of computer literacy at businesses.

**(1) Corporate activities**

(a) Corporate activities and management resources

Understand that a corporation is an organic organization with multifaceted attributes, such as economic functionality, commercial activities, separation between ownership and management, and independency in marketplaces. In addition, understand the importance of management of people, materials, money, and information.

**Sample terms** corporate philosophy, CSR (Corporate Social Responsibility), green IT

(b) Corporation forms

Understand the forms of corporations and their typical characteristics. Understand the characteristics of general incorporation, limited liability, and the spinning off.

**Sample terms** membership company ((limited) partnership), stock company, IPO (Initial Public Offering)

(c) Characteristics of corporations

Understand the characteristics of corporations, including separation between ownership and management, going concern (continuous entity), and diversified corporate objectives.

**Sample terms** corporate governance, IR (Investor Relations), BCP (Business Continuity Plan), corporate identity, corporate brand

**(2) Business management**

(a) What is business management?

Understand the overview of business management, which is intended for smoothly conducting corporate activities for the purpose of attaining corporate objectives and creating and operating a framework for optimal allocation and effective use of corporate resources.

**Sample terms** business objectives, PDCA, financial affairs management, property management, human resource management, information management, TQM (Total Quality Management)

(b) Human resources management

Understand that human resources management plays an important part in business management. In addition, understand the overview of human resources management, including OJT, objective management, human resources development, and discretionary labor system.

**Sample terms** competency, coaching, mentoring, case study, e-Learning, job rotation, talent management, work-life balance, work-sharing, diversity

(c) Behavioral science

Understand how people should behave in a corporate organization, including leadership, communication, and negotiation. In addition, understand the importance of motivation management, intended for communicating technical writing, presentations, and the like, and conflict management.

**Sample terms** logical thinking, brainstorming, hygiene theory, XY theory

(d) Risk management

Understand how important it is to make up a plan for selecting critical business operations and continuing them by estimating risks and analyzing the effects of them as efforts to maintain and increase the corporate value and to develop a plan that acts as the guidelines for maintaining and improving feasible frameworks.

**Sample terms** BCP (Business Continuity Plan), BCM (Business Continuity Management), JIS Q 22301 (ISO 22301), Business Impact Analysis (BIA)

**(3) Management organization**

Understand the types and characteristics of typical organizational structures, the functions of business managers, the roles of the CEO (Chief Executive Officer), CIO (Chief Information Officer), and other positions.

**Sample terms** hierarchical organization (pyramid organization), functional organization, line and staff organization, divisional system organization, matrix organization, company system organization, project organization, CEO (Chief Executive Officer), CIO (Chief Information Officer), CISO (Chief Information Security Officer), CPO (Chief Privacy Officer), CFO (Chief Financial Officer), COO (Chief Operating Officer)

**(4) Changes in the business environment**

Understand the recent changes in the business environment and the relationships between businesses, including globalization, business diversification, working styles in consideration of work-life balance, and CSR (Corporate Social Responsibility).

**Sample terms** SRI (Socially Responsible Investment), satellite office, telecommuting, SOHO (Small Office Home Office)

### (5) Computer literacy

Understand that it is essential for businesses to use computers to conduct corporate activities. In addition, understand why enhancing computer literacy is required, which means being able to make effective use of computers.

## 2. OR and IE

### [Goal]

- Understand basic techniques for typical OR and IE so that you can apply them to your tasks.
- Understand the basic techniques for collecting, organizing, analyzing, and visually representing data so that you can apply them to your tasks.

### (1) Linear programming

Understand the basic techniques for LP (linear programming), formalization of problems, and the cases for which linear programming is effective.

**Sample terms** simplex method, allocation problem, transportation problem

### (2) Inventory problem

Understand the basic concept of inventory control and the basic mechanisms of fixed quantity ordering system and periodic ordering systems.

**Sample terms** safety stock, EOQ (Economic Ordering Quantity), order point

### (3) Scheduling

Understand the basic techniques of PERT and CPM (Critical Path Method).

**Sample terms** scheduling, arrow diagram, critical path

### (4) Game theory

Understand the basic concept of game theory.

