■ Information Technology Engineers Examination

Applied Information Technology Engineer Examination
(Level 3)
Syllabus

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

Version 4.0

IPA

INFORMATION-TECHNOLOGY PROMOTION AGENCY, JAPAN

CONTENTS

◆**MANAGEMENT**◆

◆**STRATEGY**◆

■ Introduction

The syllabus (subtitled as "details of the knowledge and skills required for the Information Technology Engineers Examination") for the Applied Information Technology Engineer Examination, in which "the scope of exam questions"[1] is described in more detail and the breadth and depth of the knowledge and skills required for Level 3 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 Applied Information Technology Engineer Examination according to the knowledge structure of the Common Career/Skills Framework[2] as shown in Figure 1, along with the learning targets and descriptions on a minor category basis.
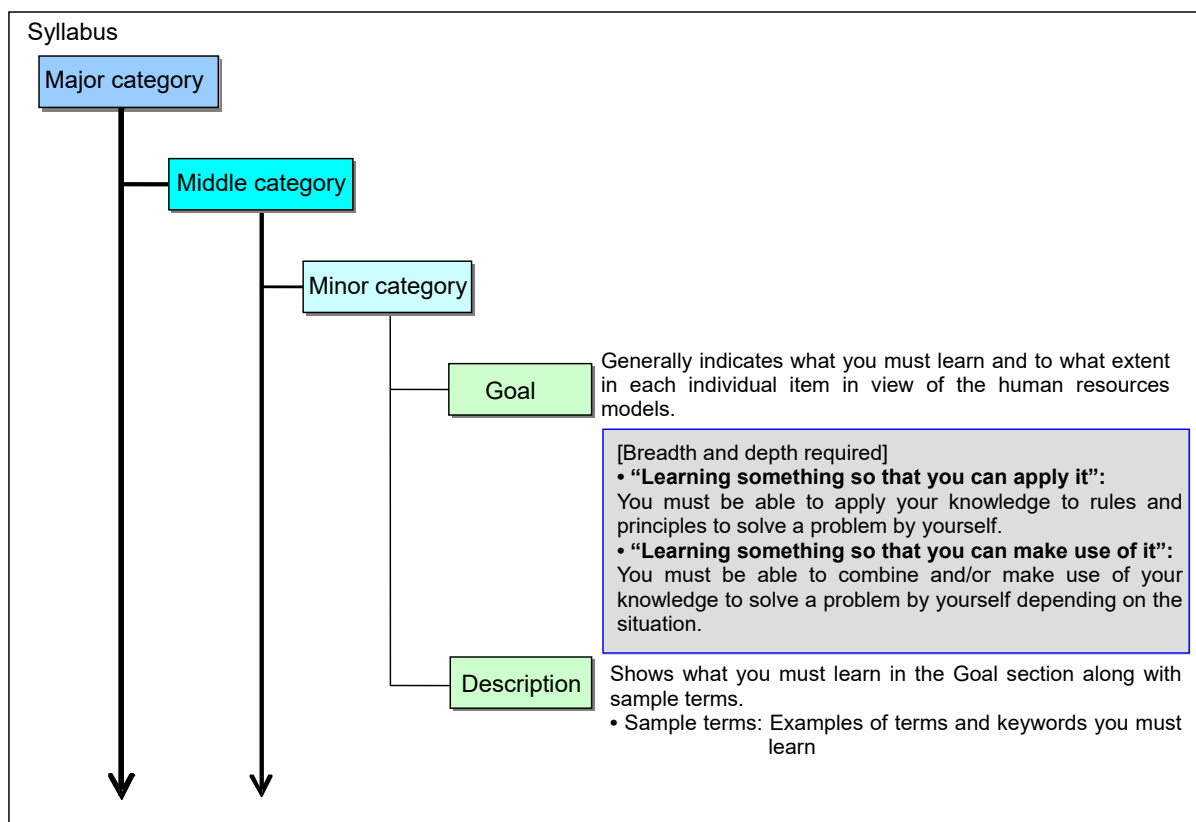
Figure 1   Configuration of the syllabus

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1 "Outline of IT Engineers Examination" 7. Scope on the test
   http://www.jitec.ipa.go.jp/1_00topic/topic_20081027_hani.html
2 Common Carrier/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]**
> ➢ Learn the numeric representations handled by the computer, including the radix, radix conversion, numeric representation, and arithmetic operations and precision so that you can make use of them.
> ➢ Learn the basic rules of and techniques for sets and logical operations so that you can make use of them.

(1)   Radix

Understand how the binary, octal, decimal, hexadecimal, and base-n numbers are represented and how you can convert the radixes 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 precisions

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

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

(4)   Sets and propositions

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

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

(5) Logical operations

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

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

2.   Applied mathematics

[Goal]
> Learn the techniques for calculating and analyzing probability and statistics so that you can make use of them.
> Learn mathematical principles, including numerical analysis, graph theory, and queueing theory so that you can make use of them.

(1) Probability and statistics

(a) Probability

Understand the permutation, combination, number of cases, probability and its basic theorems, (discrete and continuous) probability distributions and expected values, and Markov process.

Sample terms   factorial, addition theorem, multiplication theorem, normal distribution, Poisson distribution, exponential distribution, chi-square distribution, probability density

(b) Statistics

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

Sample terms   median, mode, mean, standard deviation, variance, correlation coefficient, estimation, regression analysis, null hypothesis, level of significance, chi-square test

(2) Numerical calculation

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

Sample terms   matrix, logarithm, discharge calculation, approximate solution, convergence, error

(3) Numerical analysis

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

Sample terms   numerical integration, Simpson's method, Newton's method, absolute error, relative error, rounding error, truncation error

(4) Formula manipulation

Understand the formula manipulation system, which symbolically and algebraically manipulates formulas using a computer, along with its algorithm.

Sample terms   factorization, differentiation, integration

(5) Graph theory

Understand the basic concept and applications of the graph theory.

Sample terms   undirected graph, directed graph, complete graph, weighted graph

(6) Queueing theory

Understand the components and concept of the queuing model, calculations in the M/M/1 model, and simulations based on random numbers.

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

(7) Optimization problems

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

Sample term   dynamic programming

3.   Theory of information

[Goal]
> Learn the concepts and mechanisms of the information and coding theories so that you can make use of them.
> Learn code-based character representation so that you can make use of it.
> Learn the concepts and mechanisms of the theories about information, including the predicate logic, formal language, and automaton, so that you can make use of them.
> Learn the concept and mechanism of the correctness theory so that you can make use of them.
> Learn the concept and mechanism of AI (artificial intelligence) so that you can make use of them.
> Learn the concepts and mechanisms of the compiler and programming language theories along with semantics so that you can make use of them.

(1) Information theory

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

(2) Coding theory

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 safety in information transmission.

Sample terms   channel coding, Huffman codes, data compression

(3) Character representation

Understand typical character codes.

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

(4) Predicate logic

Understand the concept of the 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 BNF and syntax diagram, the regular expression, and context-free grammar.

Sample term   reverse Polish notation

(6) Automaton

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

Sample term   pushdown automaton

(7) Correctness theory

Understand the program correctness theory, along with the basic concepts and mechanisms of partial and total correctness.

Sample term   halting problem

(8) Computational complexity

Understand the concept of the computational complexity theory.

Sample terms   time complexity, domain complexity, big O notation, P (Polynomial) problem, NP (non-deterministic polynomial) problem, NP-complete problem

(9) AI (Artificial intelligence)

Understand the basic concept and mechanism of artificial intelligence.

Sample terms   knowledge engineering, learning theory, machine learning, neural network, deep learning, expert system, analysis problem, synthesis problem, knowledge base, inference engine

(10) Compiler theory

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

Sample terms   context-free grammar, semantic analysis, code generation, intermediate language, object program, formal language, automaton

(11) Programming language theory and semantics

Understand the basic concepts and mechanisms of the programming language theory and semantics, including how a programming language provides syntaxes and meanings to represent objects, how the syntaxes and meanings are defined for each language, how the data structures and algorithms are represented, and how the structure and abstraction are defined.

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

4.   Theory of communications

[Goal]
  ➢ Learn the concepts and mechanisms of typical methods for transmitting information so that you can make use of them.

(1)   Transmission theory

(a) Transmission path

Understand the concept and mechanism of the transmission path, including how data is transmitted over transmission paths.

Sample terms   simplex, half duplex, full duplex, two-wire, four-wire, 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 concepts and mechanisms of typical modulation and demodulation techniques.

Sample terms   AM (Amplitude Modulation), FM (Frequency Modulation), PM (Phase Modulation), PCM (Pulse Code Modulation), QAM (Quadrature Amplitude Modulation), PWM (Pulse Width Modulation), modem

(c) Multiplexing

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

Sample terms   FDM (Frequency Division Multiplexing), TDM (Time Division Multiplexing), CDM (Code Division Multiplexing), WDM (Wavelength Division Multiplexing)

(d) Error detection and correction

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

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

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(e) Signal synchronization techniques

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

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

(f) Cryptography

Understand the concepts and mechanisms of techniques associated with cryptography.

Sample terms	coding theory, public key, private key, PKI (Public Key Infrastructure)

(g) Data compression

Understand the concepts and mechanisms of techniques associated with data compression.

Sample terms	coding theory, run length, Huffman code

5. Theory of measurement and control

> **[Goal]**
> ➢ Learn the concept and mechanism of signal processing so that you can make use of them.
> ➢ Learn the need for and the concept and mechanism of control so that you can make use of them.

(1) Signal processing

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

Sample terms	DFT (Discrete Fourier Transform), FFT (Fast Fourier Transform), impulse response, filter (low-pass filter, high-pass filter, band-pass filter, digital filter), sampling theorem, D/A conversion, A/D conversion

(2) Theory of control

(a) Concept and mechanism of control

Understand the concept and mechanism of control. Understand the concepts and mechanisms of control techniques, including feedback control and feed-forward control.

Sample terms	real-time OS, MPU architecture, open loop, response characteristics, control stability, PWM (Pulse Width Modulation) control

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

Understand that computer-based control uses a sensor to detect the 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.

Sample terms   optical sensor, image sensor, laser sensor, infrared sensor, X-ray sensor, magnetic sensor, accelerator sensor, gyro sensor, ultrasonic sensor

(c) Types and operating characteristics of measurement systems

Understand the concept and scheme of an advanced measurement system using computers such as a positioning system.

Sample terms   GPS, base station positioning, wireless LAN access point positioning

1.　Data structure

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[Goal]

➢ Learn the concept and the mechanism of data structures so that you can make use of them.

➢ Learn the types of typical data structures and their characteristics along with how to manipulate them so that you can make use of them.

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(1)　Data structure

Understand the concept and mechanism of the data structure along with how to define data structures using BNF.

(2)　Types of data structures

(a)　Array

Understand the concept of the array along with how to manipulation data, including how to store and retrieve data.

Sample terms   multidimensional array, static array, dynamic array

(b)　List

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

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

(c)　Stack and queue

Understand the concept of the stack and queue along with how to manipulate them.

Sample terms   FIFO, LIFO, push, pop

(d)　Tree structure

Understand the types of tree structures and their concepts, tree traversing, node addition and deletion, 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

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[Goal]

➢ Learn the concepts and representation techniques of the algorithm and flowchart so that you can make use of them.

➢ Learn typical algorithms so that you can make use of them.

➢ Learn how to design algorithms so that you can make use of them.

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(1) Flowchart

Understand the concepts of the algorithm and flowchart. Understand how to represent processing steps including symbols, sequence, selection, and iteration to know how to draw flowcharts.

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

(2) Typical algorithms

(a) Algorithms for sorting, merging, and searching

Understand the 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, synonym measure

(b) Recursive algorithms

Understand the concept and characteristics of the recursive algorithm along with the data structures suitable for implementing a recursive algorithm.

(c) Graph algorithms

Understand the graph algorithms.

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

(d) Algorithms for character string processing

Understand the algorithms for character string processing.

Sample terms　　string pattern matching, KMP (Knuth-Morris-Pratt) algorithm, BM (Boyer-Moore) algorithm

(e) Algorithms for file processing

Understand the algorithms for sorting, merging, control break, and editing used in batch processing and the like.

(f) Approximation algorithm

Understand the approximation algorithm.

Sample term　　approximate calculation

(g) Stochastic algorithm

Understand the Monte Carlo method as an example of the stochastic algorithms.

(h) Genetic algorithm

Understand that genetic algorithms are an application of the evolution theory to optimization problems.

(i) Algorithms for natural language processing

Understand the algorithms for natural language processing by using information retrieval,

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machine translation, and others as examples.

(j) Algorithms for data compression

Understand the algorithms for data compression.

Sample terms   run length method, Huffman method

(k) Algorithms associated with graphics

Understand the algorithms for three-dimensional graphics processing.

Sample terms   Z-buffer algorithm, scan line algorithm, ray-tracing algorithm

(l) Memory management algorithms

Understand the algorithms used by operating systems to manage memory, including the data structures for managing free memory and memory allocation/release.

(3) Algorithm design

Understand that algorithms are expressed using pseudo-languages, flowcharts, decision tables, and others.   In addition, understand how to design algorithms.

Sample terms   recursion, divide-and-conquer approach

3.   Programming

[Goal]
> Learn the programming rules and coding conventions so that you can make use of them.
> Learn the notations for the grammars of programming languages so that you can make use of 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 rules or coding conventions are not followed.

Sample terms   indentation, nesting depth, naming conventions, prohibited use of instructions, increased functionality efficiency, usability, maintainability of a program

(b) Program structure

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

Sample terms   module partitioning, independence, main routine, subroutine, DLL

(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 mechanism of the web servers and clients. Understand the role of programs in web servers and clients and how to create them along with the environments for developing web application programs.

Sample terms server-side programming, rich client, Ajax, Apache, JSP (Java Server Pages), HTML5 technology (canvas, WebSocket, Geolocation API, etc.)

(2) Grammar notation

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

Sample term EBNF (Extended Backus Naur Form)

4. Programming languages

[Goal]
- ➤ Learn the types of programming languages and their characteristics along with their description methods so that you can make use of them.
- ➤ Learn the control structures of programming languages so that you can make use of them.
- ➤ Learn the concept and usage of the memory area required for executing programs so that you can make use of them.
- ➤ Learn the syntax and semantic rules included in programming languages so that you can make use of them.

(1) Types of programming languages and their characteristics

(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, functional language, logic language, object-oriented language, script language

(b) Procedural languages

Understand the characteristics and description methods of typical procedural languages.

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

(c) Object-oriented languages

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

Sample terms Java, C++

(d) Script languages

Understand the characteristics and description methods of typical script languages.

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ECMAScript, Perl, PHP, Python, Ruby

(e)   CLI (Common Language Infrastructure)

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

Sample term   CLI (Common Language Infrastructure)

(2)   Control structure in programming languages

Understand the basic control structure, procedures and functions, and sequential and parallel control in programming languages.

Sample terms   sequence, selection, iteration, procedure call, parameter, dummy argument, actual argument, call by value, call by reference, control flow, recursive call, process, quasi-parallel control

(3)   Memory area of programming languages

Understand the concept and usage of the memory area required for running programs.

Sample terms   object program text, constant, static variable, automatic variable, heap, garbage collection, block, scope

(4)   Description methods of programming languages

Understand the syntax rule included in programming languages along with semantic rule with emphasis placed on formal semantics.

Sample terms   program structural unit, context-free grammar, syntax notation, BNF

5.   Other languages

[Goal]
➢ Learn the types of typical markup languages and their characteristics along with their description methods so that you can make use of them.
➢ Learn other languages used in the computer so that you can make use of them.

(1)   Markup languages

(a)   HTML

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

Sample terms   start tag, end tag, DTD (Document Type Definition), SGML

(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 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 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.

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

(2)   Other languages

Understand UML, a notation for object-oriented design, and other languages.

Sample terms   class diagram, sequence diagram, object diagram, collaboration diagram, statechart diagram, manipulation, attribute, role name, use case diagram, SDL (Specification and Description Language), ADL (Architecture Description Language), DDL (Data Definition Language)

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1.   Processor

> **[Goal]**
> ➢ Learn the types of computers and their configurations so that you can make use of them.
> ➢ Learn the types, architecture, structure, features, and operating principles of the processor so that you can make use of them.
> ➢ Learn the indexes for processor performance so that you can make use of them.
> ➢ Learn high-speed and high-reliability technologies for processors so that you can make use of them.

(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 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 characteristics, and intended purposes.

Sample terms   CPU, GPU, DSP

(4)   Processor architecture

(a)   Unit of data processing

Understand that the size of data processed by a processor with a single instruction depends on its architecture.

Sample terms   bit, character, byte, word

(b)   Instruction format

Understand that instruction formats can be classified according to the number of operands handled with a single instruction.

Sample terms   one-operand format, two-operand format

(c)   Instruction set

Understand that the instruction set depends on the processor architecture and that the processor architecture is available in two types: RISC and CISC.

Sample terms   fixed-length instruction, variable-length instruction

(5) Processor structure and features

Understand the following: what roles the control unit and processing unit play as components of the processor; what roles the accumulator, register, and instruction decoder play as components of the control unit and processing unit; and how the processor performance is related to the system performance.   In addition, understand how the register behaves while an instruction is executed.

Sample terms   accumulator, complementer, multiplier, multiplier-accumulator, instruction address register (instruction counter, program counter, and sequential control counter), IR (Instruction Register), GR (General Register), index register, base register, MAR (Memory Address Register), DR (Data Register), MR (Memory 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, combinational 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 the assembler symbol representation and how they are converted to each other.

Sample terms   arithmetic operation instruction, logical operation instruction, transfer instruction, comparison instruction, branch instruction, shift instruction, input/output instruction, address part (operand), fetch, address calculation, addressing mode, address modification, direct addressing, indirect addressing, indexing addressing (index modification), base addressing, relative addressing, absolute addressing, immediate addressing, effective address

(c) Interrupt

Understand the mechanism of the interrupt, types of interrupts categorized as internal or external interrupts, and how multiple interrupts are handled.

