ESE 2021

UPSC ENGINEERING SERVICES EXAMINATION

Preliminary Examination

General Studies and Engineering Aptitude

Information and Communication Technologies (ICT)

Comprehensive Theory *with* Practice Questions
and ESE Solved Questions

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Preface

B. Singh (Ex. IES)

The compilation of this book **Information and Communication Technologies** was motivated by the desire to provide a concise book which can benefit students to understand the concepts of this specific topic of General Studies and Engineering Aptitude section.

This textbook provides all the requirements of the students, i.e. comprehensive coverage of theory, fundamental concepts and objective type questions articulated in a lucid language. The concise presentation will help the readers grasp the theory of this subject with clarity and apply them with ease to solve objective questions quickly. This book not only covers the syllabus of ESE in a holistic manner but is also useful for many other competitive examinations. All the topics are given the emphasis they deserve so that mere reading of the book clarifies all the concepts.

We have put in our sincere efforts to present detailed theory and MCQs without compromising the accuracy of answers. For the interest of the readers, some notes, do you know and interesting facts are given in the comprehensive manner. At the end of each chapter, sets of practice question are given with their keys, that will allow the readers to evaluate their understanding of the topics and sharpen their question solving skills.

Our team has made their best efforts to remove all possible errors of any kind. Nonetheless, we would highly appreciate and acknowledge if you find and share with us any printing and conceptual errors.

It is impossible to thank all the individuals who helped us, but we would like to sincerely thank all the authors, editors and reviewers for putting in their efforts to publish this book.

With Best Wishes

B. Singh

CMD, MADE EASY

Information and Communication Technologies

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2 ICT Based Tools

Information and Communication Technologies (ICT) tools are the various goods, products and services used in the form of digital infrastructures such as computers, tablets, projectors, interactive white boards, digital signage, printer, networking switches, wi-fi, cables, servers and so on. The basis function of ICT tools are primarily intended to fulfil or enable the function of information processing and communication by electronic and digital means, including transmission and display.

As per OECD (Organisation for Economic Co-operation and Development) guide to measuring the information society 2011, the ICT products classifications are as:

Computer and peripheral equipment/tools	• Point of sale terminals, ATM's • Laptop, notebook • Input peripherals (keyboard, mouse) • Scanners • Printers (Inkjet, Laser and others) • Media storage units (Fixed/Removable) • Parts and accessories of computing machines • Monitors and projectors • Solid-state non-volatile storage devices
Communication equipment	• Transmission apparatus • Television cameras • Line telephone sets with cordless handsets • Telephones for cellular network • Various parts for above mentioned subclasses
Consumer electronic equipment	• Video game consoles • Video camera recorders • Digital cameras • Radio broadcast receivers • Television receivers, monitors and projectors • Sound/Video recording • Microphone, loudspeakers, headphones etc.
Miscellaneous ICT components and goods	• Printed circuits, CRT's, diodes etc. • Magnetic and optical media • Card with a magnetic strip • Smart cards • LCD, lasers and other optical appliances
Manufacturing services for ICT equipments	• Electronic component and board • Computer and peripheral equipment • Communication equipment • Consumer electronic • Magnetic and optical media
Business and productivity software and licensing services	• Operating system, system software, application software, network software • Database management software • Development tools and programming language software • Licensing services, online software

Information technology consultancy services	• Business process management services • IT consulting and support services • IT design and development services for applications networks and systems • Web hosting services • Network services • Computer system management services
Telecommunication services	• Mobile telecommunication services • Carrier services • Private network services • Data transmission services • Internet services (Narrowband/Broadband)
Leashing or rental services for ICT equipments	• Leasing or rental services concerning computers without operator telecommunication equipment without operator, television, radio etc.
Other ICT services	• Engineering services for telecommunication and broadcasting projects. • Maintenance and repair services of computer and peripheral equipment, telecommunication equipment. • Installation service of computers, radio, television and communication equipment.

2.1 Computer

Computer is a programmable machine that can execute a programmed list of instructions and simultaneously work upon new instructions given to it. It is a electronic device that has the capacity of storing and retrieving information from its memory and can generate the required output as per the processing instructions given to it by the users with high speed, accuracy and reliability.

It a simpler sense, a computer can:

(i) Take data as input

(ii) Store data in its memory

(iii) Retrieve data when necessary

(iv) Generate the output

Advantages	Disadvantages
• **Speed:** Can perform very large calculations in fractions of second. • **Accuracy:** Can run a program and give output without any error. • **Storage:** It can store large amount of data which can be retrieved later.	• **Dependency:** In a digital world almost all works are dependent on computers. • **No self-awareness:** It has no intelligence on its own and user has to manipulate it.

