**ENGINEERS AND GEOSCIENTISTS BC**

2016 ELECTRICAL ENGINEERING SYLLABUS

For Self-Evaluation

N**ame: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ User ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

***For directions refer to the*** [***Instructions for Completing Syllabus and Course Descriptions***](https://www.apeg.bc.ca/getmedia/8fbcf379-28d9-4639-bafd-bb3df83f225d/APEGBC-Guide-to-Completing-Syllabus-and-Course-Description-1.pdf.aspx)***.***

***Please save as a PDF document and upload via your applicant portal.***

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| **Exam Number** | **Exam Name** | **Applicant’s Self-Evaluation - Course Equivalent Code** | **Page Number Reference** | **For Office Use Only** |
| *Basic Studies (4 Required)* | | | | |
| 04-BS-1 | Mathematics |  |  | Full Credit  No Credit  Comments: |
| 04-BS-2 | Probability and Statistics |  |  | Full Credit  No Credit  Comments: |
| 04-BS-4 | Electric Circuits and Power |  |  | Full Credit  No Credit  Comments: |
| 04-BS-9 | Basic Electromagnetics |  |  | Full Credit  No Credit  Comments: |
| *Basic Studies (4 required)* | | | | |
| 04-BS-3 | Statics and Dynamics |  |  | Full Credit  No Credit  Comments: |
| 04-BS-5 | Advanced Mathematics |  |  | Full Credit  No Credit  Comments: |
| 04-BS-6 | Mechanics of Materials |  |  | Full Credit  No Credit  Comments: |
| 04-BS-7 | Mechanics of Fluids |  |  | Full Credit  No Credit  Comments: |
| 04-BS-8 | Digital Logic Circuits |  |  | Full Credit  No Credit  Comments: |
| 04-BS-10 | Thermodynamics |  |  | Full Credit  No Credit  Comments: |
| 04-BS-11 | Properties of Materials |  |  | Full Credit  No Credit  Comments: |
| 04-BS-15 | Engineering Graphics and Design Process |  |  | Full Credit  No Credit  Comments: |
| 04-BS-16 | Discrete Mathematics |  |  | Full Credit  No Credit  Comments: |
| *Group A (7 required)* | | | | |
| 16-Elec-A1 | Circuits |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A2 | Systems and Control |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A3 | Signals and Communications |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A4 | Digital Systems and Computers |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A5 | Electronics |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A6 | Power Systems and Machines |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-A7 | Electromagnetics |  |  | Full Credit  No Credit  Comments: |
| *Group B (2 Required)* | | | | |
| 16-Elec-B1 | Digital Signal Processing |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B2 | Advanced Control Systems |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B3 | Digital Communications Systems |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B4 | Information Technology Networks |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B5 | Advanced Electronics |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B6 | Integrated Circuit Engineering |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B7 | Power Systems Engineering |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B8 | Power Electronics and Drives |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B9 | Electromagnetic Field, Transmission Lines, Antennas, and Radiation |  |  | Full Credit  No Credit  Comments: |
| 16-Elec-B10 | Electro-Optical Engineering |  |  | Full Credit  No Credit  Comments: |
| *Complementary Studies (All Required)* | | | | |
| 11-CS-1 | Engineering Economics |  |  | Full Credit  No Credit  Comments: |
| 11-CS-2 | Engineering in Society – Health and Safety |  |  | Full Credit  No Credit  Comments: |
| 11-CS-3 | Sustainability, Engineering and the Environment |  |  | Full Credit  No Credit  Comments: |
| 11-CS-4 | Engineering Management |  |  | Full Credit  No Credit  Comments: |

# INTRODUCTION

The Canadian Engineering Qualifications Board of Engineers Canada issues the Examination Syllabus that includes a continually increasing number of engineering disciplines.

Each discipline examination syllabus is divided into two examination categories: compulsory and elective. A full set of Electrical Engineering examinations consists of nine, three-hour examination papers. Candidates will be assigned examinations based on an assessment of their academic background. Examinations from discipline syllabi other than those specific to the candidates’ discipline may be assigned at the discretion of the constituent association.

Before writing the discipline examinations, candidates must have passed, or have been exempted from, the Basic Studies Examinations.

Information on examination scheduling, textbooks, materials provided or required, and whether the examinations are open or closed book, will be supplied by the constituent association.

# ELECTRICAL ENGINEERING EXAMINATIONS GROUP A

**COMPULSORY EXAMINATIONS (SEVEN REQUIRED)**

**16-Elec-A1 Circuits**

Electric circuit components: lumped parameter models. Nodal and mesh analysis of linear, passive circuits; equivalent networks. Steady state analysis of lumped parameter, time- invariant circuits: differential equation formulation, sinusoidal inputs, frequency response, impulse response, and transfer functions. Laplace transform analysis and circuit transient response. Two-port circuit models and analysis.