Sample terms   SVC (Supervisor Call) interrupt, input/output interrupt, interrupt control, machine check interrupt, program interrupt

(7) Microprogram control

Understand that one of the mechanisms for controlling processor operations is embedding a program (microprogram) for executing single machine language instruction as firmware. Understand the characteristics of this method.

Sample terms   microprogram memory, microprogram counter, emulation, horizontal microcode, vertical microcode

(8) Processor performance

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

Sample terms   cycle time, FLOPS, instruction mix

(9) High-speed technology for processors

Understand the types and characteristics of typical high-speed technologies for processors.

Sample terms   instruction pipeline, super-pipeline, superscalar, VLIW, vector processing, hyperscalar, super parallel processor, pipeline hazard, data hazard, structural hazard, control hazard, single-core processor, multi-core processor, multithreading

(10) Parallel processing

(a) Flows of instructions and data

Understand the types of typical parallel processing and their characteristics.

Sample terms   SISD, SIMD, MISD, MIMD

(b) Bottleneck in parallel processing

Understand cases where parallel processing cannot be used, and therefore, serial processing must be used, which may be caused by, for example, conflicting main storage use requests from multiple processors or locks from concurrent accesses to a database, and that handling these factors may hinder performance.

(11) Multiprocessor system

It is possible to enhance a system in terms of speed and reliability by equipping it with multiple processors. Understand the types, characteristics, and mechanism of such systems along with platform design through appropriate combinations of multiprocessor systems.

Sample terms   loosely coupled multiprocessor system, tightly coupled multiprocessor system, tandem multiprocessor system, array computer system, Amdahl's law, synchronization, SMP (Symmetric Multi Processing), cluster, torus, hypercube, hypertree

2.　Memory

[Goal]

➢ Learn the types of memories and their characteristics along with how they should be chosen so that you can make use of them.

➢ Learn the mechanism of main storage including its configuration, memory system configuration, and storage hierarchy so that you can make use of them.

➢ Learn the types of storage media and their characteristics so that you can make use of them.

(1)　Types of memories and their 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, their characteristics (volatility, non-volatility, access speed, capacity, cost, and physical size), typical purpose, and how they should be chosen in designing a system must be understood.

Sample terms　　RAM, ROM, DRAM, SRAM, refresh, mask ROM, PROM (Programmable Read Only Memory), EPROM (Erasable Programmable Read Only Memory), EEPROM (Electrically Erasable Programmable Read Only Memory), flash memory, SDRAM (DDR2 SDRAM, DDR3 SDRAM)

(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 component, address selection mechanism, read/write mechanism, ECC (Error Correction Code), parity

(3)　Memory system configuration and storage hierarchy

Understand how the storage hierarchy is configured along with the types and characteristics of methods for writing data in cache memory to main memory.　Understand how data in cache memory is written to main memory.

Sample terms　　auxiliary memory, disk cache, write through, write back, direct mapping, full associative, set associative, associative memory, instruction cache, data cache

(4)　Access method

Understand the memory interleave for speeding up main memory.

Sample term　　bank

(5)　Memory capacity and performance

Understand the relationship between memory capacity and performance, including access time and cycle time, cache memory hit ratio, miss ratio, effective access time, miss penalty, 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), optical
disk, CD (CD-ROM, CD-R), DVD (DVD-ROM, DVD-RAM, DVD-R),
Blu-ray disc, magneto-optical disk, MO, semiconductor disk, flash memory
(USB memory, SD card), streamer, DAT, RAM file

3.   Bus

> **[Goal]**
> ➢   Learn the types of buses along with their characteristics, control methods, and standard specifications so that you can make use of them.

(1)   Types of buses and their characteristics

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

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

(2)   Bus system configuration

Understand that the bus system configuration is available in two types: Harvard architecture, which separates instruction fetch from data access, and Princeton architecture, which uses the same bus for both instruction fetch and data access.   Understand the characteristic of each architecture.

(3)   Bus control

Understand the bus control for determining, for example, which component should use a bus in a case where it is shared by multiple devices, along with the specific operations made during this process.

Sample terms   bus arbiter, bus master, centralized control, interruption, polling

(4)   Bus access mode

Understand the bus access modes, which are for controlling external data bus widths, along with their operations.   Understand that the bus widths can be specified by specifying a bus access mode.

(5)   Bus capacity and performance

Understand that the word bus capacity is synonymous with bus width and that bus performance is synonymous with clock frequency.   Understand how to calculate bus throughputs.

(6)   Bus standard specifications

Understand the bus standard specifications and requirements along with their characteristics.

Sample terms   PCI (Peripheral Component Interconnect) bus, PCI Express, IEEE 1394,

ANSI-X3.131 (SCSI), USB (Universal Serial Bus)

4.   Input/output interface

> **[Goal]**
> ➢ Learn the types of input/output interfaces and their characteristics so that you can make use of them.
> ➢ Learn the roles and functions of device drivers so that you can make use of them.

(1)   Input/output interfaces

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

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

Sample terms   USB, RS-232C, IEEE 1394, SCSI, HDMI, PC card, serial ATA, Bluetooth,

ZigBee, IrDA, NFC, FC (Fiber Channel)

(b)   Data transmission methods and topologies

Understand the serial and parallel data transmission methods.   Understand the types of topologies used for connecting peripherals and their characteristics along with the devices 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 and channel control methods, which are transfer methods that can transfer data without any intervention of the CPU.   Understand the roles of the input/output interruptions.

Sample terms   program control, DMA (Direct Memory Access), channel command, optical

channel, offline seek, offline search, ultrahigh-speed channel, extended

channel system

(d)   Types of channels and their characteristics

Understand the types of channels along with their characteristics and operation modes.

Sample terms   multiplexer mode, burst mode

(2)   Device driver

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

5. Input/output device

[Goal]
- Learn the types of typical I/O devices along with their characteristics, mechanisms, and uses so that you can make use of them.
- Learn the types of typical auxiliary storage devices along with their characteristics, mechanisms, and uses so that you can make use of them.

(1) Input devices

Understand the types of typical input devices along with their characteristics, mechanisms, and uses.

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 of typical display devices and output devices, along with their characteristics, mechanisms, and uses. 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, text mode, graphics mode, packed pixel mode, planar pixel 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, mechanisms, and purposes. Understand how to calculate the memory capacities and average access times based on the specification data of devices.

Sample terms   hard disk drive, SSD (Solid State Drive), SD/SDHC/SDXC card, CD-R/RW drive, Blu-ray drive, DVD-R/RW drive, magnetic tape unit, track, cylinder, blocking factor, IBG (Interblock Gap), sector, track density, spindle, access arm, magnetic head, fixed disk, defragmentation, seek time, search time, data transfer time, data transfer rate, volume, volume label, header label, trailer label, disk array, RAID

(4) Other I/O devices

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

Sample terms   wired LAN interface card, wireless LAN interface card

1. System configuration

> **[Goal]**
> - Learn the processing modes, usage, and application areas of systems so that you can make use of them.
> - Learn the types of typical system configurations and their characteristics along with the functional allocation of system components so that you can make use of them.
> - Learn the characteristics and configuration of the client/server system so that you can make use of them.
> - Learn the concept and technique of reliability design for systems so that you can make use of them.

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

(a) Centralized processing systems

Understand the mechanism and characteristics of centralized processing systems.

Sample terms   cost performance, centralized maintenance personnel

(b) Distributed processing systems

Understand the mechanism and characteristics of distributed processing systems.

Sample terms   distributed architecture, management responsibility, functional allocation, horizontal distribution system, horizontal load distribution system, vertical distribution system, interactive processing, responsiveness to organizations and management responsibility associated with information resources, TCO

(c) Usage

Understand the types and characteristics of system usage, including batch processing and real-time processing. Understand which usage is suitable for which task.

(2) System configuration

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

Sample terms   dual system, duplex system, cluster, clustering, tandem connection, multiprocessor system, load sharing system, backup site, hot site, warm site, cold site, primary system (currently used system), secondary system (backup system), shared everything, shared nothing, tight coupling, loose coupling, thin client, peer to peer, grid computing, virtualization, VM (Virtual Machine), cloud computing, SaaS, PaaS, IaaS, migration

(3) High-performance computing

Understand the characteristics of HPC (High Performance Computing) used in areas that require high-precision, high-speed operations. Understand that a supercomputer that enables HPC and a single high-performance computer can be configured by connecting multiple computers through a LAN to share resources including the CPU.

Sample terms   massively parallel, array processor

(4) Client/server system

Understand the characteristics of the client/server system and the 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, response speed for local processing, cost performance, flexibility, management responsibility, intensive use of a server

(5) Web system

Understand the characteristics, architecture, and configuration of the web system along with the mechanism of communications between layers.

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 characteristics, along with NAS, SAN, and other technologies associated with storage.

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

(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. Understand what system configurations and technologies are available.

Sample terms   fault, reliability block diagram, backup switching, parallel operations, contention control, active-standby configuration, active-active configuration, fault tolerant system, fault avoidance system, fail safe, fail soft, foolproof, non-stop computer, UPS

2.　System evaluation indexes

[Goal]
> Learn the concept for measuring the performance, reliability, and cost efficiency of systems, the evaluation indexes for them, and the concept of design for improving them so that you can make use of them.

(1)　Performance characteristics and evaluation of a system

(a)　System performance indexes

Understand the types of evaluation items used for evaluating system performance, along with their characteristics and indexes.

Sample terms　response time, throughput, benchmark, system monitor, TPC, SPEC (Standard Performance Evaluation Corporation), SPECint, SPECfp, monitoring, Gibson mix

(b)　Capacity planning

Understand that system performance is identified and evaluated on a continuous basis in the following 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, system parameter, 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 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 how you can calculate the availability of parallel and serial systems.

Sample terms　bathtub curve

(3)　Cost efficiency evaluation of a system

With regard to the cost efficiency of a system, understand the concept of evaluation, evaluation items, indexes, evaluation targets, and specific methods, along with the system evaluation based on initial costs and TCO.　In addition, understand what expenses the initial and operational costs include and what the difference between the direct and indirect costs is.

1. Operating system

> **[Goal]**
> ➢ Learn the types of OSs along with their characteristics, functions, and configurations so that you can make use of them.
> ➢ Learn the typical functions and roles of OSs, including job management, task management, and memory management so that you can make use of them.
> ➢ Learn the types of programs and their properties along with the trends of OSs so that you can make use of them.

(1) Types of OSs and their characteristics

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

Sample terms   system software, UNIX, OS for PCs, open OS, real-time OS, VM (Virtual Machine), compatibility

(2) Functions and configurations of OSs

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

Sample terms   microkernel, monolithic kernel, middleware, kernel mode (supervisor mode), privileged mode, user mode, non-privileged mode, compiler, interpreter, linkage editor, service program, virtual memory management, process management, task management, memory management, data management, operations management, fault management, input/output management, user management, interrupt, multiprogramming, bootstrap, network boot, multi-boot, flash bootloader

(3) Job management

Understand a job as a unit of work, the concept of job steps that make up a job, the procedure for managing jobs, and the roles of the control programs associated with job management. Understand what roles JCL plays in OSs for general purpose computers.

Sample terms   job scheduler, master scheduler, session, labor saving, automatic operations, system management, background job, batch processing, cron

(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 role of the dispatcher.

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

(b)　Multiprogramming (multitask) and scheduling

Understand the concept of multiprogramming.　With regard to typical task scheduling methods, understand the scheduling techniques, characteristics, the roles of triggers and priority in scheduling, and the need for synchronous and exclusive control along with the way for implementing them.　In addition, understand synchronization between tasks, data passing between tasks, the concept of multithreading, parallel processing, and so on.

Sample terms　　preemptive, non-preemptive, time slice, event-driven, feedback queue, shortest processing time first, priority scheduling, static priority, dynamic priority, round robin, SJF (Shortest Job First), interrupt mask, multi CPU, exclusive control, FCFS (First Come First Served), time quantum, resource starvation, SVC (SuperVisor Call) interrupt, I/O completion interrupt, dispatch

(5)　Data management

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

Sample terms　　record, space management, catalog management, file protection

(6)　Input/output management

Understand the mechanism of input/output control including the types of input/output control systems for allowing input/output devices to operate efficiently and their characteristics, types of channels, and data transmission methods.　In addition, understand the mechanism for improving the efficiency by reducing CPU idle time including spooling and buffering.

Sample terms　　IOCS (Input/Output Control System), spooling, buffer pool, input/output port (I/O port), input/output mapping (I/O mapping), memory mapping, channel, channel control, DMA (Direct Memory Access), channel subsystem, selector channel, multiplexer channel, input/output interrupt, memory-mapped I/O, I/O-mapped I/O

(7) Memory management

(a) Real memory management

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

Sample terms　real address, single continuous allocation, memory management algorithm (first fit, best fit, worst fit), memory compaction, roll-in, roll-out, swap-in, swap-out, segment, compaction

(b) Virtual memory management

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

Sample terms　base address, segment, paged segment, single virtual memory space, multiple virtual memory space, thrashing, DAT (Dynamic Address Translation), TLB (Translation Lookaside Buffer), page fault, page-in, page-out, demand paging, page replacement, LRU, FIFO, working set

(8) Network control

Understand the role and functions of network control programs and their position in the OS along with the communications interface provided by OSs.

Sample terms　network OS, LAN, WAN, protocol control, real-time OS, communications protocol, TCP/IP, OSI basic reference model

(9) Operations management

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

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

(10) User management

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

Sample terms　superuser, root, administrator, guest, administrator privileges, LDAP, active directory

(11) Security control

Understand that OSs provide security control functions such as access control, flow control, inference control, and cryptographic control.   Understand the types and characteristics of control methods used by OSs.   In addition, understand the characteristics of security kernels provided with security measurements such as file protection and outside intrusion detection/prevention.

Sample terms external security, internal security, multilevel security, BLP (Bell-LaPadula) model, logging function, audit function, accountability, reliability process, integrity, isolation, authentication, verifiability, ITSEC (Information Technology Security Evaluation Criteria)

(12) Fault management

Understand a series of processes from the occurrence of a fault to the completion of measures, including fault detection, testing and diagnosing, automatic correction, fault recording, reconfiguration, restarting, and elimination of causative factors.

Sample terms Timer monitoring, CPU monitor, hardware fault, software fault, reconfiguration (dynamic device reconfiguration, automatic CPU reconfiguration), multiplexing (input/output path multiplexing, double auxiliary storage, double library, double disk volume), multiplexing system (dual system, duplex system) hot standby system, fault-recovery routine

(13) Types of programs and their properties

Understand that there are some types of programs such as source programs and object programs and that the macro sources, including data structure and record structure definitions, must be managed for source programs.   Understand the properties of reentrant programs, serially reusable programs, etc. and their usage.

Sample terms source program, object program, compiler, load module, loader, library, dynamic linking, reentrant, API, ABI (Application Binary Interface), POSIX (Portable Operating System Interface), SCM (Software Configuration Management)

(14) Service program

Understand the types of service programs and their characteristics.

Sample terms utility program, sort program, merge program, formatting, archiver, data editing, file copy, backup

(15) Trends of OSs

Understand the latest topics about OSs along with their standardization and technology trends.

Sample terms small mobile OS, JavaOS, cell phone OSs, OSE (Open Systems Environment), ODP (Open Distributed Processing), secure OS, OS for cloud computing

2. Middleware

[Goal]
- ➤ Learn the roles and functions of typical middleware so that you can make use of them.

(1) Roles and functions of middleware

Understand the roles and functions of middleware, positioned between the OS and application software, along with the concept regarding middleware selection and usage.

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. In addition, understand typical commands.

Sample terms   command interpreter, Bshell, Cshell, COMMAND.COM, cmd.exe

(3) API

Understand the role and capabilities of APIs seen from application programs.

Sample terms   function, library, web API, API specifications

(4) Library

Understand libraries for storing programs and macros.

Sample terms   source library, object library, load library, DLL (Dynamic Link Library), class library

(5) Componentware

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

Sample terms   component, Java Beans, ActiveX, CORBA

(6) Development framework

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

Sample terms   Apache Struts, CakePHP, Spring, Ruby on Rails

3.   File system

[Goal]
- ➢ Learn the types of directories for managing hierarchical files along with their characteristics and the mechanism of file management so that you can make use of them.
- ➢ Learn the types and characteristics of file systems so that you can make use of them.
- ➢ Learn file organization, access methods, search, and backup methods so that you can make use of them.

(1)   Directory management and file management

Understand the mechanism of file management, including the types and characteristics of directories for managing hierarchical files, file information managed by directories, file control block, file pointers, and file handles, along with how to identify files based on absolute and relative paths.   In addition, understand the directory management, mechanism and concept of file sharing, and access privileges.

Sample terms   physical location, protected information, reference information, symbolic link, shortcut, alias, root directory, current directory, home directory, single directory, two-level directory, hierarchical directory, tree-structured directory, path name, file handle, file descriptor, character device, block device, blocking, shared file

(2)   Types and characteristics of file systems

Understand 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 unique file systems.   In addition, understand the characteristics of typical file systems.

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

(3)   File organization and access methods

Understand the types of file organization and access methods, along with their characteristics. Understand how to add, delete, update, and process records in each file organization.

Sample terms   logical record, physical record, block, unblocked record, blocked record, block size, sequential access, direct access, dynamic access, sequential organization, partitioned organization, indexed sequential organization, direct organization, VSAM organization, overflow area, blocking, deblocking

(4)   Search methods

Understand that different search techniques are used for different directory structures.

Sample terms   hashing, index

(5) Backup

Understand backup methods: the method and procedure for getting backup files for the purpose of recovering files; generation management; and the method and procedure for recovering files.

Sample terms   multiple backup, full backup, differential backup, incremental backup

4.　Development tools

> **[Goal]**
> ➢ Learn the types of development tools used for developing software along with their characteristics and functions so that you can make use of them.

(1) Types and characteristics of development tools

Understand the types of typical development tools along with their characteristics and 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 tools (SADT: Structured Analysis and Design Techniques, SREM: Software Requirement Engineering Methodology, PSL/PSA: Problem Statement Language / Problem Statement Analyzer), design tool, document generation tool, building tool, testing tool (static debugging tool (pretty printer, cross reference), dynamic debugging tool, static analysis tool (source code analysis tool, program structure analysis tool), dynamic analysis tool (test data generator, test coverage tool, test bed tool, program inspection tool), tool chain, emulator, simulator, ICE (In-Circuit Emulator), tracer, inspector, snapshot, assertion checker, version control tool

(2) Types of language processing tools and their characteristics

Understand the types of typical language processing tools along with their characteristics and 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]**
> ➢ Learn the types of open source software along with their characteristics, functions, configurations, considerations for use, and trends so that you can make use of them.

