ENGINEERS AND GEOSCIENTISTS BC

2017 COMPUTER ENGINEERING SYLLABUS

For Self Evaluation

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 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** | **Page Number Reference** | **For Office Use Only** |
| ***Basic Studies (6 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-5 | Advanced Mathematics |  |  | Full Credit No Credit  Comments |
| 04-BS-8 | Digital Logic Circuits |  |  | Full Credit No Credit  Comments |
| 04-BS-9 | Basic Electromagnetics |  |  | Full Credit No Credit  Comments |
| ***Basic Studies (2 required)*** | | | | |
| 04-BS-3 | Statics and Dynamics |  |  | 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-10 | Thermodynamics |  |  | Full Credit No Credit  Comments |
| 04-BS-11 | Properties of Materials |  |  | Full Credit No Credit  Comments |
| ***Group A (6 required)*** | | | | |
| 17-Comp-A1 | Electronics |  |  | Full Credit No Credit  Comments |
| 17-Comp-A2 | Digital Systems Design |  |  | Full Credit No Credit  Comments |
| 17-Comp-A3 | Computer Architecture |  |  | Full Credit No Credit  Comments |
| 17-Comp-A4 | Program Design and Data Structures |  |  | Full Credit No Credit  Comments |
| 17-Comp-A5 | Operating Systems |  |  | Full Credit No Credit  Comments |
| 17-Comp-A6 | Software Engineering |  |  | Full Credit No Credit  Comments |
| ***Group B (3 Required)*** | | | | |
| 17-Comp-B1 | Advanced Computer Architecture |  |  | Full Credit No Credit  Comments |
| 17-Comp-B2 | Principles of VLSI |  |  | Full Credit No Credit  Comments |
| 17-Comp-B3 | Data Bases and File Systems |  |  | Full Credit No Credit  Comments |
| 17-Comp-B4 | Computer Graphics |  |  | Full Credit No Credit  Comments |
| 17-Comp-B5 | Computer Communications |  |  | Full Credit No Credit  Comments |
| 17-Comp-B6 | Computer Control and Robotics |  |  | Full Credit No Credit  Comments |
| 17-Comp-B7 | Digital Signal Processing |  |  | Full Credit No Credit  Comments |
| 17-Comp-B8 | Computer Integrated Manufacturing |  |  | Full Credit No Credit  Comments |
| 17-Comp-B9 | Artificial Intelligence and Expert Systems |  |  | Full Credit No Credit  Comments |
| 17-Comp-B10 | Distributed Systems |  |  | Full Credit No Credit  Comments |
| 17-Comp-B11 | Advanced Software Design |  |  | Full Credit No Credit  Comments |
| 17-Comp-B12 | Computer Security |  |  | Full Credit No Credit  Comments |
| 17-Comp-B13 | Mechatronic Design |  |  | 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 |

**COMPUTER ENGINEERING EXAMINATION**

**GROUP A**

**COMPULSORY EXAMINATIONS (6 REQUIRED)**

**17-Comp-A1 Electronics**

Devices: circuit models and characteristics. Integrated circuits. Diodes, rectifiers, and wave shaping networks. Field effect and bipolar transistors: small-signal and AC analysis. Single-stage amplifier design. Operational amplifiers and applications. Large-signal analysis, wave shaping and bistable circuits including multivibrators, triggers, and waveform generators. Digital electronics including basic logic gates and memory elements. Hybrid analog/digital devices including A/D and D/A converters.

**17-Comp-A2 Digital Systems Design**

Boolean algebra. Design of combinatorial and sequential logic. Implementation using simple gates. Programmable logic devices and gate arrays. Characteristics of digital integrated circuit families. Analysis and design for controllers, processors, and memories. Microprocessors, including components, data flow, signals, and timing. Small system design, interconnection of associated devices. Computer interfacing, including parallel and serial I/O, interrupts and DMA. Common bus structures.

**17-Comp-A3 Computer Architecture**

Architecture, programming and I/O. Computer structure and typical processor architecture. CPU and memory organization, buses. Characteristics of I/O and storage devices. Processing unit and controller design, hardwired and microprogram control. Instruction sets and addressing modes; assembly language programming, I/O and interrupt servicing.

**17-Comp-A4 Program Design and Data Structures**

Programming language syntax and semantics. Design of structured and modular programs in a high level language (C, C++). Basics of object-oriented programming: classes. Non-numerical processing. Design and construction of programs involving structured data: arrays, stacks, queues, lists, trees, and records.

**17-Comp-A5 Operating Systems**

Operating system principles, components, and programming. Design and implementation of operating systems. Synchronization of concurrent processes, resource allocation, scheduling, protection, and privacy. Data, task, and job management: loading, linking; I/O control. Multi-core, multithreading and multiprocessing. Virtualization, hypervisors and containers. Real-time aspects. Basic characteristics of modern operating systems: unix, Windows.