# 16-Elec-A2 Systems and Control

System models, impulse response functions, and transfer functions. System input-output and convolution. Root locus analysis and design. Feedback and stability: Bode diagrams. Nyquist criterion, frequency domain design. State variable representation. Simple PID control systems. Systems with delay.

# 16-Elec-A3 Signals and Communications

Analysis of continuous-time signals: Fourier series and Fourier transform; magnitude, phase, and power spectra. Analysis of discrete-time signals: Nyquist sampling theorem; the Z- transform. Analog communication systems: amplitude and angle modulation and demodulation. Digital communication systems: digital modulation; and demodulation techniques.

# 16-Elec-A4 Digital Systems and Computers

Combinational, sequential, and synchronous logic circuits. Register level design of digital systems. Computer arithmetic, central processing unit, memory systems and peripherals. Embedded and higherlevel (e.g. C) programming, interrupts, and interfacing and communication. Computer architecture.

# 16-Elec-A5 Electronics

Semiconductor devices; diodes and thyristors. Bipolar and field effect transistors as linear devices and switches. Bias circuits, basic amplifiers, small-signal equivalent circuits, transfer functions, and frequency response. Operational amplifiers and comparators. Digital integrated circuits and logic families: CMOS.

# 16-Elec-A6 Power Systems and Machines

Magnetic circuits and transformers. Wye and delta connected three-phase systems. Generation, transmission, and distribution of electric power. Three-phase transformers. AC and DC machines. Three-phase synchronous machines and three phase induction motors.

# 16-Elec-A7 Electromagnetics

Field concepts. Maxwell's equations, integral and differential forms. Free space and guided wave propagation, transmission lines. Radiation from current elements.

# GROUP B

**ELECTIVE EXAMINATIONS (TWO REQUIRED)**

**16-Elec-B1 Digital Signal Processing**

Discrete-time signals and systems: system input-output and convolution, Z-transform and transfer functions. Discrete-time Fourier transform (DFT) and Fast Fourier transform (FFT). Design of finite impulse response (FIR) and infinite impulse response (IIR) filters. DSP implementation considerations.

# 16-Elec-B2 Advanced Control Systems

Modelling of engineering systems; state variables and transfer function representations. Analytical and numerical solutions of state variable equations. Observability, controllability, stability; classical design, stabilization by pole assignment. Systems with noise. Computer control, discrete systems. System identification; least squares.

# 16-Elec-B3 Digital Communications Systems

A/D conversion, source coding; signal sets, line codes, modulation, optimal reception, demodulation, performance in noisy channels, error detecting and correcting codes. Radio communications; link analysis and performance, terrestrial and satellite communications.

# 16-Elec-B4 Information Technology Networks

Layered architecture, circuit-switching networks, peer-to-peer protocols and data link layer, medium access control protocols, local area networks, packet-switching networks, cellular networks, and wireless networks.

# 16-Elec-B5 Advanced Electronics

Device models: circuit behaviour, high frequency, and feedback. Multi-stage amplifiers, oscillators, current mode op-amps, non-linear circuits. Power amplifiers and linear regulators. Instrumentation: differential amps, optical isolators, and analog-digital and digital-analog converters.

# 16-Elec-B6 Integrated Circuit Engineering

Integrated Circuit Design: MOS circuit design methods; specification; use of CAD design tools. Non-ideal effects. Mask level layout. Integrated Circuit Fabrication: basic knowledge of IC processing techniques. Digital and analog IC's: basic building blocks. Design considerations for submicron CMOS and bipolar devices.

# 16-Elec-B7 Power Systems Engineering

Power system representation and analysis. Components: power transmission lines, transformers, synchronous machines. Distribution: power flow, operations, and control. Fault analysis and power system protection. System stability.

# 16-Elec-B8 Power Electronics and Drives

Principles and modelling of electric machines: dc machines, induction machines, and synchronous machines. Power electronic devices and converters: choppers, inverters, cycloconverters, and switched power supplies. Electric drives: torque and speed control, and field and vector oriented control techniques.

# 16-Elec-B9 Electromagnetic Field, Transmission Lines, Antennas, and Radiation

Field radiation equations. Distributed circuits: steady-state transmission line equations; impedance transformation, Smith charts, matching. Transients. Coaxial lines, waveguides. Antennas: infinitesimal elements, linear antennas, radiation resistance, antenna patterns, gain.

# 16-Elec-B10 Electro-Optical Engineering

Optical transmission: waveguide modes, fibre optic propagation characteristics. Optoelectronics: lasers, sources and detectors, couplers, modulators, guided wave devices. Applications.