(1) Types of OSS and their characteristics, facilities, and configurations

Understand the details 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, functions, 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), BSDL (Berkeley Software Distribution License), MPL (Mozilla Public License), Apache license

(2) Unix-family OSs

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

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

(3) Open source community

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

Sample term   SCM (Source Code Management)

(4) Considerations in the use and utilization of OSS

Understand the 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 of OSS

Understand the trends in the development and dissemination of OSS.

1.　Hardware

[Goal]

➢ Learn electric and electronic circuits, as a component of the computer, along with machines and their control so that you can make use of them.

➢ Learn component parts/elements and their implementation, the roles of the parts that make up embedded systems, and the relationships between those parts so that you can make use of them.

➢ Learn the important points in performing logic design for optimal configurations so that you can make use of them.

➢ Learn the importance of power consumption in developing embedded devices along with associated technologies and their trends so that you can make use of them.

(1)　Electric and electronic circuits

Understand the operating principles of the basic computer logic circuits, such as the AND, OR, and NOT circuits.　Understand that the logic circuits are classified into combinational logic circuits and sequential logical circuits.　Understand the characteristics of each circuit.

Sample terms　　NAND circuit, XOR circuit, flip-flop

(2)　Machines and their control

With regard to how to implement typical electronic control of machines, understand their structures, the operating principles and functions of each part.

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

(3)　Components/elements and their implementation

(a)　Semiconductor device

Understand the operating principles, structures, characteristics, and implementation of typical semiconductor devices.

Sample terms　　diode, LED, transistor, IC, LSI, VLSI (Very Large Scale Integration), CMOS, bipolar, BiCMOS (Bipolar Complementary MOS), bipolar memory

(b)　Custom IC

Understand that the circuits requested by users can be implemented as an IC.

Sample terms　　ASIC (Application Specific IC), FPGA (Field Programmable Gate Array), HDL (Hardware Description Language)

(c) System LSI

Understand that system LSI is used in the embedding field and that combining multiple semiconductors can reduce occupation space, downsize systems, enhance speed, reduce costs, and provide other advantages.

Sample terms   co-design, SoC (System on a Chip)

(d) Component parts of embedded systems

Understand the roles of the parts that compose embedded systems and the relationships between them.

Sample terms   processor, DSP (Digital Signal Processor), sensor, actuator, memory, ASIC, D/A converter, A/D converter, MEMS, diagnostic program

(4)   Logical design

Understand that the most suitable configuration should be studied and designed in consideration of the performance, design efficiency, cost, and so on.

Sample terms   circuit design, timing design, synchronous design, asynchronous design, disjunctive normal form, logic compression

(5)   Power consumption

Understand the importance of hardware power consumption in developing embedded devices, along with the associated technologies and their trends.

Sample term   reduction of power consumption, leak current, power gating, clock gating

1. Human interface technology

> **[Goal]**
> ➢ Learn the concept and purpose of the information architecture so that you can make use of them.
> ➢ Learn the types and characteristics of typical human interface technologies so that you can make use of them.
> ➢ Learn the characteristics and components of GUI along with the procedure and important points of GUI screen design so that you can make use of them.

(1) Information architecture

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

Sample terms	label, chunk, navigation, LATCH (Location, Alphabet, Time, Category, Hierarchy), hierarchical, linear, web link, folksonomy, semantic web, metadata

(2) Human interface

Understand what requirements determine the human 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, learning function, selective perception, analysis of user operation, physical adaptability, non-verbal interface, multimodal interface, spatial interface, natural-language interface

(3) GUI

Understand the characteristics of GUI: for example, visual display based on graphics and intuitive operation based on pointing devices. Understand the characteristics and roles of the components used in GUI along with the procedure and important points of GUI screen design and scenario-based design.

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

2.   Interface design

> **[Goal]**
> ➢ Learn the concepts, procedures, and techniques of screen design, form design, and code design so that you can make use of them.
> ➢ Learn desirable interfaces based on application of the concept of universal design so that you can make use of them.

(1)   Screen design and form design

(a)   Screen design

Understand the concepts, procedures, and techniques for screen design, along with typical methods for checking input.   In addition, understand how each input/output item corresponds with database and its processing.

Sample terms   screen layout, information retrieval, information relationship, terms for users, information presentation story, story board, partial transmission, numeric check, format check, limit check, combination check, matching check, balance check, check character, fill-in-the-blank method, menu input method, format error, logical error, sequence error

(b)   Form design

Understand the concepts, procedures, and techniques for form design.   In addition, understand the following: the relationships between the restrictions on devices, such as printer types and copying methods, and form design; output on form overlays and preprinted forms; correspondence between each input/output item and database; and correspondence between each input/output item and its processing.

Sample terms   output characteristics, input characteristics

(2)   Code design

Understand the types and characteristics of code.   Understand the concepts, procedures, and techniques 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. Understand that international standards for usability are available.   In addition, understand how to evaluate usability and navigate websites.

Sample terms   frame, principle of spatial adjacency, affordance, in-site search function, ISO 9241, site map, cross browser, progressive enhancement

(4) Human centered design

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

Sample terms   ISO 13407, understanding and manifestation of usage, manifestation of requirements of users and organization, creation of solutions based on design, evaluation of design based on requirements

(5) Universal design

Understand the concept of the seven principles of universal design. Moreover, in the information technology area, understand the interface and design methods to which the concept of universal design, including explanations based on illustrations and the voice readout and Undo (cancellation) functions, is applied.

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

(6) Usability evaluation

Understand the concept and method of usability evaluation.

Sample term   heuristic evaluation

1. Multimedia technology

> **[Goal]**
> ➢ Learn the mechanisms and characteristics of how characters, sound, and images are handled in the computer, along with the concept of multimedia, which handles them in an integrated way, and the resources and functions required for it so that you can make use of them.
> ➢ Learn the purposes, characteristics, and mechanisms of compressing and decompressing information so that you can make use of them.

(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 the concept of processing multimedia, including authoring for editing and combining multiple media, and the resources and functions required for it.

Sample terms　　web content, hypermedia, streaming, authoring environment, media
integration, PDF, DTP

(2) Sound processing

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

Sample terms　　PCM (Pulse Code Modulation), MIDI, WAV (Waveform Audio Format), AU
(Audio or mu-law), AIFF (Audio Interchange File Format), MP3, sampling
frequency, quantization bit rate, MIDI sound source, sampling

(3) Static image processing

Understand the 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),
dithering, look-up table, layer, trimming

(4) Moving image processing

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

Sample terms　　MPEG, QuickTime, AVI, Motion JPEG, interlaced, progressive, linear
editing, nonlinear editing

(5)   Compression and decompression of information

Understand that information is compressed and decompressed according to the type of media. Understand the purpose of compression and decompression along with the characteristics and mechanisms of typical compression/decompression methods.   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, run length, MH (Modified Huffman), MR (Modified READ), MMR (Modified Modified READ), MP3, efficient data storage, network load reduction

2.   Multimedia application

[Goal]
> ➢   Learn the characteristics of multimedia systems and example applications of multimedia so that you can make use of them.

(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), multimedia data synthesis, video on demand, DSP (Digital Signal Processor), digital broadcasting, 3D video, motion capture, virtual surround

1. Database architecture

> **[Goal]**
> ➢ Learn the types of databases along with their characteristics, database models, and the concept of the three-level schema so that you can make use of them.
> ➢ Learn the purpose and functions of database management systems (DBMS) so that you can make use of them.

(1) Database

(a) Types and characteristics of databases

Understand the types of typical databases and their characteristics, including the data representation structure and method for associating a record with another. Understand that the most appropriate database should be selected and used for design based on the given requirements.

Sample terms   relational database, structured database, HDB (Hierarchical Database), NDB (Network Database), CODASYL (Conference on Data Systems Languages) database, OODB (Object Oriented Database), object-relational 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 their characteristics and advantages, along with the representation style, represented content, and characteristic of each schema.

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. In addition, understand how a data model can be represented using the specified notation according to the given requirements.

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

(2)   Database management system

(a)   Purpose of database management system

Understand the purpose and typical functions of DBMS.   Understand that DBMS is available in different types: hierarchical, network, and relational types.   Understand that the management functions of DBMS are used for database development and maintenance.

Sample terms   database definition function, database manipulation function, database
control function, maintenance function, data security protection function

(b)   Exclusive control

Understand what control method is required when a database is accessed by multiple application programs concurrently.

(c)   Failure recovery

Understand the function and procedure for recovering a database in the event of a failure.

(d)   Data security

Understand how security can be achieved as an important requirement for data sharing.

Sample terms   transaction, lock, deadlock, ACID characteristics, data dictionary

2.   Database design

[Goal]
- Learn the concept of data analysis so that you can make use of it.
- Learn the concept, procedure, and techniques of database design so that you can make use of them.
- Learn the purpose and procedure of data normalization so that you can make use of them.
- Learn the procedure for creating databases and method for evaluating databases so that you can make use of them.
- Learn the concept of the object-oriented database so that you can make use of it.

(1)   Data analysis

Understand the concept in analyzing data: identification, analysis, 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.   In addition, understand the top-down and bottom-up approaches as techniques for creating data models.

Sample terms   elimination of data duplication, metadata, data dictionary

(2) Database design

(a) Database development process

Understand the process, procedure, and technique for developing databases, including development planning, external design, internal design, programming, testing, and migration.

Sample terms   system analysis, requirements definition, corporate data model, data model, conceptual data model, logical data model, physical data model, secondary index, partitioning method, DOA (Data Oriented Approach),

(b) Conceptual design of databases

Understand that in the conceptual design process, the data items defined by the requirements definition and data items that occurred during the functional design of the system are organized to design the whole data items. In addition, understand the techniques for representing data independent of DBMS: how to represent the components, attributes, and relationships using E-R diagrams; characteristics; and cardinality (one to one, one to many, many to many).

Sample terms   Bachman diagram, entity, attribute, relationship

(c) Logical design of databases

Understand the concept of table design that causes no data duplication or conflict, concepts such as primary key and foreign key, and constraints such as referential constraint and consistency constraint.   In addition, understand the function and definition of a user view.

Sample terms   deployment mode, parent-child set ordering, parent-child set, index, field (item), record, file, NULL, unique constraint

(3) Data normalization

Understand the purpose and procedure for normalization, along with first, second, and third normalizations and others.   Understand that specific proposed design based on the concept of normalization should be evaluated in terms of ease of updating and performance for optimal design.

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

(4) Performance design of databases

Understand the concept of designing databases with importance placed on performance by consciously choosing to abandon normalization for speeding up processing and reducing time required for joining tables.

Sample term   denormalization

(5) Physical design of databases

Understand that in the database physical design process, the database is optimized in terms of access and storage efficiency.   Understand that the considerations in designing the physical structure of a database, including the formats stored on hard disks and mapping of the logical data structure onto the physical data structure.

Sample terms   disk capacity estimation, mapping of logical data structure, file organization, optimal block design, physical input/output, performance evaluation, compression, decompression, points of performance improvement

(6) Procedure for creating databases

Understand the steps for creating databases, including database environment preparation, input data preparation, database definition, data registration, and database verification.

Sample terms   database definition information, record format, parentage, key sequence, existence constraint, inverted file

(7) Evaluation and operation of databases

Understand how to evaluate the performance of databases.   Understand that tuning, reorganization, and other measures are required depending on the evaluation result.

Sample terms   operations and maintenance of databases

(8) Object-oriented database

Understand the factors that drove the object-oriented database development.   Understand that object-oriented databases are used to store data having a complicated data structure.

Sample terms   object-oriented data model, complex object, XML database, object identity, O/R mapping

3.   Data manipulation

[Goal]
- Learn the manipulation of relational databases so that you can make use of it.
- Learn the types of database languages and SQL statements so that you can make use of them.

(1) Database manipulation

Understand the data manipulation of relational databases such as set operations (union, 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 classified 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, view 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 following 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; and so on.

Sample terms   aggregate function, pattern character, correlation name, sub query, correlation sub query

(iii) Other data manipulation languages

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

(iv) Embedded SQLs

Understand the data manipulation mechanism, advantage, and usage of embedded SQLs, inducing cursor manipulation, non-cursor manipulation, and connection with the host language.   In addition, understand SQL statements which perform a cursor declaration, initiation and termination of manipulation, reading, etc.

Sample term   cursor

4. Transaction processing

[Goal]

➢ Learn the concepts and mechanisms of database exclusive control and failure recovery so that you can make use of them.

➢ Learn the concepts of transaction management and access efficiency improvement so that you can make use of them.

➢ Learn the need for controlling access to data and typical access rights so that you can make use of them.

(1) Exclusive control

Understand the concept of exclusive control, intended for preventing multiple transactions from updating a database concurrently to maintain the data consistency. In addition, understand the 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 concept of generation management, the mechanism of recovery processing for recovering the state immediately before the failure occurrence, preparation of the environment for the usage of database, and the concept and mechanism of reorganization for improving access efficiency.

Sample terms   full backup, differential backup, incremental backup, dump file, restore, data
                 directory, 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 meanings 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.

Sample terms   number of indexes, load, unique index, cluster index

(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

(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.　Understand how to apply these technologies.

Sample terms　OLTP (Online Transaction Processing), ETL (Extract/Transform/Load), data cleansing, big data, document 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, the mechanism of data synchronization between sites, associated functions, and the difference between distributed and centralized databases.

Sample terms　transparency, client cache, commitment control, two-phase commitment, commit sequence, concurrency control, replication, horizontal distribution, vertical distribution, table distribution (horizontal and vertical), distribution query, join operation, distributed transaction, OSI-RDA (Open Systems Interconnection-Remote Database Access) protocol

(3)　Data resource management

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

Sample terms　IRDS (Information Resource Dictionary System), fact database, reference database, database service

1. Network architecture

> **[Goal]**
> ➢ Learn the mechanisms and characteristics of LAN and WAN and the types of services provided by common carriers so that you can make use of them.
> ➢ Learn wired and wireless LANs and the mechanisms and characteristics of their switching methods so that you can make use of them.
> ➢ Learn the relationships among line speed, data amount, and transfer time so that you can make use of them.
> ➢ Learn the need for the Internet technologies and their characteristics so that you can make use of them.

(1)   Role of communications network

Understand the role and effect of communications network.   Understand that a network failure has a profound impact on society.

Sample terms   network society, ICT (Information and Communication Technology), u-Japan initiative

(2)   Types and characteristics of networks

Understand the mechanisms of LAN and WAN along with their characteristics, components and running costs.   In addition, understand the types and characteristics of WAN-based services provided by common carriers.

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

(3)   Wired LAN

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

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

(4)   Wireless LAN

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

Sample terms   electromagnetic wave, infrared ray, wireless LAN access point, infrastructure mode, ad-hoc mode

(5)   Switching system

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

Sample terms   packet, VoIP (Voice over Internet Protocol)

(6)   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.   In addition, understand how to calculate the required line speed from a given traffic volume.

Sample terms   transfer (transmission) rate, bps (bit per second), circuit capacity, bit error rate, traffic theory, traffic intensity, lost-call rate, Erlang Formula B (Erlang loss formula), erlang, queueing theory, M/M/1, Kendall's notation, traffic design, performance evaluation

(7)   Internet technology

Understand that intercommunication is actualized by assigning each node an IP address unique in the world.   Understand the roles of the network and host addresses as the components of an address; how IP packets are routed; and the need for IPv6 and its characteristics.

Sample terms   IPv4, IPv6, address class, global IP address, private IP address, IP masquerade, NAT, overlay network, DNS, domain, TLD, proxy server, QoS (Quality of Service), ubiquitous, pervasive, security protocol, firewall, RADIUS

2.   Data communication and control

[Goal]
- Learn the concept, importance, and effectiveness of network architecture so that you can make use of them.
- Learn the types of transmission methods and lines along with their characteristics so that you can make use of them.
- Learn the types of network connecting devices and their characteristics so that you can make use of them.
- Learn the mechanisms and characteristics of typical control functions in networks so that you can make use of them.

(1)   Network architecture

(a)   Network topology

Understand the types and characteristics of typical network configurations along with how terminals and control devices are connected and how to create a network configuration diagram.   In addition, understand the reliability of each configuration and the difference in behavior during failures.

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

(b)   OSI basic reference model

Understand the 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

(c) Examples of standardizations

Understand that the communication protocols used in WAN are standardized by ITU-T.

Sample terms　　X series, V series, I series

(2) Transmission methods and lines

Understand the types of lines, along with the types and 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, PLC (Power Line Communication)

(3) Network connecting devices

Understand the types of intra-LAN, inter-LAN, and LAN-to-WAN connection devices and their 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 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, PVC (Permanent Virtual Connection (or Circuit)), switching method, connection method, connection-less, parity check, CRC, Hamming code, bit error rate, SYN synchronization, flag synchronization, frame synchronization

(5) Media access control

Understand the mechanism and characteristics of MAC (Media Access Control), designed for defining how to transmit and receive data and detect errors.　In addition, understand the purpose of access control and the typical types of access control techniques and their mechanisms.

Sample terms　　TDMA, CSMA/CD, CSMA/CA, token passing, collision

3. Communications protocols

> **[Goal]**
> ➢ Learn the layer function of the OSI basic reference model implemented by TCP/IP – one of the typical protocols – along with the role of it so that you can make use of them.

(1) Protocols and interfaces

(a) TCP/IP

Compare TCP/IP with the seven layers of the OSI basic reference model to understand the roles of the layers and the interfaces provided by them. In addition, understand the port numbers for typical services (well-known ports) and so on.

Sample terms　　packet, header

(b) Data link layer protocols

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

Sample terms　　RARP (Reverse Address Resolution Protocol), PPP, PPPoE (Point to Point Protocol over Ethernet), VLAN

(c) Network layer protocols

Understand the 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 roles and functions of TCP and UDP.