**Sample terms** zero-sum two-person game, maximin principle, decision tree

### (5) IE (Industrial Engineering) analysis techniques

Understand the overview of typical job measurement methods, including the working hour analysis, PTS (Predetermined Time Standard) method, and work sampling method.

**Sample terms** therblig, work analysis, operation analysis

### (6) Inspection techniques

Understand the overview of typical inspection techniques including the sampling inspection, OC (Operating Characteristic) curve, sampling, and simulation.

**Sample terms** fraction defective, failure rate curve (bathtub curve)

### (7) Quality control techniques

Understand the overview of the techniques of the seven tools mainly used for quantitative analyses and the new seven tools mainly used for qualitative analyses along with how to use them.

**Sample terms** quality characteristics, quality function deployment, fraction defective estimation, time series analysis

### (8) Demand forecasting

Understand the overview of typical demand forecasting techniques, including regression analysis and time series analysis.

**Sample terms** least squares method, correlation coefficient, moving-average method

### (9) Job analysis and operational planning

Understand the basic techniques for analyzing and planning business operations and for achieving efficient decision-making (decision theory), including data collection techniques, various diagrams and graphs, and techniques for organizing and analyzing data.

**Sample terms** Pareto analysis, focus group, data mining, brainstorming, radar chart, cluster analysis method, Delphi method, Monte Carlo method, decision tree

## 3. Accounting and financial affairs

### **[Goal]**

- Understand the relationship between sales and profit, the procedure for corporate accounting, and the basic way to read the financial statements so that you can apply them to your tasks.
- Understand “financial accounting” and “management accounting” along with the purpose and concept of “cash flow accounting” so that you can apply them to your tasks.
- Understand the purposes and concepts of asset management, along with cash planning and cash management and so that you can apply them to your tasks.

### (1) Corporate activities and accounting

#### (a) Sales-profit relationship

Understand the relationships between amounts of sales, profits, and costs along with such basic terms as fixed, variable, and initial costs as well as the concepts of them. In addition, understand associated calculation methods including that for the break-even point.

**Sample terms** opportunity loss, break-even point

#### (b) Procedure for corporate accounting

Understand that in accordance with corporate activities, the flow of transaction information is recorded (journal entry). In addition, understand that the accounts are settled and the actual performance is evaluated every accounting term.

**Sample terms** journal book, general ledger

(c) Mechanism of closing account

Understand the purpose and mechanism of closing accounts along with the types and characteristics of the statements as well as how to read them. In addition, understand the purpose of consolidation accounting, which regards a group of companies including subsidiaries as a single organization.

**Sample terms** trial balance sheet, work sheet, financial statements, balance sheet, income statement, earnings summary, goodwill, IFRS

(d) Financial statements

Understand the purposes of the balance sheet, income statement, and cash flow statement; recorded items; basic terms such as asset, liability, and capital along with their concepts; and basics of how to read the financial statements. In addition, understand how to calculate gross profit, operating profit, and ordinary profit.

**Sample terms** current assets, fixed assets, deferred assets, current liability, fixed liability, net assets, capital stock, cost, income, “selling, general and administration expense”, no operating profit and loss, extraordinary items

**(2) Financial accounting and management accounting**

Understand that corporate accounting involves two forms: financial accounting, which is a legally prescribed mechanism for disclosing information, and management accounting, which is a mechanism for managing information directly connected with reviews of corporate activities and management planning.

**Sample terms** accounting standards, financial indicator, profit indicator, ROA (Return On Assets), ROE (Return On Equity), safety index, current ratio, equity to total asset, economy computation

**(3) Cash flow accounting**

Understand the purpose and concept of cash flow accounting.

**Sample terms** cash flow management

**(4) Cash planning and cash management**

Understand the purpose and concept of cash planning and cash management, which are arranged for raising the funds required for operational activities, continuing effective investments, and maintaining a proper cash flow.

**Sample term** cash management

**(5) Asset management**

Understand the following: the purpose of asset management; how to evaluate inventories; the concepts of the depreciation and amortization cost. In addition, understand the characteristics of leasing and rental.