2.2 Computer Generations

In the era of digitalization, there have been upgrades in the advancement of technology leading to updates in computer technology both in hardware components as well as software. As of present day, there have been five generations of computers.

All the five generations of computers have been discussed in details as follows:

Generation	Period	Technology based on
First	1945-1955	Vacuum tubes
Second	1955-1965	Transistors
Third	1965-1975	Integrated Circuits (IC's)
Fourth	1975-1989	Very Large Scale Integration (VLSI) microprocessor
Fifth	1989-till date	Ultra Large Scale Integration (ULSI) microprocessor

2.2.1 First Generation of Computers (1945-1955)

The first generation computers used vacuum tubes as the basic components of memory and circuitry for CPU. These vacuum tubes were invented by Lee De Forest. The first operational electronic general purpose computer, namely ENIAC (Electronic Numerical Integrator and Computer) was built using about 18000 vacuum tubes.

Some **basic features** of first generation computers are:

- Vacuum tube technology based.
- Mainly batch processing operating system.
- Punch cards, paper tape and magnetic tape as input and output devices.
- Machine language as programming language:

Disadvantages:

- Bulky and costly.
- Generates high heat and consumes lot of electricity.
- Performance very slow and unrealiable.
- AC required.

Examples:

- ENIAC, EDVAC, UNIVAC, IBM-701, IBM-650, EDSAC.

2.2.2 Second Generation of Computers (1955-1965)

The second generation computers used transistors in place of vacuum tubes, that were cheaper, less power consumption, more compact in size, more fast and reliable than first generation machines.

Best features:

- Transistor technology based.
- Batch processing and multiprogramming operating system.
- Magnetic cores used as primary memory and magnetic tape and magnetic disks as secondary memory.
- Assembly language and high-level language like FORTRAN, COBOL as programming language.

Disadvantages:

- Still very costly.
- Still large amount of heat generated.
- AC required.

Examples:

- IBM 7030, IBM 1620, CDC 3600, CDC 1604, UNIVAC 1108, Honey well 400

C and C++ : C and C++ (pronounced "c plus plus") are powerful, general-purpose languages developed at Bell Laboratories. The C language was created in 1972 and the C++ language was created in 1983.

C# : Pronounced "c sharp." This language was created by Microsoft around the year 2000 for developing applications based on the Microsoft .NET platform.

LaTeX : It is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the de facto standard for the communication and publication of scientific documents. LaTeX is available as free software.

Java : It was created by Sun Microsystems in the early 1990s. It can be used to develop programs that run on a single computer or over the Internet from a web server.

JavaScript : It was, created in the 1990s, can be used in web pages. Despite its name, JavaScript is not related to Java.

Python : It is a general-purpose language created in the early 1990s. It has become popular in business and academic applications.

MATLAB : Matrix laboratory is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, C#, Java, Fortran and Python.

Ruby : Ruby is a general-purpose language that was created in the 1990s. It is increasingly becoming a popular language for programs that run on web servers.

Visual Basic : Visual Basic which is commonly known as VB is a Microsoft programming language and software development environment that allows programmers to create Windows based applications quickly. VB was originally created in the early 1990s.

ALGOL: ALGOL, stands for Algorithmic Language was designed by an international committee of the Association of Computing Machinery (ACM) for publishing algorithms as well as for doing computations. It was the most influential of the four high level language mentioned earlier.

Previous ESE Prelims Questions

Q.1 Which type of output device creates coloured images which look and feel like photographs?

(a) Electrostatic plotter (b) Laser printer
(c) Dye sublimation printer (d) Inkjet plotter

[ESE-2018]

Ans. (c)

Q.2 **Statement (I) :** An emulator is not a mixture of hardware and software and it cannot be used to test and debug the hardware and software of an external system.

Statement (II) : Part of the hardware of an emulator is a multiwire cable which connects the host system to the system being developed.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

[ESE-2019]

Ans. (d)

Q.3 The core elements of high-level programming languages are:
(a) Keywords, Expressions and Punctuation (b) Functions, Keywords and Operators
(c) Keywords, Operators and Punctuation (d) Functions, Expressions and Operators
[ESE-2019]

Ans. (c)
Individual statements that are used in a program in a High-Level Language (HLL) are called statements, and a programming statement nearly in all high-level programming languages (say Application Programming Interfaces or APIs) includes keywords, operators and punctuation. While Machine Level Languages (MLLs) are binary based say Operating System (OS), High Level Languages (HLLs) say multiple Application Programs are based on Alpha-Numerals.