Sample term　　port number

(e) Application layer protocols

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

Sample terms　　TELNET, DHCP, IMAP, NTP, SOAP (Simple Object Access Protocol)

(f) Interfaces for LAN and WAN

Understand the roles and functions of typical interfaces for LAN and WAN, including Ethernet, wireless LAN, ISDN (Integrated Services Digital Network), PRI (Primary Rate Interface), and ATM.

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

(g) CORBA

Understand that CORBA is independent of programming languages or network protocols, and therefore can be used as the basic concept regarding system integration in heterogeneous

distributed environments.

Sample terms distributed object technology, client, object service, request application

object

4.   Network management

[Goal]
  ➤ Learn the control items in network operations management along with how to manage them so that you can make use of them.
  ➤ Learn tools for network management, functions, mechanisms, and usage of protocols so that you can make use of them.

(1)   Network operations management

  (a) Configuration management

Understand the technique for configuration management, which involves maintenance of configuration information and recoding of the modifications.

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

OpenFlow

  (b) Fault management

Understand the technique for 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 technique for managing network performance by, for example, analyzing the relationship between the traffic volume and transfer time.

Sample term traffic monitoring

(2)   Network management tools

Understand the functions and mechanisms of tools used for network management.

Sample terms ping, ipconfig, arp, netstat

(3)   SNMP

Understand the traffic analysis technique that uses SNMP – a protocol for collectively managing the devices that compose the network – and MIB (Management Information Base).

Sample terms SNMP agent, SNMP management station, MIB (Management Information

Base), get request, put request, trap request

5. Network application

[Goal]
- ➤ Learn the mechanisms, characteristics, and functions of e-mail used over the Internet and web so that you can make use of them.
- ➤ Learn the mechanisms and characteristics of intranets and extranets so that you can make use of them.
- ➤ Learn the mechanisms, characteristics, and functions of network OSs so that you can make use of them.
- ➤ Learn the types of typical communication services along with their characteristics, functions, and considerations so that you can make use of them.
- ➤ Learn the mechanisms and characteristics of mobile systems so that you can make use of them.

(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.   Understand the characteristics and functions of the e-mail system.

Sample terms   SMTP, POP3, IMAP4, MIME, base64

(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 see different pages. Understand the mechanisms, characteristics, and functions of web application systems.

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

(c) File transfer

Understand the mechanisms of the FTP server and client and the mechanism of embedding of them into the web along with its characteristics and functions.

Sample terms   upload, download, TFTP (Trivial File Transfer Protocol)

(d) Search engine

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

Sample terms   full text search, directory type, robot type

(2) Intranet

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

Sample terms   VPN (Virtual Private Network), PVC (Permanent Virtual Connection (or Circuit)), private IP address, NAT

(3) Extranet

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

Sample terms   EC (Electronic Commerce), EDI

(4) Network OS

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

Sample terms   peer to peer connection, client/server system, NetWare

(5) Communication services

Understand the types of typical communication services along with their characteristics, functions, use conditions, and considerations in selecting services.

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

(6) Mobile systems

(a) Mobile communication services

Understand the types of mobile communication services along with their characteristics, and considerations in selecting services.

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

(b) Mobile system components

Understand the components, characteristics and functions of mobile systems.

Sample terms   base station, femtocell, mobile devices (cell phone, smartphone, tablet computer, etc.), tethering

(c) Mobile communication technology

Understand the characteristics of fundamental technologies that are used for wireless communications, including wireless LAN.

Sample terms   handover, roaming, MIMO, electric power saving technology (intermittent reception, dormant (preservation), etc.)

1. Information security

> **[Goal]**
> ➢ Learn the purpose, concept, and importance of information security so that you can make use of them.
> ➢ Understand the basic concepts of threat and vulnerability to information assets and the types of main attack methods so that you can make use of them.
> ➢ Learn the types of information security technologies along with their mechanisms, characteristics, and what threats they can prevent so that you can make use of them.

(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 assets, threat, vulnerability, cyberspace, cyber attack

(3) Threat

(a) Types of threat

Understand the 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, fallacy, fraudulent behavior, sabotage, denial of service

(b) Malware and malicious program

Understand 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

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(4) Vulnerability

Understand the basic concept of vulnerability such as defect on 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 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 types of malicious attackers and the main motivations causing attackers to carry out fraud, criminal acts, and attacks.

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

(7) Attack method

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

Sample terms
- dictionary attack, brute force attack, reverse brute force attack, rainbow 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, replay attack
- DoS (Denial of Service) attack, DDoS attack, email bomb, reflector attack
- targeted attack (APT (Advanced Persistent Threats), watering hole attack, interaction-type attack, etc.)
- phishing (one-click fraud, smishing, etc.), zero-day attack, side-channel attack, footprinting, DoS attack, targeted attack

(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 mechanisms and characteristics of typical cryptographies.

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), elliptic curve cryptography, S/MIME (Secure MIME), PGP (Pretty Good Privacy), hybrid encryption, hash function (SHA-256, etc.), block encryption use mode (CBC, CRT, etc.), key management, disk encryption, file encryption, compromise

(b)   Authentication technology

Understand the types, mechanisms, and characteristics of authentication systems, along with what authentication technologies are required for threat and what they prove.

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, mechanisms, and characteristics of technologies used for user verification.

login (user ID and password), access management, IC card, PIN code, Kerberos method, one time password, multi-factor authentication, identity linking (OpenID, SAML), security token, single sign-on, CAPTCHA

(d)   Biometric authentication technology

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

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

(e)   Public key infrastructure

Understand the mechanism and characteristics of the PKI (Public Key Infrastructure) along with where it can be utilized.

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), SET (Secure Electronic Transaction)

2. Information security management

[Goal]
- Learn the concept of information security so that you can make use of it.
- Learn the procedure for analyzing and evaluating risks so that you can make use of them.
- Learn the concept of the information security continuity so that you can make use of it.
- Learn the purpose and concept of the information security regulations (regulations in the organization, including information security policy) so that you can make use of them.
- Learn the concepts of the other standards associated with Information Security Management System (ISMS) and information security along with the role of information security organizations so that you can make use of them.

(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 evaluation

(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 information assets should be classified based on the understanding that the criteria for protecting information assets are created and the required information security level is defined by reviewing the importance of information assets in terms of confidentiality, integrity, and availability, for classification of them.

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 factor

(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), risk aversion, risk appetite, 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, computerization insurance, 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 the basic concept of 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   emergency category, emergency response plan (contingency plan), recovery plan, disaster recovery, backup measures, investigation method of damage status

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

Understand the purpose and concept of the information security policy in managing information security.   Understand how an organization should be managed according to an information security policy.

(4)   Development of security regulations on corporate activities

In addition, understand the purpose and details of information security regulations that are developed based on risk analysis and 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, procedure for approving regulations

(5)   Information security management system (ISMS)

Understand the 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 (internal audit, management review, etc.), improvement (nonconformity and corrective action, continuous improvement), control objective, controls (information security incident management, information security education and training, compliance with legal and contractual requirements, etc.), effectiveness, 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 roles 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]
> Learn the purpose and concept of security technology evaluation along with how to apply it so that you can make use of them.

(1)   Security evaluation criteria

Understand the purpose and concept of security technology evaluation, intended for finding out the security levels of security products for preventing unauthorized copying and

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falsification of information assets.　　Understand how to apply this assessment.

Sample terms　　evaluation procedure, security functional requirements, security assurance

requirements, assurance level, 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 resistant

(2)　ISO/IEC 15408

Understand how to use ISO/IEC 15408 (common criteria), intended for evaluating, from the viewpoint of information technology security, that products and systems associated with information technology are appropriately designed and properly implemented.

Sample terms　　CC (Common Criteria), ST (Security Target), CEM (Common Methodology

for Information Technology Security Evaluation), EAL (Evaluation

Assurance Level), JISEC (IT security evaluation and certification system)

4.　Information security measures

> **[Goal]**
> ➢ Learn measures for information security from the viewpoints of human, technical, and physical security so that you can make use of them.

(1)　Types of information security measures

(a)　Human security measures

Understand that human security measures include educational and training programs for reducing risks, such as human errors, thefts, and fraudulent conducts, in addition to measures for minimizing the damages caused by incidents and accidents.

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 damages 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 (measures against spam, SPF, URL filtering, content filtering), security of mobile devices (cell phone, smartphone, tablet computer, etc.), wireless LAN security, hardware security (secure element, TPM (Trusted Platform Module)), cloud computing security, cloud service security, digital watermarking, digital forensics (preservation of evidence, etc.)

[Security products and services]
anti-virus software, DLP (Data Loss Prevention), 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 are carried out to protect information systems from outside intrusions, thefts, water damage, lightning, earthquakes, polluted air, explosions, fire, and so on, and to ensure the reliability and availability of information systems.

Sample terms   RASIS (Reliability, Availability, Serviceability, Integrity, Security), RAS technology, quakeproof and fireproof equipment, UPS, dual redundancy technology, mirroring, housing security, 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]
➤ Learn security measures in system development and operation, along with the mechanism, implementation technology, and effectiveness of secure OSs so that you can make use of them.
➤ Learn the mechanism of security measures implemented in networks and database along with the effectiveness of the implementation technology for them so that you can make use of them.
➤ Learn the mechanisms of application security measures and the effectiveness of the implementation technology for them so that you can make use of them.

(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, Diameter

(3)   Secure OS

Understand the mechanism of secure OSs, which are equipped with enhanced security measures in system development and operation, along with the implementation technology for them and the effectiveness of them.

Sample terms   MAC (Mandatory Access Control), least privilege, trusted OS

(4)   Network security

Understand the mechanism of measures against threats, such as unauthorized access to networks, unauthorized use of networks, and hindrance to network services, along with the implementation technology for them and the effectiveness of them.

Sample terms   gateway router, packet filtering, MAC (Media Access Control) address filtering, application gateway, authentication server, NAT, IP masquerade, VLAN, VPN, security monitoring, OP25B, honey pot, reverse proxy

(5)   Database security

Understand the mechanism of measures against threats, such as unauthorized access to databases, unauthorized use of databases, and destruction of databases, along with the implementation method for them and effectiveness of them.

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

(6)   Application security

Understand the mechanism of application security measures, intended for controlling attacks on web applications, along with the implementation method for them and the effectiveness of them.

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

1.　System requirements definition

[Goal]
> Learn the concept of system requirements definition along with the procedure, technique, and considerations for it so that you can make use of them.

(1)　System requirements definition tasks

Understand that the following are performed in the system requirements definition: 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 that the objectives and scope (affected business operations and business units) of computerization should be put together.

(b)　Definition of functions and performance

Understand that the functional requirements and performance requirements of a system must be put together.

Sample terms　　system functional specifications, response time, throughput

(c)　Requirements from tasks, organizations, and users

Understand that 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.　In addition, understand that the specific use of the target system is reviewed and analyzed to extract requirements, which are clearly documented considering the five Ws and two Hs (why, when, where, who, what, how, and how much).

Sample terms　　performance requirements, database requirements, testing requirements, security requirements, migration requirements, operational requirements, operational procedure, operational style, maintenance requirements, availability, failure handling, education, training, cost, types of maintenance, maintenance timing

(d)　Other requirements

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

Sample terms　　execution environment requirements, peripheral interface requirements,

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quality requirements, functional requirements, non-functional requirements

(3)　Evaluation and review of system requirements

Understand the criteria for evaluating system requirements.　Understand that the system acquirer conducts joint reviews with the supplier after system requirements are documented.

Sample terms　　traceability, consistency, testability, feasibility of systems architecture design, feasibility of operation and maintenance, review participants, review method

2.　Systems architecture design

> **[Goal]**
> ➢ Learn the concept of systems architecture design along with the procedure and techniques for it and considerations in designing systems architectures so that you can make use of them.

(1)　Systems architecture design tasks

Understand that in the systems architecture design process, 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, functional requirements, non-functional requirements

(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 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 work

Understand that 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 that 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 that 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 that centralized or distributed processing should be selected according to the business operations. Understand that the processing methods for web systems and client/server systems are reviewed and determined.

(f) Database architecture design

Understand that the type of database used in the system, replication with redundancy in consideration of reliability, and so on should be reviewed and determined.

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

(3) System integration test design

Understand that 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 that 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   traceability, consistency, appropriateness of design standards and methods, feasibility of software items, feasibility of operation and maintenance, review participants, review method

3. Software requirements definition

[Goal]
➢ Learn the concept of software requirements definition along with the procedure and techniques for it and considerations in defining software requirements so that you can make use of them.

(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 term   software configuration item

(2)   Establishment of software requirements

(a)   Purpose of software requirements definition

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.

(b)   Design of subsystem functional specifications and their interface

Understand the activities associated with the design of subsystem functional specifications and their interface and the considerations in carrying out them.

Sample terms   subsystem partitioning, subsystem functional specifications definition, subsystem interface definition, subsystem association diagram, service definition

(c)   Design of business operations models and data models

Understand a series of activities for creating business operations models and data models from business operations flows and relationships between subsystems, considerations in carrying out these civilities, and the types of data models along with their characteristics.

Sample terms   business operations modeling, form design, slip design, data modeling, system operations flow

(d)   Security design

Understand the series of activities for designing the method of implementing security functions in conformance with the corporate information security policy and the considerations in carrying out these activities.

Sample terms   information security policy, security requirements, security implementation method, safety measures, reliability measures

(e)   Consideration of maintainability

Understand that design consideration is needed to minimize the person-hours required for adding new functions or changing existing functions after operation commencement.

Sample terms   consistency, self-description, structuring, simplicity, expandability

(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   traceability, external consistency, internal consistency, testability, feasibility of software design, feasibility of operation and maintenance, 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 for 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.   Understand the characteristics and purpose of use cases along with how to describe use cases.

Sample terms   actor, behavior, use case diagram

(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 evaluated 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   context diagram, mini spec, stepwise refinement, structured analysis method, 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.

Sample terms   data-oriented design, entity, relationship

(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 how to represent system mechanisms using UML.

Sample terms   class diagram, operation, attribute, role name, package diagram, activity diagram, use case diagram, state machine diagram, sequence diagram, communication diagram, event flow analysis, backtrack, control flow, separation of analysis and design roles, agent oriented, model, framework

(g) Other techniques

Understand other techniques used for analyzing business operations and defining requirements.

Sample term   decision table

4. Software architecture design and software detailed design

[Goal]
- Learn the concept, procedure, technique, and considerations of software architecture design so that you can make use of them.
- Learn the concept, procedure, technique, and considerations of software detailed design so that you can make use of 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

In software architecture design, understand the following: the software structure and components are designed based on the software requirements definition document from a developer's point of view; 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; and the structure and considerations of software architecture specifications.

Sample terms   structuring, decision of software component functional specifications, component-to-component interface design, basic functions, component, input/output design, physical data 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, complied, and tested.

Sample terms   component interface, database, modular partitioning, module specifications, segmentation, control structure, control segment, data processing, processing segment, 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, layout design, interface design standards, timing design, interface condition, interface item, human interface, screen layout, form overlay, limit check

(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   software integration test specifications, test requirements, checklist, black box test

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

Understand the 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   traceability, external consistency, internal consistency, appropriateness of design methods and work standards, test feasibility, operation and maintenance feasibility, 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). In addition, understand that each characteristic is composed of a set of related subcharacteristics.

Sample term   functional suitability, performance efficiency, compatibility, usability (learnability, operability, accessibility, etc.), reliability (availability, recoverability, etc.), security, maintainability (analysability, testability, etc.), portability

(10) **Software design technique**

(a) Process-oriented design

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

(b) Data-oriented design

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

Sample terms   DOA (Data Oriented Approach), 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, composite design

    (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), block diagram, bubble chart, hierarchical structure diagram, event trace diagram, 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 concept, procedure, and techniques of object-oriented design.

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

(11) Design of components

(a) Concept of component partitioning

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

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(12) Module design

(a) Partitioning technique

Understand that the partitioning techniques are divided into those that focus attention on the data flow 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 partitioning techniques.

Sample terms   STS (Source Transform Sink) partitioning, TR (Transaction) partitioning, common functional partitioning, logical design, domain design, subroutine, recursive program

(b) Partitioning criteria

Understand that the criteria for evaluating module independency include the module strength and module 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, functional strength, informational strength, data coupling, control coupling

(c) Preparation of module specifications

Understand the concept, procedure, and techniques of module specifications preparation.

Sample terms   flowchart, PSD (Program Structure Diagram), DSD (Design Structure Diagram), SPD (Structured Programming Diagram), HCP (Hierarchical and ComPact description) chart, PAD (Problem Analysis Diagram), decision table, Warnier method, Jackson method, NS chart, logical structure diagram, programming table

(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 usage of software packages.

Sample terms   componentware, white box type, black box type, class library, design pattern, legacy wrapping

(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 patters 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.

Sample terms   creation, structure, behavior

(16) Review

(a) Purpose of and procedure for reviews

Understand the purpose of the 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 the procedure where a document is first prepared, then a review is conducted (the review method is determined, the review evaluation criteria are determined, and the review participants are selected), and finally the review results are incorporated into the document.

(b) Objects and types of reviews

Understand the objects to be reviewed along with the timing and types of reviews.

Sample terms   program design review, code review, test specifications review, user manual review, design review, inspection, moderator, documentation method, walk-through, joint review

(c) Validation items

Understand the validation items checked during reviews.

Sample terms   function, performance, capacity/capability, reliability, operability, stability, ease of operations, technical consistency, suitability, feasibility, development rationality, economical efficiency, investment effect

(d) Other validation techniques

Understand the validation techniques other than reviews, including actual data measurement based on measuring instruments and test programs and collection of users' opinions and feedback.

Sample terms   hearing, questionnaire, checklist

5. Software construction

> **[Goal]**
> ➤ Learn the concepts, procedure, techniques, and considerations of software construction so that you can make use of them.