**Sample terms** inventory valuation, first-in first-out method, periodic average method, moving average method, off-balance



## 1. Intellectual property rights

### **[Goal]**

- Understand the basic concept of intellectual property rights so that you can apply them to your tasks.
- Understand the basic concepts of copyright protection and rights infringement so that you can apply them to your tasks.
- Understand the basic concepts of rights protection and infringement defined by the four laws which play a central part of the Industrial Property Law so that you can apply them to your tasks.
- Understand the basic concept of the Unfair Competition Prevention Act so that you can apply it to your tasks.

### **(1) Intellectual property rights**

Understand that under the current situation where software and other intellectual property rights are increasing in importance along with growing development and distribution activities, laws are being developed and improved for protecting the interests of developers so that they can make fair profits.

**Sample terms** Intellectual Property Strategy Headquarters, Intellectual Property Basic Act, industrial property right, patent right, utility model right, design right, trademark right, copyright, circuit layout right, trade secrets

### **(2) Copyright Act**

Understand that a copyright is a set of multiple rights. Understand that in Japan, the principle that copyright protection is granted automatically has been adopted, which means that at the point when a work is created, the copyright for it is granted and retained for a certain period. Understand what types of works are protected by the Copyright Act (understand that programs and databases are also protected). Understand what are considered as infringements of rights. Understand that a work can be used without permission of the copyright owner if certain requirements are satisfied.

**Sample terms** moral right (right of publication, right of name announcement, and right of avoidance of modification), copyright and property rights (right of reproduction, right of public transmission, right of distribution, right of transfer of ownership, right of public rental), employee work, derivative work, transmittable, quote, private use, library, educational institution, examination question

### (3) Industrial Property Law

Understand that the Industrial Property Law was instituted for the purpose of contributing to industrial development. Understand what are protected by the Patent Act, Utility Model Act, Design Act, and Trademark Act. In addition, understand what are considered as infringements of rights.

**Sample terms** invention, device (as used with regard to a utility model), design, trademark, software patent, patent for a business method

### (4) Other associated laws, etc.

Understand the basic concept of the Unfair Competition Prevention Act concerning unauthorized uses of business names and trademarks, illicit obtainment and unauthorized uses of trade secrets, protection of interests, and actions against infringements of interests. In addition, understand that the software copyrights are protected by means of, for example, the Copyright Act, and Patent Act as appropriate.

**Sample terms** trade secrets, illicit obtainment of a domain name, cancel of copy guard

## 2. Laws on security

### **[Goal]**

- Understand the overview of the Basic Act on Cybersecurity, which establishes basic measures and other matters relating to Japan's cyber security.
- Understand the overview of the Act on the Prohibition of Unauthorized Computer Access.
- Understand the overview of the criminal law on illegal activities using computers.
- Understand the overview of the concepts, methods, and techniques for personal information protection and privacy protection.
- Understand the overview of the laws concerning electronic signatures, certification services, and so on.
- Understand the overview of the 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.

### (1) Basic Act on Cybersecurity

Understand the purpose of the Basic Act on Cybersecurity and the concepts underlying its measures.

**Sample terms** cybersecurity, electromagnetic method, electromagnetic recording medium, cybersecurity strategy, basic principle

### (2) Act on the Prohibition of Unauthorized Computer Access

Understand the overview of the Act on the Prohibition of Unauthorized Computer Access, which evenly regards network invasions, provision of code for access control, and others as crimes while the criminal law prohibits data falsification and erasure as acts for which penalties are imposed.

**Sample terms** access control function, unauthorized access, act that facilitates unauthorized accesses

### **(3) Criminal law**

Understand the types of illegal acts concerning the use of computers for which criminal penalties are imposed.

**Sample terms** penalty on electromagnetic records by illegal command (penalty on computer virus creation); computer fraud; penalty on obstructing business through destruction of a computer, etc.; penalty on unauthorized creation and use of electromagnetic records; penalty on unauthorized creation of electromagnetic records for cards for payment

### **(4) Act on the Protection of Personal Information, Act on the Use of Numbers to Identify a Specific Individual in Administrative Procedures**

#### **(a) Laws and guidelines related to personal information protection and privacy protection**

Understand the overview of the Act on the Protection of Personal Information, including what personal information is protected and what businesses are covered by the act and how a business is affected if it violates the act.