**17-Comp-A6 Software Engineering**

Software cycles and requirements analysis. Design, implementation, test, verification and validation, documentation, quality assurance, control and life-cycle management of correct, reliable, maintainable, and cost effective software. Current design methodologies, including modularization, graphical design tools, design in high-level languages, and data flow driven designs. Planning and management of software projects. Software maintenance and configuration management.

**GROUP B**

**ELECTIVE EXAMINATIONS (3 REQUIRED)**

**17-Comp-B1 Advanced Computer Architecture**

Architecture of high speed workstation and personal processors and systems. Instruction set design for pipelined machines. Caches. Multiple processor architectures, highly parallel machines, systolic arrays, neural networks, multitasking machines, real-time systems, interconnection of multiple processor systems. Architectures for specialized purposes, array processors, vector processors. Virtual machines. Embedded systems and control.

**17-Comp-B2 Principles of VLSI**

Very large scale integrated circuits. Fabrication processes in CMOS and BICMOS. Simplified design rules. Design methodology. Static and dynamic logic, multiphase clocking. Memory elements and memory structures. Gate arrays and standard cell technology; placement and routing. Programmable logic devices. I/O devices. Testing.

**17-Comp-B3 Data Bases and File Systems**

Concepts and structures for design and implementation of data bases and file systems. Data models, data normalization, data description languages, query facilities, data integrity and reliability, concurrency. Data bases: hierarchical, network and relational databases; data organization. Relational query languages: relational algebra and calculus, SQL. Relational database design. Transaction processing, query processing, reports. Security and integrity; concurrency control. File organization: sequential, indexed and direct access, multiple key, and hashing. File processing: records, files, compaction. Sorting, merging and updating files. Algorithms for inverted lists, multilist, indexed sequential and hierarchical structures. File I/O: control, utility, space allocation, and cataloguing. Index organization.

**17-Comp-B4 Computer Graphics**

Hardware and software systems for graphics. Input and output devices, display devices. Techniques for describing and generating image. Object modeling and display techniques. Transformations in two and three dimensions: scaling, translation, rotation, clipping and windowing. Visual realism: perspective, visibility, hidden surface elimination, illumination, shading and rendering. Graphic software and data structures, display data structures and procedures, efficient algorithms. Graphic standards such as GKS, PHIGS, TIGA, and X-windows.

**17-Comp-B5 Computer Communications**

Data communications, including signals, modulation and reception. Error detecting and correcting codes. Including circuit and packet switching. Multiplexing, including time, frequency and code division multiplexing. Digital networks, including ISDN, frame relay and ATM. Protocols: the ISO/OSI reference model, X.25. Internetworking and router-based networks: the TCP/IP suite of protocols, routing and flow control, Internet addressing and domain names. Local area networks, topologies, access schemes, medium access and logic layers; CSMA/CD and token ring protocols; segmented and hubbed LANs.

This syllabus requires knowledge of linear systems as described in 16-Elec-A1.

**17-Comp-B6 Computer Control and Robotics**

Discrete-time and quantized data control systems. Z-transform and state space methods. Principles of digital control. Digital controllers and components. Controller software. Industrial and robotic systems. Descriptions of 3D space, geometry of robotics manipulators. Transducers and interfacing.

This syllabus requires knowledge of linear systems as described in 16-Elec-A1.

**17-Comp-B7 Digital Signal Processing**

Theory of discrete-time linear systems. Digital filtering. Discrete Fourier analysis. Application to voice and image processing, communications, etc. Hardware for digital signal processing, including digital signal processors.

This syllabus requires knowledge of linear systems as described in 16-Elec-A1.

**17-Comp-B8 Computer Integrated Manufacturing**

The integration of mechanical, electronic and informational components in manufacturing. Hierarchical and distributed computer control, including hardware and software. Collecting, controlling, processing and disseminating data. Sensors and tool control, station control. “Factory floor” local area networks and protocols; manufacturing data bases. Process design and operation. CAD/CAM, manufacturing resource planning, and numerical control.

**17-Comp-B9 Artificial Intelligence and Expert Systems**

Concepts of artificial intelligence. Overview of knowledge-based and expert systems. Logic programming. Programming languages (LISP and Prolog) for AI and expert system implementation. Knowledge representation. Rule-based and object-based systems.

**17-Comp-B10 Distributed Systems**

Characteristics of distributed systems. Networked vs. centralized systems. Fundamental concepts and mechanisms. Client-server systems. Process synchronization and interprocess communications. Principles of fault tolerance. Transaction processing techniques. Distributed file systems. Operating systems for distributed architectures. Security.

**17-Comp-B11 Advanced Software Design**

The design and programming aspects of the construction of large software systems. Advanced object-oriented design. Language support for modular programming, visual programming systems, GUI design and implementation.

