Electrical Engineering

Examination

Coverage of the Electrical Engineering Exam

The Electrical Engineering Exam questions will cover the following areas:

#	Area	Number of Questions
1	**Fundamentals of Electrical Circuits**	8 or 9 questions
2	**Fundamentals of Electromagnetism**	8 or 9 questions
3	**Electrical machines and Power Systems**	8 or 9 questions
4	**Electronics**	8 or 9 questions
5	**Fundamentals of Communication**	8 or 9 questions
6	**Control System Fundamentals**	8 or 9 questions
	Total	50 questions

The exam covers the six areas mentioned above (8 or 9 questions from each area).

The topics covered in the Electrical Engineering Exams are listed below.

Fundamentals of Electrical Circuits:

- Circuit variables and elements
- Circuit laws and simple resistive circuits
- Inductance and Capacitance
- Responses of RL, RC and RLC Circuits
- AC network analysis
- Sinusoidal Steady-State Analysis
- AC power Calculations
- Power factor correction

Fundamentals of Electromagnetism:

- Electrostatic Fields in Material Space
- Magneto static Fields
- Inductance and Capacitance
- Maxwell's Equations and Electromagnetic Waves
- Electromagnetic Wave Propagation

Electrical machines and Power Systems:

- Electro-mechanical energy conversion
- Single and three-phase circuits
- DC motors and generators
- Transformers
- AC machines
- Synchronous machines
- Induction motors
- AC power and the per unit system
- Transmission line models in the transient and the steady state,
- Basics of Power system modeling

Electronics:

- Operational amplifiers characteristics and configurations

- Diodes characteristics and circuits

- Field Effect Transistors (FET) and bipolar junction transistors (BJT) characteristics

- Biasing

- Large/small signal models

- High and low frequency responses of amplifiers

- Data conversion and oscillator circuits.

- Basics of Digital logic circuits

Fundamentals of Communication:

- Convolution

- Signal transmission and channel characterization

- Fourier series and transform

- AM modulation and demodulation

- FM Modulation and demodulation

- Behavior of analog communication systems in the presence of noise

- Basics of digital communication systems.

Control System Fundamentals:

- Introduction to control systems

- Transfer functions

- Block diagrams

- Time responses

- Performance specifications of control systems

- Stability and the Routh-Hurwitz criterion

- Basic control actions and response of control systems

- Root Locus and Bode plots

Sample Questions of the Electrical Engineering Exam

Q1. What is the equivalent impedance of the following circuit:

- **A.** $10+j3 \ \Omega$
- **B.** $10 - j3 \ \Omega$
- **C.** $10 - j \ \Omega$
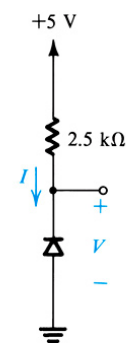- **D.** $10 + j4 \ \Omega$

w=200 rad/s
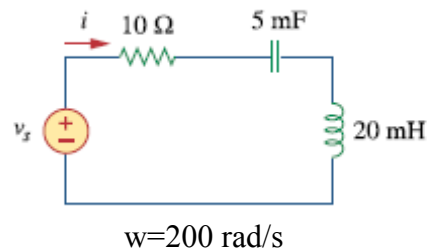
Q2. Most of the loads in power systems are:

- A. Capacitive Loads
- B. Inductive Loads
- C. Resistive Loads
- D. Zero power factor loads

Q3. For the circuit shown in the figure, the diode has an ON voltage of $V_D = 0.7$ Volt, then

- A. $V = 0.7$ Volt and $I = 1.72$ mA
- B. $V = 5$ Volt and $I = 0$ A
- C. $V = 0$ Volt and $I = 2$ mA
- D. $V = -0.7$ Volt and $I = -1.72$ mA

Q4. If an electromagnetic wave is incident on a perfect conductor, then the wave would be

- A. Totally absorbed
- B. Totally reflected
- C. Totally transmitted
- D. Partially transmitted

Q5. The wave $E(t) = A \sin (\omega_c t + m(t))$ is under

    A.   Amplitude modulation

    B.   Frequency modulation

    C.   No modulation

    D.   All the above

Q6. Consider the system depicted in the following block diagram. The signal *r* is the reference signal for the output y. The closed-loop transfer function of the system is:
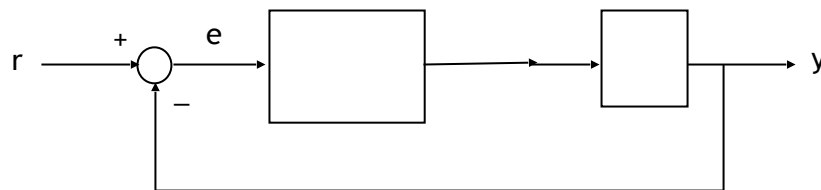
    A. $\dfrac{5}{s(s+4)}$

    B. $\dfrac{5K}{s(s+4)}$

    C. $\dfrac{5K}{s^2 + 4s + 5K}$

    D.   None of the above

Recommended References the Electrical Engineering Exam

The following references are suggested for the Electrical Engineering Exam.

1. J. Nilsson and S. Riedel, "Electric Circuits" 9th edition, Addison Wesley, 2011.

2. M. N. O. Sadiku, "Elements of Electromagnetics", 6th edition, Oxford University Press, 2011

3. E. Fitzgerald, C. Kingsley and S. D Umans, "Electric Machinery", 6th edition, Mc-Graw-Hill Higher Education, 2002.

4. S. Chapman, "Electric Machinery Fundamentals", 4th edition, McGraw-Hill, 2005.

5. A. S. Sedra and K. C. Smith, "Microelectronic Circuits" 7th edition, Oxford University Press, 2015.

6. B. P. Lathi and Z. Ding, "Modern Digital and Analog Communication Systems", 4th edition, Oxford University Press, 2009.

7. N. S. Nise, "Control Systems Engineering", 7th edition, John Wiley & Sons, 2015.