**Sample terms** Guidelines on Personal Information Protection, business operator handling personal information, My Number Act (Act on the Use of Numbers to Identify a Specific Individual in Administrative Procedures), Guidelines for proper handling of Specific Personal Information, Personal Information Protection Commission, JIS Q 15001, privacy mark, OECD Privacy Guidelines (Recommendation of the Council concerning Guidelines governing the Protection of Privacy and Transborder Flows of Personal Data)

#### **(b) Methods and techniques for personal information protection and privacy protection**

Understand the overview of the methods and techniques for information management related to the acquisition, processing, utilization, storage, and disposal of personal information.

**Sample terms** opt-in, opt-out, provision to third parties

### **(5) Laws concerning electronic signatures and certification services**

Understand that the requirements for electronic signatures and certification services have been defined for smooth socioeconomic activities through networks, including electronic commerce based on the Internet.

**Sample terms** accredited certification business operator, electronic certificate

**(6) 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**

Understand that as the use of websites and electronic commerce become widespread and expand, individual rights are violated through mental abuse and the disclosure of someone's personal information without consent posted to a bulletin board or the like on the web. In addition, understand the overview of the 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, which defines who should be liable for such individual rights violations and how.

**(7) Act on regulation of transmission of specified electronic mail**

Understand that the specified electronic mail is referred to as the one dedicated for the purpose of sales activities, and this act defines the banned items in transmitting such electronic mail.

**(8) Standards concerning information security**

Understand the overview of the standards and guidelines concerning information security.

**Sample terms** Computer Crime Prevention Law, Standards for Measures against Computer Viruses, Standards for Measures against Unauthorized Access to Computers, Standards for Handling Fragility-related Information in Software or the like, Management Standards for Information Security Measures for the Central Government Computer Systems, Cybersecurity Management Guidelines, Reinforcement Strategy on Smartphone Safety and Security, social media guidelines (SNS usage policy)

**3. Laws on labor and transaction**

**[Goal]**

- Understand the overview of typical laws on labor and transaction.
- Understand the overview of typical contracts concerning transactions between businesses.

**(1) Laws on labor**

**(a) Labor Standards Act**

Understand the overview of the Labor Standards Act, which defines the minimum standards associated with labor conditions such as wages, working hours, on-the-job accidents and injuries, and dismissal/resignation/age retirement systems.

**Sample terms** Article 36 agreement, discretionary labor system, flexible working hours system, maternity protection

**(b) Act for Securing the Proper Operation of Worker Dispatching Undertakings and Improved Working Conditions for Dispatched Workers**

Understand the overview of the Act for Securing the Proper Operation of Worker Dispatching Undertakings and Improved Working Conditions for Dispatched Workers, including what agreements are concluded between the worker, company to be supplied with labor, and employment agency and how they are related to one another in a case where a worker is dispatched. In addition, understand the difference between the dispatch contract and service contract.

**Sample terms** temporary worker dispatch contract, employment agreement, authority to provide instructions, disguised contract work, prohibition of secondary dispatch of temporary worker

(c) Other laws

Understand the overview of the other laws on labor.

**Sample terms** Labor Contracts Act, Industrial Safety and Health Law; Act on Securing, Etc. of Equal Opportunity and Treatment between Men and Women in Employment; Act on the Welfare of Workers Who Take Care of Children or Other Family Members Including Child Care and Family Care Leave; Act on Improvement, etc. of Employment Management for Part-Time Workers, Whistleblower Protection Act

**(2) Laws on transaction**

(a) Act against Delay in Payment of Subcontract Proceeds, Etc. to Subcontractors

Understand the overview of the Act against Delay in Payment of Subcontract Proceeds, Etc. to Subcontractors, including the purpose and coverage.

**Sample terms** manufacturing contract, service contract, information-based product, main subcontracting entrepreneur, subcontractor, capital

(b) Civil law

Understand the overview of the trading regulations defined by the civil law, including the basics of contracts and the settlement, force and effect, and fulfillment/non-fulfillment of sales contracts, and the overview of the mechanisms of the systems important in conducting business transactions.