(1) Tasks for software construction

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, programming style

(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   segmentation, algorithms, data processing, processing segment, structured programming, logic programming, parallel processing 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 conventions.   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 specifications, 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 the 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 purpose, policy, schedule, and framework, along with test tools to be used; preparation of the tests, including creation of the test items and 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 and test data), person in charge of the tests, unit test, check sheet preparation

(c) Test execution and evaluation

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

Sample terms   debugger, driver, stub, test data generator, test design and management technique (bug curve, error removal, bug control chart), test automation

(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, path coverage, coverage rate, coverage, boundary value analysis, equivalence partitioning, cause-effect graph method, error embedding method, experimental design

6.　Software integration and software qualification tests

> **[Goal]**
> ➢ Learn the concept, procedure, techniques, and considerations of the software integration and software qualification tests so that you can make use of them.

(1) Software integration tasks

Understand that the following are included in software integration: creation of software

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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. Understand the execution timing and procedure for the software integration test, and the criteria for evaluation.

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, test bed, integration test report, documentation of test results, documentation standards

(4) Software qualification test

Understand that a software qualification 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 (e.g., function test, non-functional requirements test, performance test, load test, security test, regression test), software qualification test

(5) Test result evaluation

(a) Tasks after test execution

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.

(b) Evaluation of software integration

Understand the criteria for evaluating software integration.

Sample terms   traceability, external consistency, internal consistency, test coverage, appropriateness of test standards and test methods, feasibility of the software qualification test, feasibility of operation and maintenance

(c) Evaluation of software qualification test

Understand the criteria for evaluating software qualification tests.

Sample terms   qualification for the expected result, feasibility of system integration and the test

7.   System integration and system qualification tests

[Goal]
> Learn the concept, procedure, techniques, and considerations of system integration and system qualification tests so that you can make use of them.

(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.   Understand the execution timing and procedure for the system integration test, and the criteria for evaluation.

Sample terms   test plan, test preparation (e.g., test environment or test data), system integration test report, documentation of test results, documentation standards

(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), system

qualification test report

(5) Test result evaluation

(a) Tasks after test execution

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.

(b) Evaluation of system integration

Understand the criteria for evaluating system integration.

Sample terms   test coverage, appropriateness of test methods and work standards, conformance to the expected result, feasibility of system qualification test, feasibility of operation and maintenance, review

(c) System qualification test evaluation

Understand the criteria for evaluating system qualification tests.

Sample term   appropriateness of test methods and work standards

8. Installation

> **[Goal]**
> ➢ Learn the concept, procedure, techniques, and considerations of system or software installation so that you can make use of them.

(1) System or software installation tasks

Understand that in system or software installation, a system or software installation plan is created and then system or software is installed.

(2) Creation of a system or software installation plan

Understand that prior to the system or software installation, an installation plan is created and documented, 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 framework 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, replace, support for parallel operation, installation document

(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 that system or software and databases are initialized as prescribed by the agreement to build an

execution environment and that actual result of installation operations is documented.

Sample terms   installation procedure, installation framework, user department, system operations department

(4)   User support

Understand the tasks for supporting the users prior to the system or software installation.

9.   Acceptance support

[Goal]
> Learn the concept, procedure, techniques, and considerations of system acceptance support or software acceptance support so that you can make use of them.

(1)   Tasks for system or software acceptance support

Understand that the following is included in 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 that the system or software supplier supports acceptance review and tests by the acquirer.   Understand the purposes of the acceptance review and test along with how they are carried out.   In addition, understand that the acquirer receives acceptance support from the supplier, and, in consideration of the results of the joint review and system or software qualification test, 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 that 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 that the system or software supplier provides the acquirer with educational/training programs and support for initial and continuous operation, and that, based on support from the supplier, the system acquirer builds a framework, and plans and implements educational/training programs.   Understand the purpose, details, preparation, and framework of education and training along with the method for evaluation of the results.

Sample terms   education and training plan, preparation of education and training, education and training framework, method for evaluating education and training results

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(5) User manuals

Understand that the business operations of the system or software acquirer and the procedures for operating the computer and using the business application programs or systems must be documented as user manuals, and that, at the time of systems architecture design or software architecture design, preliminary user manuals are prepared, which is updated as appropriate as the development proceeds.

Sample terms   operations regulations, user manual, system usage document, software usage document, tutorial

10. Maintenance and disposal

[Goal]
- Learn the concept, types and styles, procedure, and considerations of maintenance so that you can make use of them.
- Learn the concept, procedure, and considerations of disposal so that you can make use of them.

(1) Maintenance task

Understand that maintenance requirements are 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) Software maintenance style Disposal task

Understand that in disposal, an active support by the operation and maintenance organizations is ended, or 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 and styles 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, management of change tasks, 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 reports 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.

Sample term	integrity 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 the 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

1. Development process and methods

> **[Goal]**
> ➢ Learn the concept and characteristics of the techniques associated with the software development process so that you can make use of them.

(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 characteristics of software development models.

Sample terms   waterfall model, spiral model, prototyping model, RAD (Rapid Application Development), agile, DevOps, software product line, iterative model, 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   principles of agile software, XP (extreme programming), test driven development, pair programming, refactoring, continuous integration

(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.   In addition, understand the types of software components and their characteristics along with the points in designing components.

(i)   Types and characteristics of components

Understand the types and characteristics of software components.

Sample terms   function component, object component (class library), data component, process component, resident component and embedded component, black box component, white box component, parametric component, non-parametric component, closed-system component, open-system component

(ii) Component design criteria

Understand the purpose and details of design criteria according to the use of components.

Sample terms   module independence, customization, library, naming conventions

(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 suppliers. In addition, understand the concept of mashup, characteristics in productivity and quality, and items to be noted.

Sample term   Web 2.0

(f) Mobile application software development

Understand the 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, support for a variety of terminal specifications (display size, etc.), handling of the application when going out of a range or receiving an incoming call while the application software is running, 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 concept, characteristics, procedure, effect, and considerations of structured methods.

Sample terms   hierarchical structuring, stepwise refinement, 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 to strictly describe the formal specifications according to specific rules for the purpose of improving the quality of software and that it emphasizes describing the state of a model.   Understand VDM-SL (Vienna Development Method - Specification Language), a model description language and the concept and characteristics of VDM++.

Sample term   VDMTools

(4) Development process

(a) Software life cycle process

Understand the purpose and perspective of SLCP (Software Life Cycle Process).

Sample terms   SLCP-JCF (Japan Common Frame), JIS X 0160, JIS X 0170, process, activity, task

(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, and the measures required to reach any higher level.

Sample terms   initial, managed, defined, quantitatively managed, optimizing

2.   Intellectual property application management

> **[Goal]**
> ➢ Learn the acquisitions of intellectual property rights required in the software development process along with the purpose and concept of managing them so that you can make use of them.
> ➢ Learn the procedure for protecting the intellectual property rights that arise during the software development process so that you can make use of them.

(1)   Copyright management

Understand the idea as to the ownership of the copyright of the software to be developed along with the considerations in outsourcing programs.

Sample terms   author of the program, employee work

(2)   Patent management

Understand the procedure for protecting inventions created during the software development process.   Understand that if a patent held by a third party must be used, then it must be licensed.

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   licenser, 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, AACS

3. Development environment management

(1) Development environment construction

Understand that for efficient development activities, development tools, including hardware, software, a network, and a simulator for development, are 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 is properly monitored and managed.

Sample terms   resources management, operations management

(b) Design data management

Understand the 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 is 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 are 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 that it is 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]**
> ➢ Learn the purpose, concept, and procedure of configuration management and change control so that you can make use of them.

(1) Configuration management

Understand that 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, baseline |

(2) Change control

(a) Configuration status recording

Understand that the status and history information of the reference software items are managed and documented.   In addition, understand that the details in the project, such as the number of changes, latest version, and migration status, are recorded in the appropriate documents.

(b) Assurance of the integrity of items

Understand that assurance of the completeness of software items is to determine and assure the functional completeness and physical completeness.   Understand the need for assurance of the completeness of software items.

| Sample terms | consistency, accuracy |

(c) Release management and shipment

Understand that a series of procedures, such as the shipment of the new version of software and its related documents, is performed after the integrity assurance of the configuration items. In addition, understand that the software code and documents are maintained 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]**
> ➢ Learn the purpose, approach, processes, process groups, and subject groups of project and project management so that you can apply them.
> ➢ Learn the types of project frameworks along with the characteristics and roles as well as the details of responsibility assignment and self-management so that you can apply them.

(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 that 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, program management, project environment, project portfolio management, program, program management, project governance, project life cycle, project constraints, ISO 21500, PMBOK (Project Management Body of Knowledge)

(b)   Three types of processes

Understand the purposes, roles, and functions 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 purposes, roles, and functions of the five process groups in project management.

Process groups   initiating process group, planning process group, executing process group, controlling process group, closing process group

(d)   Ten subject groups in project management

Understand the 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 types of project frameworks, characteristics, and roles along with assigned responsibilities.

Sample terms   functional organization, matrix organization, project organization, RAM (Responsibility Assignment Matrix), OBS (Organizational Breakdown Structure)

(b) Self-management
Understand the points, plans, activities, reports, notifications, and consultations to be self-managed in a project framework.

Sample terms   activity planning, activity estimation, progress management, quality management, cost management, risk management, change control, problem discovery, problem reporting, measures planning, documentation, communication

2   Project integration management

[Goal]
➢   Learn the purpose and concept of project integration management so that you can apply them.
➢   Learn the purposes, roles, and functions of the processes in project integration management along with the relationships between them so that you can apply them.
➢   Learn the documentation and methods necessary to understand and manage an entire project and apply them.

(1)   Purpose and concept of project integration management
Understand that project integration management is intended for managing and aligning the processes of the project management activities in an integrated manner.

Sample terms   project charter, scope, constraints

(2)   Processes in project integration management
Understand the purposes, roles, and functions of the processes included in project integration management along with the relationships between them.

Processes   preparation of project charter, preparation of project plan, direction of project activities, control of project activities, control of change, closing of project phase or project, collection of lessons learned

(3)   Understanding and management of an overall project

Understand the documents required to understand the entire project and possible changes to the specifications and schedule during the project implementation, 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), problem management table, project evaluation, evaluation index

3.   Project stakeholder management

[Goal]
- Learn the purpose and concept of project stakeholder management so that you can apply them.
- Learn the purposes, roles, and functions of the processes in project stakeholder management along with the relationships between them so that you can apply them.
- Learn 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 purposes, roles, and functions of the processes included in project stakeholder management along with the relationships between them.

Processes   identification of stakeholders, management of stakeholders

(3)   Documentation of information concerning project stakeholder

Understand the documenting of information concerning the advantages and disadvantages for, and involvement of, a stakeholder

Sample term   stakeholder register

4.　Project scope management

> **[Goal]**
> ➢ Learn the purpose and concept of project scope management so that you can apply them.
> ➢ Learn the purposes, roles, and functions of the processes in project scope management along with the relationships between them.
> ➢ Understand the purpose of WBS creation and learn its usage techniques so that you can apply them.

(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.　In addition, understand the importance of scope management performed by individual project members.

Sample terms 　　scope, WBS, activity, baseline

(2)　Processes in project scope management

Understand the purposes, roles, and functions of the processes included in project scope management along with the relationships between them.

Processes 　　scope definition, WBS creation, activity definition, scope control

(3)　The purpose of WBS creation and its utilization

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]**
> ➢ Learn the purpose and concept of project resource management so that you can apply them.
> ➢ Learn the purposes, roles, and functions of the processes in project resource management along with the relationships between them so that you can apply them.
> ➢ Learn the concept of external human resources management so that you can apply it.

(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 purposes, roles, and functions of the processes included in project resource management along with the relationships between them.

| Processes | project team formation, resource estimation, project organization decision, project team development, resource control, project team management |

(3) External human resources management

Understand the concept about the management to be performed in a case where human resources are accepted as external resources.

| Sample terms | procurement, Act for Securing the Proper Operation of Worker Dispatching Undertakings and Improved Working Conditions for Dispatched Workers |

6.　Project time management

> **[Goal]**
> ➢ Learn the purpose and concept of project time management so that you can apply them.
> ➢ Learn the purposes, roles, and functions of the processes in project time management along with the relationships between them.
> ➢ Learn the types of schedules along with techniques for schedule development and schedule management so that you can apply them.

(1) Purpose and concept of project time management

Understand that project time scope management aims to ensure that a project is completed at a given 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 purposes, roles, functions, and interrelationship 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 the types and characteristics of schedules.

| Sample terms | master schedule, intermediate schedule, detailed schedule |

(b) Techniques for schedule development

Understand that a schedule 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 usage.

| Sample terms | analogous estimating, parametric estimating, three-point estimate, reserve |

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analysis, schedule network analysis, PERT, CPM (Critical Path Method), PDM（Precedence Diagramming Method), critical chain, arrow diagram, Gantt chart, trend chart, milestone, resource leveling, crushing, fast-tracking, lag, lead

(c) Techniques for managing schedules

Understand typical techniques for managing schedules along with the characteristics and usage.

Sample terms   progress report, trend analysis, variance analysis, EVM (Earned Value Management)

7.　Project cost management

> **[Goal]**
> ➢ Learn the purpose and concept of project cost management so that you can apply them.
> ➢ Learn the purposes, roles, and functions of the processes in project cost management along with the relationships between them so that you can apply them.
> ➢ Learn typical techniques for estimating and managing costs so that you can apply them.

(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 performed by individual project members.

Sample terms   cost baseline, cost of resources

(2) Processes in project cost management

Understand the purpose, roles, and functions of the processes included in project cost management along with the relation between them.

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 usage.

Sample terms   three-point estimate, top-down estimate, bottom-up estimate, analogous estimate, FP (Function Point) method, parametric estimate, LOC (Lines of Code) method, COCOMO (Constructive Cost Model), COCOMO II (Constructive Cost Model II), development productivity, reserve analysis, EVM (Earned Value Management)

8. Project risk management

[Goal]
- Learn the purpose and concept of project risk management so that you can apply them.
- Learn the purposes, roles, and functions of the processes in project risk management along with the relationships between them so that you can apply them.
- Learn methods for identification of typical risks, analysis methods, and responses to risk, and apply them.

(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.   In addition, understand the importance of risk management performed by individual project members.

Sample term   risk

(2) Processes in project risk management

Understand the purpose, roles, and functions of the processes included in project risk management along with the relation between them.

Processes   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, SWOT analysis, sensitivity analysis, contingency reserve

9. Project quality management

[Goal]
- Learn the purpose and concept of project quality management so that you can apply them.
- Learn the purpose, roles, and functions of project quality management along with the relationships between them so that you can apply them.
- Learn typical quality management techniques so that you can apply them.

(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 project members.

Sample terms   JIS Q 9000 family standards, JIS X 25010, CMMI

(2)   Processes in project quality management

Understand the purpose, roles, and functions of the processes included in project quality management along with the relationships between them.

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, statistical sampling, failure report, fault log, quality index, control chart, cause and effect diagram, Pareto chart, scatter diagram, corrective action, preventive action

10. Project procurement management

[Goal]
➢ Learn the purpose and concept of project procurement management so that you can apply them.
➢ Learn the purpose, roles, and functions of the processes included in project procurement management along with the relation between them so that you can apply them.
➢ Learn external resources utilization and procurement methods so that you can apply it.
➢ Learn the differences in typical contract types, and apply them.

(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 purposes, roles, and functions of the processes included in project procurement management along with the relationships between them.

Processes | procurement planning, supplier selection, procurement management

(3)   Utilization of external resources

Understand external resources utilization, procurement methods, etc.

Sample terms | outsourcing, co-sourcing, system integrator, IDC (Internet Data Center), open bidding, government procurement agreement, overseas procurement

(4)   Typical types of contracts

Understand typical contract types.

Sample terms | turnkey contract (lump sum contract, all-in contract), fixed price incentive fee contract, cost reimbursable contract, time and material contract

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11. Project communications management

[Goal]
➢ Learn the purpose and concept of project communications management so that you can apply them.
➢ Learn the purpose, roles, and functions of the processes in project communications management along with the relationships between them so that you can apply them.
➢ Learn typical information distribution methods and apply them.

(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 project members.

Sample term   communication

(2) Processes in project communications management

Understand the purposes, roles, and functions of the processes included in project communications management along with the relationships between them.

Processes   communication 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]**
> ➢ Learn the purpose and concept of service management so that you can apply them.
> ➢ Learn the concept of the establishment and improvement of service management system so that you can apply them.

(1) Purpose and concept of service management

Understand that in order to fulfill the service requirements and perform service design, 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 requirements for many service management processes that are closely related to one another.

Sample terms   service, service component, service quality, 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 systems, services, and improvement processes. Understand that a plan is created for performing current state analysis, defining a target, and achieving it when constructing or improving a service management system. Furthermore, understand that in current state analysis, there are methods to measure and evaluate gap analysis and process capability levels (process maturity level), and that KPI or other indicators are used to set targets.

Sample terms   process approach, continuous improvement, process capability level, gap analysis, process assessment, CSF (Critical Success Factors), KPI（Key Performance Indicator）, JIS Q 9001

(3) ITIL

Understand the purpose and concept 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 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.

SLA, availability, reliability, service time, response time, service and process performance

2. Service design and transition

[Goal]
➢ Learn the concept of design and transition of services so that you can apply them.

(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.

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
- Reporting the achieved results to customers and stakeholders in comparison to the expected results after transition is completed

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.

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, service continuation planning, recovery, cold standby, hot standby, business continuity plan (BCP), RTO, RPO, disaster recovery, availability, reliability, maintainability, MTBF, MTTR, fault tolerance

(4)　Budgeting and accounting for IT services

Perform budgeting services to plan and manage the budgeting for service provision cost. Perform accounting as an accounting service and allocation of indirect and direct costs etc. Understand that financial conditions are managed through these activities.

Sample terms　　budgeting and accounting for IT services, financial management, budgeting, accounting, billing, allocation, cost, direct cost, indirect cost, depreciation, 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 satisfying the current and future agreed-upon demands.

Sample terms　　capacity management, capacity planning, monitoring, demand, management index (CPU utilization, memory utilization, disk utilization, network utilization, etc.), threshold, business capacity management, service capacity management, component capacity management

(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, to meet the requirements of an information security policy, and to manage the risks concerning information security.