**17-Comp-B12 Computer Security**

Types of threats, terminology, network basics, internet fraud, theft, cyber stalking, DoS attacks, malware, hacking, industrial espionage, encryption and cryptography, security technology: accvess control, virus scanners, firewalls, IDS, certificates, SSL/TLS, VPN, Wi-fi security; security policies; forensics.

**17-Comp-B13 Mechatronic Design**

Microprocessors microcontrollers, architectures, programming languages, embedded software and event-driven control, software design, communications and protocols, peripherals: sensors and interface circuits.

**Computer Engineering Reference List 2017**

***NOTE: Please feel free to use the most recent edition of textbooks referenced in this list***

**17-Comp-A1 Electronics**

Sedra & Smith, Microelectronic Circuits, seventh edition

# 17-Comp-A2 Digital Systems Design

Roth, Fundamentals of Logic Design, 7th edition

Thorne, Computer Organization and Assembler Language Programming for the IBM PC and Compatibles, Addison-Wesley.

# 17-Comp-A3 Computer Architecture

William Stallings, Computer Organization and Architecture, 10th Edition, Pearson

Hayes, Computer Architecture and Organization, 2nd Edition, McGraw-Hill

Hennessy & Patterson, Computer Architecture: A Quantitative Approach, 2nd Edition

# 17-Comp-A4 Program Design and Data Structures

Carrano and Henry, Data Abstraction and Problem Solving with C++, seventh edition

Deitel & Deitel, C++: How to Program, tenth edition

Weiss, Data Structures and Algorithm Analysis in C++, fourth ed.

Addison-Wesley Hanley, Essential C++ for Engineers and Scientists

Wiley Wunder & Roberts, Developing Java Software

# 17-Comp-A5 Operating Systems

Suberschatz & Galvin, Operating System Concepts, 9th Edition

Addison-Wesley Tanenbaum, Modern Operating Systems

Stallings, Operating Systems Internals and Design Principles, 8th ed.

# 17-Comp-A6 Software Engineering

Sommerville, Software Engineering, 10th Edition

Pressman, Software Engineering: A Practitioners Approach, 8thEdition, McGraw-Hill

# 17-Comp-B1 Advanced Computer Architecture

Hennessy and Patterson, Computer Architecture: A Quantitative Approach, 5th ed, Morgan Kaufmann

# 17-Comp-B2 Principles of VLSI

Chen, CMOS Devices and Technology for VLSI

Rabaey & Chandrakasan, Digital Integrated Circuits, 2ED, Pearson

Glasser & Dobberpuhl, The Design and Analysis of VLSI Circuits Jack & Denyer, Introduction to MOS LSI Design

# 17-Comp-B3 Data Bases and File Systems

Elmasri & Navathe, Fundamentals of Database Systems, 7th Edition

Connolly and Begg, Database Systems: A Practical Approach to Design, Implementation and

Management, 4th edition, Addison-Wesley

Date, An Introduction to Data Base Systems, 6th Edition

# 17-Comp-B4 Computer Graphics

Foley, van Dam, Feiner & Hughes, Computer Graphics: Principles and Practice, 2nd Edition, Addison-Wesley

# 17-Comp-B5 Computer Communications

Stallings, W., Data and Computer Communications, 10th Edition, Pearson

Wiley Comer, Internetworking with TCP/IP Volume I: Principles, Protocols, and Architecture

Kurose & Ross, Computer Networking: A Top-Down Approach, 7th ed, Pearson

Saadawi, Amman & El Hakeem, Fundamentals of Telecommunication Networks, Prentice-Hall

**17-Comp-B6 Computer Control and Robotics** Moudgalya, Digital Control, Wiley-Interscience

# 17-Comp-B7 Digital Signal Processing

Blandford and Parr, Introduction to Digital Signal Processing, Pearson

Strum & Kirk, First Principles of Discrete Systems and Digital Signal Processing

**17-Comp-B8 Computer Integrated Manufacturing**

Rehg & Kraebber, Computer Integrated Manufacturing, 3rd ed, Pearson

**17-Comp-B9 Artificial Intelligence and Expert Systems**

Winston, Artificial Intelligence

# 17-Comp-B10 Distributed Systems

Tanenbaum & Van Steen, Distributed Systems: Principles and Paradigms, Pearson

Shuey, R.L., Spooner, D.L., and Frider, O., The Architecture of Distributed Computer Systems,

Addison-Wesley

Mullender, S. (Editor), Distributed Systems, 2nd Edition, Addison-Wesley

**17-Comp-B11 Advanced Software Design**

Dasgupta & Dimitriou, Algorithms, McGraw-Hill

# 17-Comp-B12 Computer Security

Bishop, Introduction to Computer Security, Addison-Wesley

Easttom, Computer Security Fundamentals, third edition

Anderson, Security Engineering, second ed,<https://www.cl.cam.ac.uk/~rja14/book.html>

**17-Comp-B13 Mechatronic Design**

Carryer et al, Introduction to Mechatronic Design, Pearson