**Sample terms** (quasi-)mandate contract, service contract, responsibility for completing deliverables

(c) Commercial law

Understand the overview of the commercial law including what interests it is intended to protect.

(d) Others

Understand the overview of what laws must be taken into account in cases where business transactions are conducted over the Internet, for example.

**Sample terms** Act on Special Provisions to the Civil Code Concerning Electronic Consumer Contracts and Electronic Acceptance Notice, Act on Specified Commercial Transactions, Act against Unjustifiable Premiums and Misleading Representations, public domain

### **(3) Contracts associated with transactions between businesses**

#### **(a) Outsourcing contract**

Understand that an outsourcing contract is concluded when a business outsources part of its business operations to an external organization and that it must be concluded in consideration of the pertinent laws.

#### **(b) Non-disclosure agreement**

Understand that in a case where a business discloses its confidential information to an external organization to which it outsources part of its business operations, an NDA (non-disclosure agreement) is concluded.

#### **(c) Software license agreement (license agreement)**

Understand that if the owner of software intellectual property licenses the appropriate software to a third party, a software license agreement is concluded to define the requirements for the software license. In addition, understand that there are various forms of agreements depending on licensing conditions.

**Sample terms** volume license agreement, site license agreement, shrink-wrap license agreement, OSS (Open Source Software) license, CAL (Client Access License), free software, shareware, GPL (General Public License), LGPL (Lesser General Public License), copyleft

#### **(d) Software development agreement**

Understand that a software development agreement is concluded to define the requirements for performing software development on a consignment basis.

**Sample terms** software development consignment model contract, information system/model transaction contract

## **4. Other laws, guidelines, and engineer ethics**

### **[Goal]**

- Understand the overview of the Basic Act on the Formation of an Advanced Information and Telecommunications Network Society.
- Understand the overview of compliance, engineer ethics, and the laws and standards to be followed.

**(1) Basic Act on the Formation of an Advanced Information and Telecommunications Network Society**

Understand that the Basic Act on the Formation of an Advanced Information and Telecommunications Network Society has been instituted as the basic law with the aim of using IT to appropriately accommodate abrupt, substantial changes to the social socioeconomic structure and to swiftly and specifically promote measures for forming a network society.

**Sample terms** IT Strategic Headquarters (the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society), formation of an advanced information and telecommunications network society, promotion of electronic commerce, computerization of the administration, use of the information and communication technology in the public sector

**(2) Compliance**

Understand that businesses assume an obligation and responsibility to comply with the laws and regulations. Understand the legal sanctions and risks against compliance violations.

**Sample terms** corporate philosophy, corporate ethics, human rights, corporate governance, CSR (Corporate Social Responsibility), internal control, export-related laws and regulations, System Management Standards

**(3) Information ethics and engineer ethics**

Understand the importance of the laws and regulations for protecting users from inappropriate use of information, information ethics concerning courtesy, and engineer ethics that advanced expert engineers are required to assume. In addition, understand why engineers actually need to act ethically.

**Sample terms** code of ethics for engineers, social responsibility of engineers, moral (awareness about law abiding), professionalism

**(4) Other laws and standards**

**(a) Network-related laws and regulations**

Understand the overview of typical laws and regulations that define the requirements for communication common carriers that remotely exchange data and construct information networks.

**Sample terms** Telecommunications Business Law, Radio Law, ISP Liability Law, 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, Law on Communications Interception During Criminal Investigations