Sample terms　　information security management, information assets, risk analysis, risk evaluation, physical access management, network security solution, user access management, user authentication, user password management, privilege management, access control, protection of log information,

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information security incident, malware, information security management standard (JIS Q 27000 family standards), Information Security Management System (ISMS)

(7) Business relationship management

Understand that activities including service performance reviews, complaint processing, and measurement, analysis, and review of customer satisfaction are performed 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 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, supplier, contract, internal group, 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.   Also, understand that the definition of serious incidents is documented and agreed with customers.

Sample terms   management of incident and service requests, incident, service request, escalation, impact, workaround, serious incident

(10) Problem management

Understand that problem management is a series of activities for identifying the root causes of problems to present resolutions to prevent a recurrence of such problems.

Sample terms   problem management, problem, known error, root cause, preventive action, trend analysis

(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 services to retain accurate configuration information, and registering specified CIs in a CMDB.

Sample terms   configuration management, configuration item, CMDB (Configuration Management Database), version, configuration baseline, configuration identification, configuration audit, storage of configuration items, asset management, software asset management (SAM), basic license

(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.   In addition, understand that these activities are intended to minimize the impact of the changes on the services.

Sample terms change management, RFC (Request For Change), types of change request (emergency change, normal change, standard change), change request record, change schedule, evaluation, backout, post-implementation review

(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.   In addition, understand that it is a series of activities for planning and implementing the installation of new versions, and recovering the original version in the unlikely event that a new version has not been successfully deployed and that it must be performed in conjunction with configuration management and change management.

Sample terms release and deployment management, release, emergency release, deployment, recovery

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

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environments, job management, data management, user management, cold start, warm start

(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.   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 (help 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, secondary support, tertiary support, structure of service desk organization (local service desk, virtual service desk, central service desk, follow-the-sun)

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 purpose and concept 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.   In addition, understand the redundant power supply and lines; full provision of the backup environment; and management of accesses to the power supply, air-conditioning equipment, and the building.

Sample terms   facilities management, building management (quake-absorbing unit,

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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. Also, understand a series of activities for creating a repair plan to extend the lives of the facilities and equipment for reduced life cycle costs including charges for water, heat, and electricity and maintenance and repair costs.

Sample terms   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 aspect, green IT, Datacenter Performance per Energy (GEC, PUE, ITEE, ITEU, etc.)

1. System audit

> **[Goal]**
> ➤ Learn the purposes and types of audits so that you can apply them.
> ➤ Learn the purposes, procedures, and target business tasks of system audits along with the concept of system auditability so that you can apply them.
> ➤ Learn the concepts of system audit planning, implementation, reporting, and quality evaluation so that you can apply them.
> ➤ Learn typical standards, laws, and regulations to be referred to when system-related audits are performed so that you can apply them.

(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, assurance-based audit, consulting-based 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, reliability, security, efficiency, effectiveness, strategic characteristic

(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, evaluation and conclusion, system audit standards, system audit plan, preliminary audit, main audit, audit evidence

(3) Targeted business operations of system audits

Understand that system audits target the whole lifecycle, covering system planning, development, operations, and maintenance. Understand the elements that are evaluated in each phase. In addition, understand that the purpose and targeted business operations of system audits must be clearly defined by documented regulations or agreements.

| Sample terms | validity of planning, productivity of development tasks, user satisfaction, productivity of maintenance tasks, control, profitability, timeliness, information security, 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, audit trail |

(5) System audit planning

Understand that for effective, efficient audit implementation, the system auditor drafts an audit plan that defines the purpose of the audit, the details of the audit procedure, and the timing and scope of the audit.

| Sample terms | documented system audit plan, documented medium- and long-term plan, documented basic plan, individual documented plans |

(6) System audit implementation (preliminary audit, main audit, evaluation, and conclusion

  (a) Preliminary audit, main audit, evaluation, and conclusion

Understand a series of activities; the preliminary audit, main audit, evaluation, and conclusion.

| Sample terms | statement on auditing procedure, inspection, audit work papers |

  (b) System audit techniques

Understand typical techniques for system audits including the document review (inspection) and checklist.

| Sample terms | reading and collecting of materials (documents), written inquiries and questionnaire, interview, field investigation, audit tool, statistical sampling, CAAT (Computer Aided Audit Technique) |

  (c) Audit evidence

Understand that audit evidence means the facts required to back up the audit opinion of the system auditor.

| Sample terms | access log, transaction log, operational trail |

(d) Audit work paper

Understand that the system auditor summarizes documents and retains the information studied, collected, and analyzed as an audit work paper that indicates how the audit conclusion was reached for the purpose of using it as basic information for the preparation of an audit report or as evidence of the audit result.

(e) Linkage and alignment with other audits

Understand that the system audit is related to the audits by the certified public accountant, the auditor, and the internal auditor and that the system audit in each audit is performed for a different audit purpose and different targets.

Sample terms   statutory audit, voluntary audit, Financial Instruments and Exchange Law audit, commercial law audit, management audit, operations audit, accounting audit, internal audit, information security audit, personal information protection audit, compliance audit

(7) System audit reporting

Understand that the system auditor reports the audit results to the client and takes the 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.   In addition, understand the indexes for evaluating system audits.

(9) Other system-related audits

(a) Information security audit

Understand the purpose and role of information security audits.

Sample terms   Information Security Audit Standards, Information Security Management Standards, list of companies providing auditing services

(b) Personal information protection audit

Understand the purpose and role of personal information protection audits.

Sample terms   protection of information assets, possibility of information leakage, risk of information leakage

(c) Compliance audit

Understand the purpose and role of compliance audits.

Sample terms   action guideline, ethic, transparency

(d) Management system audit

Understand the purpose and role of management system audits for various management systems, including quality, environment, services, information security, and business continuity management systems.

Sample terms   JIS Q 19011 (Guidelines for auditing management systems)

(10) Laws and regulations on system-related audits

(a) System audit standards

Understand that the code of conduct for auditors who audit systems and the procedure for and details of system audits are defined by the System Audit Standards established by the Ministry of Economy, Trade and Industry.

Sample terms   auditor independence, general criteria, implementation criteria, report
criteria, System Management Standards, Information Security Audit
Standards, Information Security Management Standards, Standards for
Measures Against Computer Viruses, Standards for Measures Against
Unauthorized Access to Computers

(b) Laws and regulations in information security

Understand the laws concerning information security, target organizations of system audits, and the effect of system audits on information systems.

Sample terms   criminal law, unauthorized creation and use of electromagnetic records;
obstruction of business through destruction of a computer, etc.; computer
fraud; Act on the Prohibition of Unauthorized Computer Access; Law
Concerning Preservation of National Tax Records in Electronic Form; Act on
Electric Signatures and Certification Services

(c) Laws and regulations on personal information protection

Understand the laws and guidelines concerning personal information protection along with the role of system audits in personal information protection.

Sample terms   JIS Q 15001, Privacy Mark System

(d) Laws and regulations on intellectual property rights

Understand that the laws and system audits concerning intellectual property rights must identify the proper infringing acts, if any.

Sample terms   Copyright Act, Patent Act, Unfair Competition Prevention Act, Guidelines
for Trade Secret Management

(e) Laws and regulations on labor

Understand that the laws and system audits concerning labor must identify the problems in the work environments based on laws.

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Labor Standards Act, Act for Securing the Proper Operation of Worker

Dispatching Undertakings and Improved Working Conditions for Dispatched

Workers, Equal Employment Opportunity Law

(f) Laws and regulations on statutory audit

Understand that system audits must be implemented in conjunction with statutory audits.

Sample terms   Law for Special Exceptions to the Commercial Code Concerning Audits,

Financial Instruments and Exchange Law, Company Act

2.   Internal control

> **[Goal]**
> ➢ Learn the purposes and concepts of internal control and IT governance at corporations and
>   other organizations so that you can apply them.

(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 along with the six fundamental components of 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,

Standards for Management Assessment and Audit concerning Internal

Control Over Financial Reporting (control environment, risk evaluation and

response, control activities, information and communications, monitoring,

response to IT), System Management Standard - Supplementary Edition

(Guidance for IT Controls over Financial Reporting), company-level IT

controls, IT general controls, IT application controls

(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.   In addition, understand the framework used for evaluating the IT governance.

Sample terms   JIS Q 38500, CIO (Chief Information Officer), CISO (Chief Information

Security Officer), IT control, corporate governance, COBIT (Control Objectives for Information and related Technology), PRM-IT (Process Reference Model for IT), maturity level model

(3) Evaluation and improvement of compliance

Understand that information systems must be constructed and operated in compliance with the applicable laws and regulations concerning business systems; that the compliance with the laws and regulations, standards, and internal and external codes of conducts must be evaluated and improved in a timely and proper manner; and that improving the internal control is effective in establishing a framework for ensuring compliance.

Sample terms   Companies Act, Financial Instruments and Exchange Law, compliance audit, CAS (Control Self Assessment)

Strategy

Major category 7: System Strategy
Middle category 17: System Strategy

1.   Information systems strategy

> **[Goal]**
> ➢   Learn the purpose, concept, and considerations of information systems strategies along with the procedure for establishing an information systems strategy so that you can apply them.
> ➢   Learn the enterprise architecture technique so that you can apply it.
> ➢   Learn program management and its framework, quality control, and information systems strategy management so that you can apply them.

(1)   Information systems strategy

(a)   Purpose and concept of information systems strategy

Understand that an effective information systems strategy should be developed according to the business strategy and that the total computerization and computerization investments should be planned according to the information systems strategy.

Sample terms   information systems strategy evaluation, CIO (Chief Information Officer)

(b)   Procedure for developing information systems strategy

Understand 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)   Considerations in developing information systems strategy

Understand the considerations in developing an information systems strategy.

Sample terms   resolution of business issue, business deployment, competitive superiority, information system construction, business innovation, information technology trend, information infrastructure development, computerization scope, management resources allocation, business process standardization, business operations model, business model, new technology introduction, computerization investment environment, investment effect, information asset management, BCP (Business Continuity Plan), compliance, IT management power index

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(d) Organization form

Understand that the organizations that plan, develop, operate, and maintain information systems include functionalized organizations, divisional organizations, matrix organizations, and project organizations.

Sample terms　information computerization committee, computerization promotion system

(e) Total computerization planning

(i) Total optimization policy

Understand that a total optimization policy is a policy that indicates the direction in which the business operations and the systems in the entire organization should go.　In addition, understand what should be defined by the total optimization policy along with the considerations in developing it.

Sample terms　total optimization goal, IT governance policy, consistency with the business strategy, ideal information system (to-be model), change policy for organizations and business operations, 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.　In addition, understand what should be defined by the total optimization plan along with considerations in developing it.

Sample terms　alignment and agreement of the rules, restrictions, pertinent laws and regulations specific to business operations with the internal/external people concerned; standardization policy and quality policy for system construction and operations; utilization of external resources; system management standards

(f) 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, management resources to be secured, methods for determining investment effects and risks

(g) 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, SFA, KMS (Knowledge Management System), shared service

(h) Model

Understand 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, reference model, EAI (Enterprise Application Integration)

(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.

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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.

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.

hardware configuration diagram, software configuration diagram, network configuration diagram

(3) Program management

Understand that program management is a set of activities for integration to ensure that a program organically consisting of more than one project with a clear purpose and goal optimizes the relationships between the projects for achieving the mission more successfully as a whole.

PMO (Program Management Office), program integration

(4) Owner

Understand that when an information system is talked about, the system owner refers to the person responsible for the information system and the data owner refers to the person responsible for the data retained in the information system. In addition, understand the roles of the departments concerned.

CIO, system user department, business operations department

(5) 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. In addition, understand that the frameworks include the process framework and control framework.

control objectives, COBIT (Control Objectives for Information and related Technology), ITIL (Information Technology Infrastructure Library), System Management Standards, SLCP-JCF (Japan Common Frame), COSO (Committee of Sponsoring Organizations of the Treadway Commission), Practice Standards for Management Assessment and Audit concerning Internal Control Over Financial Reporting, KGI (Key Goal Indicator), KPI

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(Key Performance Indicator)

(6) Quality control

Understand that quality control is an organization, a 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

(7) 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 index, variance analysis, response to risk

2.   Business process

[Goal]
> Learn the concepts about business improvement and problem solving along with typical techniques so that you can apply them.

(1) Business process improvement and problem solving

(a) Business process improvement and problem solving

Understand the concept that the existing organizational structure and business processes are reviewed to increase efficiency and that information technology is used to optimize business operations and systems.

(b) Business process management

Understand the purpose and concept of BPM (Business Process Management) along with the procedure.   Understand that a cycle consisting of analysis, design, implementation, monitoring, and evaluation of business operations is repeated to continuously improve the business processes.   In addition, understand the functions of the BPMS (Business Process Management System).

Sample terms   SFA, workflow system, PDCA

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(c) Business process reengineering

Understand the purpose, concept, and procedure of BPR (Business Process Reengineering).

Sample terms   process viewpoint, customer oriented, enhanced customer value

(d) Business process outsourcing

Understand the purpose, concept, and procedure of BPO (Business Process Outsourcing).

Sample terms   outsourcing, offshore

(e) Techniques for visualizing business processes

Understand that WFA (Work Flow Architecture), BPD (Business Process Diagram), E-R diagram, and other techniques are used to identify and analyze the business processes for the purposes of finding problems and making proposals about business improvement.

Sample terms   IDEF (Integrated DEFinition methods), BPMN (Business Process Modeling Notation), E-R model, flowchart, state transition diagram, UML, DFD

3. Solution business

> [Goal]
> ➢ Learn the concept and typical services of solution business so that you can apply them.

(1) Solution business

Understand that the progression of information technology and the management surroundings 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

(a) Cloud service

Understand the characteristics, concept, and considerations of cloud service.

Sample terms   cloud service (SaaS, PaaS, IaaS, etc.), public cloud, private cloud, hybrid cloud, ASP, BPO (Business Process Outsourcing), on demand, SOA (Service Oriented Architecture)

(b) Other solution services

Understand that a variety of solution services, intended for specific industries, business operations, and issues are provided. In addition, understand the types, characteristics, concepts, and considerations of typical services.

Sample terms   outsourcing service, hosting service, housing service, software package customization service, on-premise, CRM solution, security solution, business

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package, ERP package

4. System utilization promotion and evaluation

> **[Goal]**
> ➢ Learn the concept of information systems utilization promotion and evaluation so that you can apply it.
> ➢ Learn how important it is to evaluate and verify the utilization of information systems for the purpose of improving them so that you can apply it.
> ➢ Learn the concept of information systems disposals so that you can apply it.

(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 concepts and roles of these activities along with the procedures.

(b) Information literacy

Understand that information literacy is established to make safe, effective, and efficient use of information toward the management goal.

Sample terms   business model implementation

(c) Data utilization

Understand that the data stored in the information systems is analyzed 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 that popularization and awareness-raising activities should be conducted, including educational/training programs for utilizing information systems.

Sample terms   system user manual, business operations manual, e-Learning, seminar, human resource development planning, gamification, digital divide

(e) Evaluation and verification of information system utilization

Understand that the ROIs (return on investment) of the information systems are analyzed and the actual system utilization is examined and evaluated, and that whether or not changes should be made to business operations and/or workflows and the operation status of the systems must be identified, evaluated, and verified to define the improvement direction and goal. In addition, understand that external experts are used to make objective evaluations and verifications.

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> **Sample terms**   ROI (Return on Investment) analysis, user satisfaction, monitoring, log
> analysis, log monitoring, third party evaluation/verification, 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, operability, expandability, and cost; it must then be disposed of and the installation of a new information system must be considered; and the proper action must be taken, such as the development of a disposal plan, before a system is disposed of.   Understand the procedure for and considerations in disposing of systems.

> **Sample terms**   system life cycle, depreciation, information security policy, data erasing

1.　Computerization planning

> **[Goal]**
> ➢ Learn the purposes and concepts of the computerization initiative and planning along with the procedures so that you can apply them.
> ➢ Learn the considerations in computerization planning so that you can apply them.

(1)　Computerization initiative

Understand the purpose, concept, and steps of computerization initiative.

[Examples of steps]

(i) Defining the purpose of the computerization in accordance with the business and information system strategies and the required result (goal); (ii) Reviewing and analyzing the business environment and the business operations environment, current business operation systems, and the information technology trend; (iii) Defining the target business operations; (iv) Creating the target work overview; (v) Selecting a system investment target and setting the goal; (vi) Obtaining approval

Sample terms　　management issues, management request, business environment, business operations environment, information technology trend, analysis of business operations, workflow, system optimization technique, computerization initiative document, computerization promotion system, BABOK (Guide to the Business Analysis Body of Knowledge), BPR (Business Process Reengineering)

(2)　Computerization planning

Understand the purpose and concept of computerization planning along with the steps for planning computerization.

[Examples of steps]

(i) Defining the target business operations and issues of the system; (ii) Examining and analyzing the target business operations and systems; (iii) Developing a basic computerization policy; (iv) Summarizing the computerization planning; (v) Obtaining approval

Sample terms　　total computerization planning, individual computerization planning, basic requirements for computerization planning, computerization purpose, development scope, system application scope, examination of the pertinent information technologies, business model creation, computerization function summarizing, systems architecture creation, basic policy about the service level and quality, project promotion framework, project owner (and the person responsible for implementation)

(3)   Considerations in computerization planning

(a) Total development scheduling

Understand the purpose and concept of total development scheduling.

Sample terms   subsystems partitioning, prioritization, staff, delivery date, cost, quality, critical path

(b) Staff training planning

Understand the purpose and concept of staff training planning.

Sample terms   basic requirements for educational/training programs, educational/training framework, schedule, intended staff

(c) Decision making on investment

Understand the concept and procedure of a method for making decision on investment.

Sample terms   PBP, DCF method, NPV (Net Present Value)

(d) Return on development investment

Understand the concepts used in analyzing and reviewing returns on development investment.

Sample terms   roughly estimated person-hours, calculated development effect, roughly estimated cost, IT portfolio, payout period, NPV (Net Present Value), system life cycle

(e) Information systems installation risk analysis

Understand the types and levels of the risks attendant on the installation of information systems.