***NOTE: Please feel free to use the most recent edition of textbooks referenced in this list***  ***NOTA : Utilisez l’édition la plus récente des manuels cités dans cette liste.***

# GROUP A

# 16-Elec-A1 Circuits

Nilsson, James W. and Susan Riedel, Electric Circuits, latest edition. Prentice Hall. Alexander, Charles and Mathew Sadiku, Fundamentals of Electric Circuits, latest edition. McGraw Hill.

Schwarz and Oldham, Electrical Engineering: An Introduction, latest edition. Oxford University Press.

# 16-Elec-A2 Systems and Control

Dorf, Richard C. and Robert H. Bishop, Modern Control Systems, latest edition. Addison- Wesley.

Nise, Norman S., Control Systems Engineering, latest edition, Wiley.

# 16-Elec-A3 Signals and Communications

Haykin, Communication Systems, latest edition, John Wiley & Sons Canada Ltd.

Or

Haykin, Simon & Michael Moher, Introduction to Analog and Digital Communication Systems, latest edition, John Wiley & Sons.

Lathi, B.P., Signal Processing and Linear Systems. Oxford University Press.

Or

Haykin, Simon & Barry Van Veen, Signals and Systems, Interactive Solutions Edition, latest edition, John Wiley & Sons Canada Ltd.

# 16-Elec-A4 Digital Systems and Computers

Brey, Barry, The Motorola Microprocessor Family: 68000, 68008, 68010, 68020, 68030, and 68040: Programming and Interfacing with Applications. Saunders College Publishing.

# 16-Elec-A5 Electronics

Sedra and Smith, Microelectronic Circuits, latest edition. Oxford University Press.

# 16-Elec-A6 Power Systems and Machines

Chapman, Stephen, Electric Machinery and Power System Fundamentals, McGraw Hill.

Wildi, Theodore, Electrical Machines, Drives, and Power Systems, latest edition, Prentice Hall.

# 16-Elec-A7 Electromagnetics

Hayt, William H. and John A. Buck, Engineering Electromagnetics. McGraw Hill.

# GROUP B

# 16-Elec-B1 Digital Signal Processing

Ifeachor, Emmanuel, and Barrie Jervis, Digital Signal Processing, a Practical Approach, latest edition. Prentice Hall.

Mitra, Sanjit, Digital Signal Processing, a Computer-Based Approach, latest edition. McGraw Hill.

# 16-Elec-B2 Advanced Control Systems

Dutton, Ken, Steve Thompson, and Bill Barraclough, The Art of Control Engineering. Prentice Hall.

Nise, Norman, Control Systems Engineering. John Wiley.

# 16-Elec-B3 Digital Communications Systems

Couch, Leon W., Digital and Analog Communication Systems, latest edition. Prentice Hall.

Lathi, B. P., Modern Digital and Analog Communication Systems, latest edition. Oxford University Press.

Sklar, Bernard, Digital Communications Fundamentals and Applications, latest edition, Prentice Hall.

# 16-Elec-B4 Information Technology Networks

Leon-Garcia, Alberto, and Indra Widjaja, Communication Networks, latest edition. McGraw-Hill.

Freeman, Roger L., Telecommunication System Engineering, latest edition. John Wiley & Sons Canada, Ltd.

Rappaport, Theodore S., Wireless Communications: Principles and Practice, latest edition. Prentice Hall.

# 16-Elec-B5 Advanced Electronics

Sedra and Smith, Microelectronic Circuits, latest edition. Oxford University Press.

Horowitz, Paul, and Winfield Hill, The Art of Electronics, latest edition. Cambridge University Press.

# 16-Elec-B6 Integrated Circuit Engineering

Rabaey, Jan A., Anantha Charndrakasan and Borivoje Nikolic, Digital Integrated Circuits, latest edition. University of California, Berkeley, Prentice-Hall.

# 16-Elec-B7 Power Systems Engineering

Glover, J. Duncan, and Mulukutla Sarma, Power System Analysis and Design, latest edition. Thomson Lerning.

Grainger, John and William Stevenson Jr., Power System Analysis. McGraw Hill.

# 16-Elec-B8 Power Electronics and Drives

Rashid, Muhammad H., Power Electronics: Circuits, Devices and Applications, latest edition. Prentice-Hall.

Mohan, N, Undeland, T, Robbins, W, Power Electronics – Converters, Applications, and Design. John Wiley.

Sen, P C., Principles of Electric Machines and Power Electronics, latest edition. Wiley.

# 16-Elec-B9 Electromagnetic Field, Transmission Lines, Antennas, and Radiation

Ulaby, Farwwaz, Fundamentals of Applied Electromagnetics, latest edition. Prentice Hall,.

# 16-Elec-B10 Electro-Optical Engineering

Yariv, Amnon, and Pochi Yeh, Photonics: Optical Electronics in Modern Communication, latest edition. Oxford University Press.