- (b) Financial Instruments and Exchange Act  
Understand that the Financial Instruments and Exchange Act aims to develop the nation's economy healthily and protect investors through systems for disclosing the details of businesses and ensuring trading fairness.  
**Sample terms** annual securities report, internal control report
- (c) Companies Act  
Understand that the Companies Act systematically defines the requirements for the systems for corporate design and organizational restructuring including mergers.  
**Sample terms** stockholders meeting, director, executive officer, auditor, company with committees, business report, internal control
- (d) Tax laws  
Understand why accounting operations must be fairly conducted in compliance with the tax laws.  
**Sample terms** Corporation Tax Law, Consumption Tax Law
- (e) e-Document Law  
Understand that documents that must be retained as required by law and regulations can be stored in electronic document files.  
**Sample term** electromagnetic records
- (f) Law Concerning Preservation of National Tax Records in Electronic Form  
Understand that the "Law Concerning Preservation of National Tax Records in Electronic Form" defines the requirements for the storage of national tax records using magnetic media.
- (g) Product Liability Act  
Understand the overview of the PL (Product Liability) Law intended for addressing losses caused by the use of hardware containing a defective program.
- (h) Act on Access to Information Held by Administrative Organs  
Understand that anyone can request that national administrative bodies and independent administrative agencies disclose administrative documents and corporate documents.
- (i) Environment-related law  
Understand the regulations on acquisition and disposal of systems and IT devices with respect to various laws for environment preservation.  
**Sample terms** Waste Disposal and Public Cleansing Act, Act for Promotion of Use of Recycled Resources
- (j) International standards, export-related regulations  
Understand the regulations on IT device/software exports and the use of the IT device/software usage in foreign countries.



**Sample terms** Foreign Exchange and Foreign Trade Act, US export-related regulations

## **5. Standardization**

### **[Goal]**

- Understand the overview of typical standards and specifications, standardization organizations, and the framework of international certification.

### **(1) Standards/specifications and standardization organizations**

#### **(a) Japanese Industrial Standards**

Understand that the JIS (Japanese Industrial Standards) are established by the competent minister based on the Industrial Standardization Act and reports from JISC (Japanese Industrial Standards Committee).

**Sample terms** JIS (Japanese Industrial Standards), JIS X segment (information processing), JIS Q segment (management system), JISC (Japanese Industrial Standards Committee), JSA (Japanese Standards Association)

#### **(b) International standards**

Understand that the IS (International Standards) are established by the ISO (International Organization for Standardization) and that the ISO consists of the representative standardization organizations in the respective countries and aims to develop international standards for industrial products in areas other than electric and electronics segments.

**Sample terms** IS (International Standards), ISO (International Organization for Standardization), international certification

#### **(b) Other standards**

Understand the overview of the other related standards/specifications and standardization organizations.

**Sample terms** ITU (International Telecommunication Union), IEC (International Electrotechnical Commission), IETF (Internet Engineering Task Force), ANSI (American National Standards Institute), IEEE (Institute of Electrical and Electronics Engineers)

### **(2) De facto standards**

Understand that de fact standards are specifications, standards, and products widely used as virtual standards.

**Sample terms** OMG, W3C (World Wide Web Consortium), de jure standard

### **(3) Standards for development and transactions**

#### **(a) Standardization of development and transaction processes**

Understand the overview of the standards for the tasks and role sharing at each process of

software development and transactions.

**Sample terms** SLCP-JCF (Japan Common Frame), JIS X 0160, JIS X 0170

(b) Standards for environment and IT security evaluation

Understand the overview of the standards for environment and IT security evaluation.

**Sample terms** ISO/IEC 14000, JIS Q 14001, ISO/IEC 15408

**(4) Standards for software**

Understand the overview of the standards that provide a platform for object-oriented programming.

**Sample terms** CORBA, OMG, EJB (Enterprise Java Beans)

**(5) Standards for data**

Understand the overview of typical standards for the character and bar codes used in electronic data exchange.

**Sample terms** character and other codes, JIS code, Unicode, JAN code, QR code, ITF code, ISBN code

**(6) International certification framework**

Understand the overview of the framework for international certification.

**Sample terms** conformity assessment, conformity assessment body, accreditation body, certification body, inspection body

This page is intentionally left blank.

**Information Technology Engineers Examination**  
**– Fundamental Information Technology Engineer Examination (Level 2) –**  
**Syllabus (Version 4.0)**

Information-technology Promotion Agency, Japan  
IT Human Resources Development Headquarters, Japan  
Information-Technology Engineers Examination Center (JITEC)  
15th Floor, Bunkyo Green Court, 2-28-8, Hon-Komagome,  
Bunkyo-ku, Tokyo 113-6591 Japan  
Tel: 03-5978-7600 (main switchboard)  
Fax: 03-5978-7610  
Website: <http://www.jitec.ipa.go.jp/>

2016-05