

## 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 Industrial 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.

## INDUSTRIAL ENGINEERING EXAMINATIONS

### GROUP A

#### COMPULSORY EXAMINATIONS (SIX REQUIRED)

##### **17-Ind-A1 Operations Research**

Formulation and solution of prototype models of allocation, production and inventory control, scheduling, queuing, replacement and routing. Decision analysis value. Linear programming problems: simplex method, duality and sensitivity analysis; solution of transportation, transshipment and assignment problems, integer programming problems and their solution by Branch and Bound. Network problems: shortest route, spanning tree, maximal and minimal flow problems, C.P.M. and P.E.R.T. methods. Discrete and continuous dynamic programming. Simulation techniques. Elementary stochastic processes. Heuristics for combinatorial optimization problems.

##### **17-Ind-A2 Analysis and Design of Work**

Methods of work analysis, including process analysis, activity charts, person machine charts, operation analysis, micromotion study, fundamental hand motions and film analysis. Principles of motion economy, method study, motion and time study, rating factor, performance factor, allowances and standard data. Pre-determined motion time systems. Work sampling. Wage payment. Motivation and work. Wage incentives. Job enrichment. Software available in the field of analysis and design of work.

##### **17-Ind-A3 Facilities Planning**

Strategic planning, site selection, product, process, schedule, activity relationship and space requirements, personnel requirements. Developing solutions, including material handling systems and equipment, layout and computer aided layout. Functions, including receiving and shipping, storage and warehousing, production, offices and services. Evaluating solutions, including deterministic and

probabilistic models. Selection, implementation, and periodical review of the layout. Safety and relevant environmental considerations

#### **17-Ind-A4 Production Management**

Production systems, including identification of technical, economic, social, human components and characteristics in the system. Forecasting techniques. Inventories, including role, measuring service level, inventory models and their application in distribution and manufacturing. Aggregate planning of production levels and inventories, including master plan, materials requirements planning (MRP), detailed scheduling and sequencing, assembly line balancing. Information and control systems for production operations. Project planning and control.

#### **17-Ind-A5 Quality Planning, Control, and Assurance**

Basic concepts: planning, measurement, control, and improvement of quality. Economics of quality. Strategic planning of quality. Total quality management. Quality function organization. Motivation for quality. Statistical tools: tests, regression analysis, design and analysis of planned experiments, Taguchi methods, control charts for variables and attributes, capability analysis, acceptance sampling: single, multiple, sequential, MILSTD105 E, MILSTD 414, elements of reliability. Quality assurance: ISO/QS 9000, suppliers, audits, quality manual, certification.

#### **17-Ind-A6 Systems Simulation**

Computer simulation of systems. Design of simulation models of discrete systems. Statistical foundations and methodology. Generation of random variants. Design of simulation experiments. Simulation programming languages. Applications: the analysis and design of systems for production and distribution. Model verification and validation. Simulation output analysis. Selection and use of software.

**GROUP B****ELECTIVE EXAMINATIONS (THREE REQUIRED)****17-Ind-B1 Applied Probability and Statistics**

Basic concepts of probability, transformations of random variables and moment generating functions. Joint and conditional distributions for discrete and continuous random variables, correlation and expectation of a function of several random variables. Sums of random variables, convolutions and central limit theorem. Reliability, maintenance and repair, replacement, inventory, and other applications. Statistical methods: hypothesis testing, T and F tests, and nonparametric tests. Estimation of parameters. Analysis of variance in one way classifications with fixed effects. Linear regression with one or two independent variables. Goodness of fit tests.

**17-Ind-B2 Manufacturing Processes**

Fabricating characteristics of metals and plastics. Molding, forging, welding principles and operations, jigs and fixtures. Cold-forming and stamping, turning and related operations, other machining operations and related jigs and fixtures. Metrology. Numerical control machines and applications. Process quality control.

**17-Ind-B3 Computer Aided Design and Computer-Assisted Manufacturing**

Fundamental concepts in design and manufacturing automation strategies, high volume discrete parts production systems, numerical control of manufacturing systems, computer aided manufacturing (CAM), support systems for manufacturing, group technology, and flexible manufacturing systems. Effect of the use of computerized design aids and numerically or robotically controlled machines.

**17-Ind-B4 Design of Information Systems**

Analysis of existing systems and general design. The role of information for the control and management of integrated production systems. Concepts of information, humans as information processors, nature and value of information for decision-making, economics of sampling, structure of management information systems, hardware, software and control environments of information processing systems, transaction processing systems, data-base systems, organizational structure and management information systems, development and evaluation of management information systems, distributed systems, computer networks, data communications. Data acquisition and transmission. Economic evaluation.

**17-Ind-B5 Ergonomics**

Basic human abilities and characteristics, including vision and hearing. Psychomotor characteristics. Anthropometry: static and dynamic human body dimensions and muscle strength. Environmental factors, including illumination, atmospheric conditions, noise, and vibration. Ergonomic work design, including layout of equipment, manual work aids, design of seating, and person-machine interfaces: instruments, controls, and software. Regulated standards for work, safety and schedules.

**17-Ind-B6 Workplace Design**

System and human engineering analysis, the human as a system component, visual presentation of information, auditory and other sensory forms of information presentation, speech communication. Human machine dynamics, including data entry devices and procedures, design of the multi human machine dynamics. Layout of work places in order to maximize productivity, comfort, health and safety of employees, locating controls and displays, design for maintainability, training system design, training device design, human engineering tests and evaluation.

**17-Ind-B7 Financial and Managerial Accounting**

A study of financial and managerial accounting, including basic accounting concepts, measurements of income and balance sheet presentation. Accounting records and systems, including financial statement analysis, chartered accountant reports, and funds flow. Cost and management accounting, including standard cost and variance analysis, allocation and control of costs. Accounting in business decisions, including budgeting, cash flow forecasting, and planning.

**17-Ind-B8 Computer Integrated Manufacturing (CIM)**

Computerization in manufacturing. Manufacturing information systems. Hierarchical control. Just-in-time in the context of CIM. CIM Architecture: Networking OSI, LANS, WANS, MAP. Current technologies: operating systems, case technologies, artificial intelligence, databases. Product Information Management: CAD positioning; Design File Management; Hardware & software; Product Data Models; component, specifications, symbols. Typical Product Information Standards: PDES, IGES, EDIF; Data For Human Consumption. Case Studies.

**17-Ind-B9 Logistics: Transportation Aspects**

Introduction to transportation engineering, and transport planning and economics. Modeling of transportation and warehousing problems. Characteristics of transportation systems: rail, highway, airway, waterway, and pipeline. The rural and intercity transport system in Canada; cost and tariffs. Network analysis; the transport planning process. Logistics and competitiveness: evaluation of transportation projects and systems, urban transportation analysis and prediction, traffic studies, highway and intercity capacity, characteristics of traffic flow, traffic control principles, and economics.

**17-Ind-B10 Workplace Health and Safety**

Fundamentals of systems safety. Safety and accident prevention — causes and models. Safety in product and process design. Fault-tree analysis and risk assessment. Occupational diseases, stress, fatigue. Health, safety and the physical environment. Engineering methods of controlling chemical hazards, safety and the physical environment: engineering methods of controlling chemical and physical hazards. Code and regulations for worker safety and health.