Sample terms   risk analysis targets, occurrence frequency, effect, and bounds of a risk, details and amount of damage according to the type of risk, risk treatment (e.g., risk avoidance, loss prevention, loss reduction, risk transfer, risk retention), property loss, responsibility loss, net operating income loss, human cost, risk measurement

2. Requirements definition

> **[Goal]**
> ➢ Learn the purposes and concepts of requirements analysis and requirements definition along with the procedures and typical techniques so that you can apply them.
> ➢ Learn about the verification of the consistency with the information system strategy so that you can apply it.

(1) Requirements analysis

(a) Steps for requirements analysis

Understand that the steps for analyzing requirements consist of the identification and analysis of the requirements, arrangement of the computerization needs, and arrangement of the preconditions and constraint conditions.

Sample terms   user needs study, current state analysis, definition of problems/issues, requirements specification, current state-oriented approach, goal-oriented approach, requirements engineering

(b) Techniques for requirements analysis

Understand the characteristics of typical techniques and models used for requirements analysis.

Sample terms   questionnaire, interview, affinity diagram, functional analysis, structural analysis, data flow model, Petri net model, E-R model, parallel process model, goal-oriented requirements analysis method (KAOS method, i*), BABOK (Guide to the Business Analysis Body of Knowledge)

(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 what are defined in the requirements definition process.

Sample terms   operational requirements definition, business processing procedure, functional requirements definition, non-functional requirements definition, performance requirements, security requirements, peripheral interface requirements, information/data requirements, operational requirements, migration requirements, maintenance requirements

(c) Techniques of requirements definition

Understand the structured analysis and object-oriented analysis methods.

Sample terms   process specifications, DFD, DD (Data Dictionary), decision table, decision tree, UML, DOA (Data Oriented Approach), Coad/Yourdon technique, Schroer/Meller technique

(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, accountability, traceability, rules for requirements change, facilitation

(3) Verification of the consistency with the information system strategy

Understand that in defining requirements, it is important to verify that they are consistent with the information systems strategy.

3. Procurement planning and implementation

[Goal]
> Learn the purpose and concept of procurement planning and implementation so that you can apply them.

(1) Procurement and procurement planning

(a) Preconditions for procurement

Understand that procurement must be in accordance with the purpose, scale, work policy, preconditions, and constraint conditions of the system to be developed.

(b) Procurement planning

Understand that 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.

Sample terms   internal and external manufacturing criteria, IFB (Invitation For Bids)

(c) Use of external resources

Understand the validity of the use of external resources in system development along with the methods for making use of external resources and the characteristics.

Sample terms   system integrator, SI service provider, outsourcing, SaaS (Software as a Service), ASP, IDC (Internet Data Center), web services including SOA (Service Oriented Architecture), application of software packages, application of open source software, OEM, ODM, fabless

(d) System asset and software asset management

Understand that in implementing proper procurement, management of the system assets and software assets is effective.

Sample terms   software supply chain management, license management, configuration

management

(2) Procurement implementation

(a) Procurement methods

Understand typical procurement methods along with the considerations about them.

Sample terms proposal-based competitive bidding, open competitive bidding,
comprehensive evaluation bidding method (addition method),
comprehensive evaluation, price evaluation, government procurement
agreement by the WTO

(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 an RFQ (Request For Quotation) that indicate the system to be procured, requested items to be proposed, and procurement conditions must be presented to the vender to request that it should submit proposals and written quotations.

Sample terms scope of procurement, system model, service requirements, target schedule,
contract conditions, vendor management requirements, vendor project
system requirements, evaluation of the techniques and track record of the
vendor

(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.

Sample terms cost structure, construction time, internal control, compliance, quality risk,
delivery date risk, cost overrun risk, risks concerning skills of personnel,
CSR (Corporate Social Responsibility) procurement, green procurement

(f) Procurement risk analysis

Understand that procurement requires the knowledge about risk management in terms of

internal control, compliance, CSR (Corporate Social Responsibility) procurement, green procurement, and measures based on the analyses and evaluations of risks. In addition, understand the procurement risks are divided into quality risks, delivery date risks, cost overrun risk, risks concerning skills of personnel, and other risks according to the nature of the 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, fixed price contract,
CPIF (cost plus incentive fee), time & material contract (T&M, CPFF),
software license agreement, license agreement, sublicense, grant-back

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1. Business strategy techniques

> **[Goal]**
> ➢ Learn the purpose, concept, and layers of business strategies so that you can apply them.
> ➢ Learn the purpose and concepts of the corporate strategy and enterprise strategy along with typical business strategy techniques so that you can apply them.

(1) Business strategy

Understand the purpose, concept, and layers of business strategies.

Sample terms   corporate philosophy, corporate strategy, business strategy, competition strategy, functional strategy, diversification, synergy effect, economies of scale, economies of scope, innovation, change management, benchmarking, best practice

(2) Corporate strategy

(a) Corporate strategy development

Understand the purpose and concept of corporate strategies along with typical strategies.

Sample terms   domain, resource allocation, competitive superiority, experience curve, CS (Customer Satisfaction), group management, core competence, outsourcing, M&A (Mergers and Acquisitions), TOB (Take Over Bid), alliance, shared service, venture business, crowdfunding, incubator

(b) Product portfolio management

Understand the purpose, characteristics, and procedure for PPM (Product Portfolio Management).

Sample terms   optimized allocation of management resources, market growth rate, relative market share, question mark, star, cash cow, dog

(3) Enterprise strategy

(a) Competition strategy development

Understand the purpose and concept of competition strategies along with typical strategies.

Sample terms   five forces analysis (the rivalry between existing sellers in the market, the potential threat of new sellers entering the market, the threat of substitute products becoming available in the market, the power exerted by the customers in the market, the impact of the suppliers on the sellers), basic competition strategies (cost leadership strategy, differentiation strategy, and focus strategy), blue ocean strategy

(b) SWOT analysis

Understand the purpose, characteristics, and procedure of the SWOT (Strength, Weakness, Opportunity, Threat) analysis.

Sample terms external environment, internal environment

(c) Value chain analysis

Understand the purpose, characteristics, and procedure of value chain analyses.

Sample terms value activity, procurement, manufacturing, sale, service, added value, cost, external resource utilization, value chain redesign

(d) Growth matrix

Understand the purpose, characteristics, and procedure of the growth matrix.

Sample terms product/market matrix, growth strategy, market penetration strategy, market development strategy, product development strategy, diversification strategy

2. Marketing

[Goal]
➢ Learn the purpose and concept of marketing along with typical marketing techniques so that you can apply them.

(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 concept of market analyses along with typical surveys and analysis techniques used for market research.

Sample terms 3C (Customer, Competitor, and Company) analysis, macro environment analysis (PEST analysis, cultural environment), market research, segmentation, targeting, positioning, sampling, questionnaire, observation method, experimental technique, cross tabulation, pricing sensitivity measurement, RFM (Recency, Frequency, and Monetary) analysis, consumer behavior model (AIDMA)

(b) Marketing mix

Understand that marketing mix means effective implementation of the combination of product planning, selling prices, sales channels, and sales promotion.

Sample terms merchandising, four Ps (Product, Price, Place, and Promotion) in marketing, four Cs (Customer Solution, Customer Cost, Convenience, and Communication) in marketing

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(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 value, LTV (Life Time Value), customer royalty, brand strategy, UX (User Experience), conversion rate, retention rate

(2) Marketing strategy

(a) Product strategy

Understand the characteristics of each stage of 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, product diversification strategy, product differentiation strategy, market segmentation strategy, planned obsolescence, commoditization, PLM (Product Lifecycle Management), mass customization

(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, elasticity of demand to price

(c) Distribution strategy

Understand a distribution channel classification method, a selection criterion, and an optimization technique.

Sample terms	voluntary chain, 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, consumer behavior model (AIDMA)

(3) Marketing techniques

Understand the characteristics of typical marketing techniques along with what scenarios they fit.

Sample terms	mass marketing, target marketing, one-to-one marketing, relationship marketing, direct marketing, viral marketing, market testing (test marketing), cause-related marketing, push strategy/pull strategy

3.　Business strategy and goal/evaluation

> **[Goal]**
> ➤ Learn the purpose of the development/evaluation of a business strategy and its goal along with the concept and procedure for it so that you can apply it.
> ➤ Learn typical information analysis techniques for developing and evaluating goals so that you can apply them.

(1)　Development and evaluation of business strategy and its goals

Understand the purpose and concept of the development of business strategies and their goals and evaluations along with the concept and steps for them.

[Examples of steps]

(i) Analyzing the business environment and planning a business strategy based on the corporate philosophy, corporate vision, and corporate strategies to set specific strategic targets; (ii) Defining on which CFS (Critical Success Factors) importance should be placed to achieve the goals; (iii) Setting the indicators for measuring the goal achievement levels and evaluating them

| Sample terms | vision of an organization, mission of an organization KGI (Key Goal Indicator), KPI (Key Performance Indicator), monitoring, feasibility study |

(2)　Typical information analysis techniques for target setting and evaluation

(a)　BSC (Balanced Score Card)

Understand the purpose, characteristics, and procedure of BSC (Balanced Scorecard).

| Sample terms | financial viewpoint, customer viewpoint, business process viewpoint, viewpoint of learning and growth, CSF (Critical Success Factor), performance indicator, monitoring, variance analysis |

(b)　Needs/wants analysis

Understand the purpose, characteristics, and procedure of needs/wants analyses.

| Sample terms | needs, wants |

(c)　Competitive analysis

Understand the purpose, characteristics, and procedure of competitive analyses.

| Sample terms | competitive situation, number of competitors, prices of products and services, technology trend |

(d)　Other techniques

Understand the purposes, characteristics, and procedures of techniques such as value engineering and six sigma.

| Sample terms | values of products and services, function, cost, life cycle cost, function definition, functional evaluation, functional cost analysis, alternative proposal preparation, TQM (Total Quality Management), macro |

environment analysis (PEST analysis, cultural environment)

4.   Business management system

> **[Goal]**
> ➢ Learn the characteristics and concepts of typical business management systems so that you can apply them.

(1)   Business management system

Understand that the business management systems include corporate systems, division-specific systems, and so on.   Understand that the 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.   In addition, understand the characteristics and concept of these systems.

Sample terms   corporate system, department system, DSS (Decision Support System), SIS (Strategic Information System), ERP (Enterprise Resource Planning), value chain management, ECR (Efficient Consumer Response), SFA, KMS (Knowledge Management System), SECI (Socialization, Externalization, Combination, Internalization) model, CRM (Customer Relationship Management), SCM, TOC (Theory of Constraints), EIP (Enterprise Information Portal)

1. Planning of technology development strategy

> **[Goal]**
> ➢ Understand the purpose and concept of technology development strategies along with the procedures for planning them so that you can apply them.

(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, and that it is critical to link the technology development strategy with the business strategy and enterprise strategy.

Sample terms MOT (Management Of Technology), product innovation, process innovation, radical innovation, market creation, market value, R&D (Research and Development), CVC (Corporate Venture Capital)

(b) Three factors of value creation

Understand that to lead technology development to economic value, "Value Creation", "Value Delivery", and "Value Capture" are the key factors.

Sample terms technology S curve, valley of death, QCDE (Quality, Cost, Delivery, Environment)

(c) Procedure for planning a technology development strategy

Understand the concept of technology development strategy planning, including the details of the analyses required prior to strategy planning, determination of the core technologies, and flexible use of external resources.

Sample terms product trend, technology trend, standardization trend, core technology, technology research, contract research, joint research, technological marketing, idea creation, success case

(d) External resources exploitation strategy

Understand the techniques and considerations of strategically exploiting external resources.

Sample terms technology acquisition, technology licensing, technological tie-up, M&A (Mergers and Acquisitions), industry-academia-government collaboration, TLO (Technology Licensing Organization), standardization strategy, intellectual property rights, early examination system, patent pool, cross-licensing, defensive patents, ideathon, hackathon

2. Technology development plan

> **[Goal]**
> ➢ Learn the purpose, details, and concept of technology development plan so that you can apply them.
> ➢ Learn the purpose, concept, types, and characteristics of road maps so that you can apply them.

(1) Technology development plan

Understand the purpose, details, and 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, concept, types, and characteristics 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]
> ➢ Learn the characteristics, typical examples, and trends of the information systems used in business areas so that you can apply them.

(1) Internal operations support system

Understand what internal operations information systems support. In addition, understand the characteristics, typical examples, and trends of information systems.

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 characteristics of typical information systems intended for supporting business operations along with the expected effects. Understand the considerations in introducing an information system, including business operations framework reviews and cost effectiveness associated with the introduction of information systems. In addition, understand the characteristics of typical software packages for business systems along with examples and trends.

Sample terms   distribution information system, logistics information system, field operation support system, financial information system, medical information system, POS system, EOS (Electronic Ordering System), sales management system, purchasing management system, inventory control system, customer information system, CDN (Contents Delivery Network), ERP, electronic medical chart, traceability, ubiquitous computing, IoT (Internet of Things)

(3) Administration system

Understand the types and characteristics of typical information systems used for administrative activities. Understand that e-Government is a mechanism designed to provide administrative services and streamline administrative activities using information technology, and that the basic IT strategy developed in 2001 defines the implementation of e-Government as one of the important policy issues. In additions, understand the characteristics of e-Government along with trends and considerations.

e-Japan initiative, e-Gov, electronic local government, electronic application, electronic procurement, LGWAN (Local Government Wide Area Network), EDINET (Electronic Disclosure for Investors' Network), immigration control system, registration information system, on-line social insurance system, Automated Meteorological Data Acquisition System (AMeDAS), emergency alert, public information system, Basic Resident Register Network System, official personal authentication service, My Number (Social Security and Tax number), universal design, digital divide

(4) Public information system

Understand the characteristics and examples of typical information systems used in public segments, including the systems for solving road traffic problems and for handling tolls, along with trends.

Sample terms   smart grid, EMS (Energy Management System), GPS (Global Positioning System) application system, VICS (Vehicle Information and Communication System), ETC (Electronic Toll Collection System), seat reservation system

2.   Engineering system

> [Goal]
> ➢ Learn the purpose and concept of engineering system development and design so that you can apply them.
> ➢ Learn the purposes, mechanisms, and technologies of automatic production control, production systems, production management, and computer-aided systems so that you can apply them.

(1) Purpose and concept of engineering systems

Understand the purpose and concept of using information technology in development and design.

(2) Automatic production management

Understand the mechanism and functions of automatic control of production processes; the advantages brought by automated production, including cost reductions and the mechanization of hazardous activity; and the technology elements and trends of production automation.

Sample terms   production system, production line organization, production form, individual production, lot production, continuous production, build-to-order production, build-to-stock production, diversified needs, high-mix low-volume production, JIT (Just In Time), NC (Numerical Control), automatic monitoring equipment, automated guided vehicle, automated warehouse, industrial robots, fabless

(3)　Production system

Understand production system models, production management phases, and the purpose of production management systems.　In addition, 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 　quality management, process management, schedule management, inventory control, design control, totalizing support, procurement management, cost control, profit management, strategy management, management of changes, 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 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, CAM, CAE (Computer Aided Engineering), PDM (Product Data Management), PMS (Project Management System), CIM

3.　e-business

[Goal]
- Learn the mechanism of e-business, including EC and EDI, performed over the Internet, along with the characteristics and considerations so that you can apply them.
- Learn typical standards for data exchange so that you can apply them.

(1)　EC (Electronic Commerce)

(a)　Electronic ordering system

Understand the mechanisms and characteristics of electronic ordering and procurement systems along with the considerations.

Sample terms 　on-line mall, on-line shopping, electronic bidding

(b)　Electronic payment system

Understand the mechanism and characteristics of electronic payment systems along with the considerations.　In addition, understand the electronic money types and encryption along with the relationships to financial trading.

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financial trading, Internet banking, EFT (Electronic Fund Transfer), SET (Secure Electronic Transaction), smart card, IC card/RFID application system, fintech

(c)   How to implement e-business

Understand the concept and considerations in promoting e-business.

internet business, on-line commercial service, virtual company, 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, on-line marketing, on-line transaction processing, SCM, SEO (Search Engine Optimization), recommendation system, long tail, affiliate advertising, listing advertisement (search advertising), monetize, freemium

(2)   EDI

(a)   Mechanism and characteristics of EDI

Understand the system configuration for EDI, the ordering and payment mechanisms of EDI along with their characteristics, and the advantages of and considerations about the introduction of EDI.

material procurement, replenishment, cargo tracking, electronic payment, Web-EDI, UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business)

(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 exchanging electronic transaction data.

JIS X 7011-1, JIS X 7012-1, EIAJ-EDI (Electronic Industries Association of Japan-Electronic Data Interchange) standard, STEP (Standard for the Exchange of Product Model Data), Japanese Bankers Association protocol, XBRL, XML-EDI, ebXML, CALS (Commerce At Light Speed), information communication protocol, information representation protocol, task operation protocol, basic transaction protocol, JCA (Japan Chain Stores Association) protocols (J protocol and H protocol), JX protocol, EANCOM, distribution BMS (Business Message Standards)

(3)   Social media

Understand the concepts, types, and technical background of social media.

SNS, electronic bulletin board, blog, mini-blog, real-time web, CGM (Consumer Generated Media), IP centrex

4.   Consumer appliances

[Goal]
- ➢ Learn the characteristics, trends, and typical examples of embedded systems so that you can apply them.
- ➢ Learn the characteristics, trends, and typical examples of consumer appliances so that you can apply them.

(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 characteristics, trends, and typical examples of embedded systems.

Sample terms   microcomputer, power saving, high-reliability design, safety design, environmental resistance, embedded OS, real-time OS, real-time control, event, sensor, sequence control, robotics, firmware, WPS (Wi-Fi Protected Setup), wireless charging system

(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 video 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 peripherals/OA equipment, consumer communications terminals, smartphones, tablet computer, HDTV, set-top box, DLNA, in-vehicle information equipment, home network, wearable computer, sensor network, sensor base station, sensor terminal, HEMS (Home Energy Management System)

5.　Industrial devices

> **[Goal]**
> ➢ Learn the characteristics, trends, and typical examples of industrial electronic devices so that you can apply them.

