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ESE - 2027

UPSC MAINS EXAMINATION



ELECTRICAL ENGINEERING

Previous Years Conventional Questions with
Solutions, Subjectwise & Chapterwise

Paper-I (Conventional)

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Foreword

In UPSC Engineering Services, Conventional Papers have 54.5% weightage in the entire process of written test.

In Paper-I of Electrical Engineering six subjects are included as follows:

- | | |
|-------------------------------|---|
| 1. Engineering Mathematics | 2. Electrical Materials |
| 3. Electric Circuits & Fields | 4. Electrical & Electronic Measurements |
| 5. Computer Fundamentals | 6. Basic Electronics Engineering |



As Engineering Mathematics, Computer Fundamentals and Basic Electronics Engineering are included from ESE-2017, few expected model questions are added in this booklet. The following approach is advisable to secure maximum marks.

- The solution to any question shall have the following appropriate steps generally. Steps will also have due weightage.
 - (a) The data given
 - (b) The appropriate figure, if applicable, with parts labeled properly
 - (c) The concept on which the problem is being solved
 - (d) The relevant formulae with standard notations and abbreviations. Incase the paper setter asks to solve the question from the fundamentals, necessary derivations shall be done. Otherwise 70% of marks one has to lose. If the question carries more marks like 10 to 20 marks detailed analysis is compulsory to score high. If the question carries less marks (<8) the formulae with abbreviations and concept may be sufficient. In any case, the assumptions made shall be written clearly while solving a problem.
- The neatness and presentation of solutions will have 5% marks.
- Using short sentences and brevity in expressing the content is appreciated.
- Practice of numerical problems using calculator is very much essential instead of reading merely.
- **Try to understand and practice the solutions keeping in view QCAB (Questions cum Answer Booklet) format**

The solutions are prepared with utmost care. In spite of this there may be some typographical mistakes or improper sequence. The student is requested to inform us regarding errors, if any to aceenggpublications@gmail.com. ACE Engineering Publications will be grateful in this regard.

Thanks to all the professors who co-operated in the preparation of this booklet. Thanks to the Academic Assistants and Data Entry section in the design of this booklet.

With best wishes to all those who wish to go through the following pages.

Y.V. Gopala Krishna Murthy,
M Tech. MIE,
Chairman & Managing Director,
ACE Engineering Academy,
ACE Engineering Publications,
Frost Interactive Service Pvt. Ltd. (ACE ONLINE).

Syllabus for Electrical Engineering (EE)

1. **Engineering Mathematics:** Matrix theory, Eigen values & Eigen vectors, system of linear equations, Numerical methods for solution of non-linear algebraic equations and differential equations, integral calculus, partial derivatives, maxima and minima, Line, Surface and Volume Integrals. Fourier series, linear, nonlinear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.
2. **Electrical Materials:** Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials – basics, properties and applications; ferrites, ferro-magnetic materials and components; basics of solid state physics, conductors; Photo-conductivity; Basics of Nano materials and Superconductors.
3. **Electric Circuits and Fields:** Circuit elements, network graph, KCL, KVL, Node and Mesh analysis, ideal current and voltage sources, Thevenin's, Norton's, Superposition and Maximum Power Transfer theorems, transient response of DC and AC networks, Sinusoidal steady state analysis, basic filter concepts, two-port networks, three phase circuits, Magnetically coupled circuits, Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions, Ampere's and Biot-Savart's laws; inductance, dielectrics, capacitance; Maxwell's equations.
4. **Electrical and Electronic Measurements:** Principles of measurement, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basics of sensors, Transducers, basics of data acquisition systems.
5. **Computer Fundamentals:** Number systems, Boolean algebra, arithmetic functions, Basic Architecture, Central Processing Unit, I/O and Memory Organization; peripheral devices, data representation and programming, basics of Operating system and networking, virtual memory, file systems; Elements of programming languages, typical examples.
6. **Basic Electronics Engineering:** Basics of Semiconductor diodes and transistors and characteristics, Junction and field effect transistors (BJT, FET and MOSFETS), different types of transistor amplifiers, equivalent circuits and frequency response; oscillators and other circuits, feedback amplifiers.

Weightage of Subjects in Engineering Services Examination

Electrical Engineering (2022 - 2026)

PAPER - I (Conventional)

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S.No.	Name of the Subject	2022	2023	2024	2025	2026
01	Engineering Mathematics	72	104	92	70	84
02	Electrical Materials	66	64	52	52	52
03	Electric Circuits and Fields	106	116	96	116	76
04	Electrical & Electronic Measurements	102	92	100	92	112
05	Computer Fundamentals	64	32	56	66	72
06	Basic Electronics Engineering	72	72	84	84	84
Total Marks		480	480	480	480	480

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