Objective Brain Teasers

Q.1 Which of the following technology was introduced in the development of third generation computers?
(a) Transistors (b) Vacuum tubes
(c) Integrated circuits (d) VLSI

Q.2 Under which one of the following category, does the programming language 'C' fall into?
(a) Assembly language
(b) Machine language
(c) High level language
(d) None of the above

Q.3 BASIC is abbreviated for
(a) Beginner's All-purpose Symbolic Instruction Code
(b) Beginner's All-purpose System Information Code
(c) Basic Algorithm Syntax Information Code
(d) Basic Algorithm System Instruction Code

Q.4 Which of the following function is performed by MIDI device?
(a) It is a method of machine reading characters made of magnetized particles.
(b) It converts graphical data into binary inputs.
(c) It is used for debugging.
(d) It is designed to transmit information between electronic musical instrument.

Q.5 Consider the following statements:
1. The control unit of the CPU is used to process and store data.
2. ALU of the CPU can perform both arithmetic as well as logic operations.

Which of the following statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these

Q.6 Consider the following statements:
1. A mainframe computer uses its power to execute a reliable volume of computations concurrently.
2. Super computer uses it power in executing a few programs as fast as possible.

Which of the following statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these

Q.7 Which of the following device uses laser beam technology to read and write data?
(a) Optical device (b) Magnetic device
(c) Flash device (d) Solid state device

Q.8 Consider the following statements regarding 'QR code':
1. It is abbreviated for 'Quick Response' code.
2. QR code can hold more than 100 times data than bar code and can also be digitally scanned.
3. QR code is used in inventory tracking, to shipping and logistics, online ticketing etc.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q.9 Which among the following memory has faster access time?
(a) RAM (b) ROM
(c) Cache memory (d) Register

Which of the following statements are correct?
(a) 1 only (b) 2 only
(c) 1 and 2 only (d) None of these

Q.28 Which of the following is the most common size of floppy disk drive?
(a) $2\frac{1}{2}$ inches (b) $3\frac{1}{2}$ inches
(c) $4\frac{1}{2}$ inches (d) $5\frac{1}{2}$ inches

Q.29 Which among the following is not a modifier keys in a keyboard?
(a) Ctrl (b) Alt
(c) Shift (d) Caps Lock

Q.30 Which of the following is not an application software?
(a) Page Maker (b) Windows NT
(c) Winword XP (d) MS Office

Q.31 Which of the following is a system software?
(a) Operating System (b) Compiler
(c) Utilities (d) All of the above

Q.32 The port which connects flat panel LCD monitors to the computer's high and video graphic card is
(a) Game port (b) Modem port
(c) DVI port (d) PS/2 port

Q.33 Consider the following statements regarding graphics tablet:
1. It is an output device.
2. Screens of graphics tablet are made of CRT monitors.
3. As of now, TFT and LCT is not compatible in graphics table.

Which of the following statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Q.34 SCSI is a method a hard disk can be connected to the mother board. It is abbreated for
(a) Small Computer System Interface
(b) System Code Small Interface
(c) System Connector Small Interface
(d) Specific Connector System Interface

Q.35 In which of the ROM category, contents can be erased using ultraviolet light?
(a) PROM (b) EPROM
(c) EEPROM (d) Flash EEPROM

Q.36 Which type of software can be easily modified and distributed by editing the program's source code?
(a) Shareware
(b) Freeware
(c) Open source software
(d) Utility software

Answers

1. (c)	2. (c)	3. (a)	4. (d)	5. (b)
6. (c)	7. (a)	8. (d)	9. (d)	10. (a)
11. (a)	12. (d)	13. (b)	14. (c)	15. (c)
16. (b)	17. (a)	18. (d)	19. (c)	20. (c)
21. (c)	22. (b)	23. (c)	24. (a)	25. (b)
26. (a)	27. (c)	28. (b)	29. (d)	30. (b)
31. (d)	32. (c)	33. (b)	34. (a)	35. (b)
36. (c)				

Explanations

1. Vacuum tubes: 1st gen; Transistors: 2nd gen; IC: 3rd gen; VLSI: 4th gen

5. The control unit communicates between ALU and memory. It does not process or store data.

12. Dot-matrix and Daisy-wheel are impact printers laser and inkjet are non-impact printers.

13. A non-impact printer places an image on a page without physically touching the screen.

21. Blu laser has shorter wavelength than red laser that is used for CD's. A single Blu-ray can hold upto 25 GB of data.

24. Semiconductory memory are used in primary storage.

30. Windows NT in a system software developed by microsoft.

33. Graphics tablet is an input device which screen is made of CRT.

■■■■