(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 and MDFs (Main Distributing Frames), transport equipment such as vehicle, vessel, and aircraft, analytical/measurement instruments for detecting drugs and surveying water, equipment items such as air conditioners, and construction equipment.

Sample terms　　industrial equipment, FA (Factory Automation) equipment, industrial robots, automotive control system, ADAS (Advanced Driving Assistant System), PLC (Programmable Logic Controller), automated warehouse, vending machine, ATM (Automated Teller Machine), medical devices, AED (Automated External Defibrillator), patient monitoring equipment, smart meter (AMI)

1. Management and organization theory

> **[Goal]**
> ➢ Learn the types and characteristics of corporate activities, business management, and management organizations along with techniques so that you can apply them.
> ➢ Learn the changes in and issues to the business environment so that you can apply them.
> ➢ Learn the need for and effectiveness of computer literacy at businesses so that you can apply them.

(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 management of people, materials, money, and information.

Sample terms   corporate philosophy, CSR (Corporate Social Responsibility), corporate culture (climate), green IT

(b) Corporation forms

Understand the forms of corporations and their characteristics. Understand the characteristics of general incorporation, limited liability, and corporate spin-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 identify, corporate brand

(2) Business management

(a) What is business management?

Understand the need for and purpose 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 management resources. Understand that business management includes human resources, quality management, and production management. In addition, understand the concept of the management cycle.

business objectives, management planning, activities planning, performance evaluation, PDCA, financial affairs management, asset management, human resource management, information management, TQM (Total Quality Management)

(b)   Theory and development of business management

Understand the concept of scientific approaches associated with organizations and decision making; the relationship between the modern business management theory by Barnard, Simon, and others and system engineering; and the characteristics of system engineering.

Sample terms   scientific management method, management process theory, collaboration system, general system theory

(c)   Human resources management

Understand that human resources management plays an important part in business management.   In addition, understand the techniques and concept of human resources management, including OJT, objective management, human resources development, and discretionary labor system.

Sample terms   employability, annual salary system, competency, coaching, mentoring, case study, e-Learning, job rotation, career development, selective personnel system, CDP (Career Development Program), talent management, HPI (High Potential Individual), MBO (Management by Objectives), work-life balance EAP (Employee Assistance Program), work-sharing, diversity

(d)   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 along with the techniques.

Sample terms   logical thinking, group dynamics, affinity diagram, brainstorming, Maslow's hierarchy of needs, motivation/hygiene theory, XY theory, expectancy theory, intrinsic motivation, PM theory, SL (Situational Leadership) theory, contingency theory

(e)   Risk management

Understand how important it is to analyze risks that may hinder the maintenance and improvement of corporate values and to make up a plan that enables the necessary projects to continue in the event of a disaster or similar disruption.

[Example steps for analyzing risks]

(i) Estimating risks; (ii) Analyzing the effects of the risks estimated; (iii) Selecting important tasks; (iv) Making up a plan for continuing important tasks; (v) Improving the implementable frameworks; (vi) Developing a plan that acts as guidelines for continuous improvement

> Sample terms   BCP (Business Continuity Plan), BCM (Business Continuity Management),
> JIS Q 22301 (ISO 22301), Business Impact Analysis (BIA)

(3) Management organization

Understand the functions of business managers, the roles of the CEO (Chief Executive Officer), CIO (Chief Information Officer), and other positions, and the types and characteristics of typical organizational structures.

> Sample terms   hierarchical organization (pyramid organization), flat 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 characteristics of the modern businesses and changes in the business environment including globalization, business diversification, and working forms in consideration of work-life balance, and the issues that businesses should work on.

> Sample terms   internalization of a corporate environment, IR (Investor Relations),
> disclosure, accountability, holding company, group management, SRI
> (Socially Responsible Investment), environmental management, satellite
> office, telecommuting, SOHO (Small Office Home Office), corporate citizen

(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, along with the effectiveness of doing so.

2.   OR and IE

> **[Goal]**
> ➢ Learn techniques for typical OR and IE so that you can apply them.
> ➢ Learn the techniques for collecting, organizing, analyzing, and visually representing data so that you can apply them.

(1) Linear programming

Understand the LP (linear programming) technique, formalization of problems, graph-based solutions, and the cases for which linear programming is effective.

> Sample terms   simplex method, allocation problem, transportation problem, DP (Dynamic
> Programming)

(2) Inventory problem

Understand the concept of inventory control and the mechanisms of fixed quantity ordering system and periodic reordering system.

Sample terms	safety stock, ordering cost, inventory cost, EOQ (Economic Ordering Quantity), order point, ABC analysis, seasonal variations

(3) Scheduling

Understand the techniques of PERT and CPM (Critical Path Method).

Sample terms	scheduling, project scheduling, flow shop, job shop, arrow diagram, critical path

(4) Game theory

Understand the concept of game theory along with concrete examples of interests, profits, and losses in corporate activities.   In addition, understand the judgment criteria for risks and the principle of decision-making.

Sample terms	selection criteria, strategic form game, pure strategy, mixed strategy, extensive form game, payoff matrix (payoff table), zero-sum two-person game, nonzero-sum two-person game, maximin principle, minimax theorem, Nash equilibrium, decision tree, decision theory, expectation principle, stability principle, maximum likelihood principle, level of aspiration principle, Laplace's principle, Bayesian theory

(5) IE (Industrial Engineering) analysis techniques

Understand the characteristics of typical job measurement methods, including the working hour analysis, PTS (Predetermined Time Standard) method, and work sampling method.

Sample terms	therblig, work analysis, standard time, float, operation analysis, operation scheduling

(6) Inspection techniques

Based on the concept of inspection design, understand the characteristics of typical inspection techniques including the sampling inspection, OC (Operating Characteristic) curve, sampling, and simulation.   Also, understand the concept of simulations along with how important it is to evaluate and analyze whether or not simulation models are appropriate.

Sample terms	operating characteristic curve, fraction defective, consumer's risk, producer's risk, nondestructive inspection, failure rate curve (bathtub curve), Monte Carlo method, design of experiment

(7) Quality control techniques

Understand how to use the seven tools mainly used for quantitative analyses and the new seven tools mainly used for qualitative analyses.

Sample terms   quality characteristics, quality function deployment, fraction defective estimation, time series analysis, control level, quality assurance, seven tools (stratification, histogram, Pareto chart, scatter diagram, cause and effect diagram, check sheet, and control chart), new seven tools (affinity diagram method, association diagram method, tree diagram method, matrix diagram method, matrix data analysis method, PDPC (Process Decision Program Chart) method, and arrow diagram method), x-R control chart, p control chart, controlled state, variation within a subgroup and variation between subgroups, grouping

(8) Demand forecasting

Understand typical demand forecasting techniques, including regression analysis and time series analysis.

Sample terms   least squares method, determination coefficient, correlation coefficient, moving-average method, exponential smoothing

(9) Job analysis and operational planning

Understand the 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, G-P (Good-Poor) analysis, focus group, questionnaire method, observational method, data mining, brainstorming, radar chart, cluster analysis method, exponential smoothing, Delphi method, Monte Carlo method, decision tree

3.　Accounting and financial affairs

> **[Goal]**
> ➤ Learn about corporate activities and accounting, along with "financial accounting" and "management accounting" so that you can apply them.
> ➤ Learn the technique for analyzing financial statements so that you can apply it.
> ➤ Learn cash flow accounting, cash planning and cash management, asset management, and economic efficiency computing so that you can apply them.

(1)　Corporate activities and accounting

(a)　Sales-profit relationship

Understand the relationships between sales and profits/costs along with fixed, variable, and initial costs.　In addition, understand associated indicators, such as the break-even point and margin of safety ratio, along with the relationships with changes in variable and fixed costs.

Sample terms　volume of sales, opportunity loss, profit chart, profit volume graph, target profit sales amount, cost breakdown, cost accounting, cost system, cost analysis, cost structure, cost control, variable income statement, break-even point

(b)　Procedure for corporate accounting

Understand that in accordance with corporate activities, journal slip is managed, transactions are conducted and recorded (journal entry) as day-to-day operations.　In addition, understand that the accounts are settled and the actual performance is evaluated every accounting term.

Sample terms　journal book, cash 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 prepared in account settlements.　In addition, understand the purpose of consolidation accounting, which regards a group of companies including subsidiaries as a single organization, along with the statements prepared in this accounting system.

Sample terms　semiannual settlement, quarterly settlement, trail balance sheet, work sheet, balance sheet, income statement, cash flow statement, statements of shareholders' equity, consolidated balance sheet, consolidated statement of income, consolidated statements of cash flow, consolidated statements of shareholders' equity, control approach, annual securities report, accounting audit, settlement of accounts public notice, earnings summary, goodwill, IFRS

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(d) Financial statements

Understand the purposes of the balance sheet, income statement, cash flow statement, and statements of shareholders' equity, and how to read the financial statements including the arrangement of credits and debits in each statement. In addition, understand how to calculate gross profit, operating profit, and ordinary profit.

Sample terms   current assets, fixed assets, tangible fixed assets, intangible fixed assets, deferred assets, current liability, fixed liability, net assets, capital stock, cost, income, "selling, general and administration expense", operating profit and loss, no operating profit and loss, extraordinary items, accrual basis, conservatism

(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, international accounting standards, tax effect accounting, software accounting, accounting for the impairment of assets, current value accounting, accounting for retirement benefits, accounting for leases, percentage-of-completion method, business accounting principal, rules for financial statements and others, rules for consolidated financial statements, cost accounting, job order cost, process costing, standard cost accounting, direct cost accounting, ABC (Activity Based Costing), target costing

(3) Analyses of financial statements

Understand the purposes of management analyses and business diagnoses. Understand the concepts and types of financial analysis techniques, including the actual-figure method and ratio method along with their characteristics. In addition, understand and typical financial indicators.

Sample terms   internal analysis, external analysis, trend method, component ratio, relation ratio, static analysis, dynamic analysis, income indicator, net profit margin, ratio of gross profit to net sales (gross profit ratio), total asset turnover, ROA (Return On Assets), ROE (Return On Equity), ROI (Return on Investment), safety index, liquidity, current ratio, equity to total asset, added value, productivity, capital productivity, labor productivity, relative share, EVA (Economic Value Added)

(4) Cash flow accounting

Understand the purpose of cash flow accounting, the targets and structure of cash flow statements, and the effectiveness of cash flow accounting.

Sample terms cash flow management, cash flow based on sales activities, cash flow based on investment activities, cash flow based on financial activities, free cash flow

(5) Cash planning and cash management

Understand the need for and purpose 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 along with how to raise funds.

Sample terms cash management, statement of cash receipts and disbursement, bonds, increase in capital stock, trade credit, internal financing, netting

(6) Asset management

Understand the following: the purpose of asset management; how to evaluate inventories; depreciation; and amortization cost. In addition, understand the characteristics and mechanisms of leasing and rental.

Sample terms inventory valuation, first-in first-out method, periodic average method, moving average method, asset management, finance lease, operation lease, off-balance

(7) Economic efficiency calculation

Understand techniques for calculating economical efficiency, including the DCF (Discounted Cash Flow) method, intended for determining whether or not investments are appropriate, and the IRR (Internal Rate of Return) method.

Sample terms NPV (Net Present Value) method, DPP (Discounted Pay-Back Period) method, corporate finance, business valuation, profitability comparison

1.　Intellectual property rights

> **[Goal]**
> ➢ Learn the concepts of the laws associated with intellectual property rights so that you can apply them.
> ➢ Learn the concepts of the laws associated with copyright so that you can apply them.
> ➢ Learn the concepts of the four laws that play a central part of the Industrial Property Law so that you can apply them.
> ➢ Learn the concept of the Unfair Competition Prevention Act so that you can apply it.

(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.　In addition, understand that the protection of intellectual properties is also a globally important issue, and international treaties therefore have been concluded.

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, Paris Convention (for the Protection of Industrial Property), Berne Convention (for the Protection of Literary and Artistic Works), Universal Copyright Convention, PCT (Patent Cooperation Treaty), TRIPS (Agreement on Trade-Related Aspects of Intellectual Property Rights), WIPO (World Intellectual Property Organization)

(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 and that bail-out measures are available against infringements of rights.

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 public exhibition, right of distribution, right of transfer of ownership, right of public rental), employee work, private work, derivative work, transmittable, quote, private use, library, educational institution, examination question, right to demand an injunction, claim for loss

(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 and what bailout measures are available against infringements of rights.

Sample terms   invention, device (as used with regard to a utility model), design, trademark, patent pending, examination, registration, software patent, patent for a business method, right to demand an injunction, claim for loss

(4) Other associated laws

Understand 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.

Sample terms   trade secrets, illicit obtainment of a domain name, cancel of copy guard, right to demand an injunction, claim for loss

2. Laws on security

[Goal]
- Learn the concept of the Basic Act on Cybersecurity, which establishes basic measures and other matters relating to Japan's cyber security so that you can apply it.
- Learn the concept of the Act on the Prohibition of Unauthorized Computer Access so that you can apply it.
- Learn the concept of the criminal law on illegal activities using computers so that you can apply it.
- Learn the concepts, methods, and techniques for personal information protection and privacy protection so that you can apply them.
- Learn the concepts of the laws concerning electronic signatures, certification services, and so on so that you can apply them.
- Learn the concept 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 so that you can apply it.

(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 principles, responsibility of the government, responsibility of local governments, responsibility of critical information infrastructure CII operators, responsibility of cyberspace-related business entities and other business entities, responsibility of educational and research organizations, efforts of the people

(2) Act on the Prohibition of Unauthorized Computer Access

Understand that the Act on the Prohibition of Unauthorized Computer Access 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 helps 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); penalty on computer fraud; penalty on obstruction of 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 system, My Number Act (Act on the Use of Numbers to Identify a Specific Individual in Administrative Procedures), Guidelines for the proper handling of Specific Personal Information, Personal Information Protection Commission, specific personal information protection assessment, 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), EU data protection directive (right to erasure, etc.)

(b) Methods and techniques for personal information protection and privacy protection

Understand 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, anonymization methods (sampling, k-anonymization), privacy impact assessments (PIA), privacy framework

(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 that 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 defines who should be liable for such individual rights violations and how.

(7) Act on the 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]**
> ➢ Learn the concepts of typical laws on labor so that you can apply them.
> ➢ Learn the concepts of typical laws on transaction so that you can apply them.
> ➢ Learn the concept of contracts associated with transactions between businesses so that you can apply it.

(1) Laws on labor

(a) Labor Standards Act

Understand that the Labor Standards Act 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 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 characteristics of 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 other laws on labor

Sample terms Labor Contracts Act, Industrial Safety and Health Law; Act on Securing, Etc.

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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 purpose, coverage, and mechanism of the "Act against Delay in Payment of Subcontract Proceeds, Etc. to Subcontractors".

> Sample terms   manufacturing contract, service contract, information-based product, main subcontracting entrepreneur, subcontractor, capital

(b) Civil law

Understand 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 mechanisms of the systems important in conducting business transactions.

> Sample terms   (quasi-)mandate contract, service contract, CPIF (Cost Plus Incentive Fee), time & material contract (T&M, CPFF), responsibility for completing deliverables

(c) Commercial law

Understand the mechanisms of the systems important for business transactions between businesses defined by the commercial law.

> Sample terms   defect liability

(d) Others

Understand 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, creative commons, 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. In addition, understand the difference between the following two forms of outsourcing contracts: service contract and (quasi-)mandate contract.

(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 agreement depending on licensing conditions.

Sample terms   volume license agreement, site license agreement, shrink-wrap license agreement, CAL (Client Access License), free software, shareware, OSS (Open Source Software) license, GPL (General Public License), LGPL (Lesser General Public License), BSD (Berkeley Software Distribution), 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 contact

4.　Other laws, guidelines, and engineer ethics

[Goal]
- Learn the Basic Act on the Formation of an Advanced Information and Telecommunications Network Society and the concepts about the relation between the computerization and legal system so that you can apply them.
- Learn the concepts of compliance, engineer ethics, and the laws and standards to be followed so that you can apply them.
- Learn the concept of the Act on Access to Information Held by Administrative Organs so that you can apply it.

(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, contribution to society, corporate governance, CSR (Corporate Social Responsibility), stakeholder, 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 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, 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 that accounting operations must be fairly conducted in compliance with the tax laws.

Sample terms　Corporation Tax Act, Consumption Tax Law

(e) e-Document Law

Understand that documents that must be retained as required by law and regulations can be stored as electronic document files.

Sample terms　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 purpose, coverage, and mechanism 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 export and the use of the IT device/software usage in foreign countries.

Sample terms　CE mark, RoHS directive, Foreign Exchange and Foreign Trade Act, US export-related regulations

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> **[Goal]**
> ➢ Learn typical standards and specifications, the roles of the standardization organizations and associated bodies, and the framework of international certification so that you can apply them.
> ➢ Learn the standards for system development/transaction, software, and data so that you can apply them.

(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

(c)　Other standards

Understand the other related standards/specifications and the roles of the standardization organizations and associated bodies.

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, de facto standards, de jure standard

(3)　Standards for development and transactions

(a)　Standardization of development and transaction processes

Understand the standards for the tasks and role sharing at each process of software development and transactions.

SLCP-JCF (Japan Common Frame), JIS X 0160, JIS X 0170

  (b) Standards for environment and IT security evaluation

Understand the standards for environment and IT security evaluation.

ISO/IEC 14000, JIS Q 14001, ISO/IEC 15408

(4)   Standards for software

Understand the roles and details of the standards that provide a platform for object-oriented programming.

CORBA, OMG, EJB (Enterprise Java Beans)

(5)   Standards for data

Understand typical standards for the character and bar codes used in electronic data exchange.

character and other codes, JIS code, EBCDIC (Extended Binary Coded Decimal Interchange Code) code, shift JIS code, Unicode, JAN code, QR code, ITF code, ISBN code, image file (EPS, JPEG, GIF, BMP, TIFF, and Exif), moving image file (MPEG), sound file (MP3, WMA, RealAudio, and AIFF), document file (SGML, XML, HTML, TEX), data format (CSV format, SYLK format)

(6)   International certification framework

Understand the framework for international certification.

conformity assessment, conformity assessment body, accreditation body, certification body, inspection body

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