REDLINES INDICATE CHANGES FROM PREVIOUS SYLLABUS

Industrial engineering examinations

CEQB 2023

Group A - Compulsory examinations (six required)

23-Ind-A1 Operations Research

Formulation and solution of mathematical models of allocation, production and inventory control, scheduling, queuing, replacement, and routing: linear programming problems; simplex method; duality and sensitivity analysis; solution of transportation, transhipment 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; elementary stochastic processes; heuristics for combinatorial optimization problems.

Textbooks (most recent edition is recommended):

- W.L. Winston, Operations Research Applications and Algorithms, Duxbury Press.
- F. Hillier, Introduction to Operations Research, McGraw-Hill.

23-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.

Textbooks (most recent edition is recommended):

- A. Freivalds, B. Niebel, Niebel’s Methods, Standards, & Work Design, McGraw-Hill.

23-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

Textbooks (most recent edition is recommended):

- M. P. Stephens, F. E. Myers, Manufacturing Facilities Design and Material Handling, Purdue University Press.
- J.A. Tompkins, J.A. White, Y.A. Bozer, and J.M.A. Tanchoco, Facilities Planning, John Wiley and Sons Inc.

23-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.

Textbooks (most recent edition is recommended):

- F. Robert, Jacobs, Berry, William, Whybark, David, Manufacturing Planning and Control for Supply Chain Management, McGraw-Hill Education.
- W. J. Stevenson, M. Hojatii, J. Cao, Operation management, McGraw-Hill Education.
- Stevenson, W. J., et Benedetti, C., La gestion des opérations : produits et services, Chenelière McGraw-Hill.

23-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, elements of reliability. Quality standards, supplier-producer relations, quality certification.

Textbooks (most recent edition is recommended):

- F.M. Gryna, Quality Planning and Analysis, McGraw-Hill.
- D.C. Montgomery, Introduction to Statistical Quality Control, John Wiley and Sons.

23-Ind-A6 Systems Simulation

Computer simulation of systems. Design of simulation models of discrete systems. Statistical foundations and methodology. Generation of random variates. 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.

Textbooks (most recent edition is recommended):

- A.M. Law, Simulation Modeling and Analysis, McGraw-Hill.
- J. Banks, J. S. Carson II, B. L. Nelson, D. M. Nicol, Discrete-Event System Simulation, Pearson.

Group B - Optional examinations (three required)

23-Ind-B1 Reliability and Maintainability NEW

Reliability functions and distributions, analysis of failure, reliability of equipment and systems, failure predictive modelling, reliability block diagrams, fault tree analysis, time-to-repair and maintainability function, age and block replacement policies for components, Time Value of Money to equipment replacement decisions, maintenance program and management, availability analysis.

Textbooks (most recent edition is recommended):

- A. K. S. Jardine, A. H. C. Tsang, Maintenance, Replacement and Reliability Theory and Applications, CRC Press.
- C. E. Ebeling, An Introduction to Reliability and Maintainability Engineering, Waveland PR Inc.

23-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.

Textbooks (most recent edition is recommended):

- J.T. Black, and R.A. Kohser, DeGarmo's Materials and Processes in Manufacturing, Wiley.
- M.P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley.

23-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.

Textbooks (most recent edition is recommended):

- M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice Hall.

23-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.

Textbooks (most recent edition is recommended):

- Laudon & Laudon, Management Information Systems: A Contemporary Perspective, MacMillan.

23-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 workplace 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.

Textbooks (most recent edition is recommended):

- R.S. Bridger, Introduction to Ergonomics, CRC Press.
- Kodak Ergonomics Group, Ergonomic Design for People at Work, Volumes I and II, Van Nostrand Reinhold Co. Ltd.

23-Ind-B6 Human Factor in Design

RENAMED (NO CHANGE IN SCOPE)

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 workplaces 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.

Textbooks (most recent edition is recommended):

- M.S. Sanders, E. McCormick, Human Factors in Engineering and Design, McGraw-Hill.
- E. Grandjean, Fitting The Task To The Human: A Textbook Of Occupational Ergonomics, CRC Press.

23-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.

Textbooks (most recent edition is recommended):

- Rich, Jones, Mowen, Hansen, Jones, Tassone, Cornerstones of Financial Accounting, Nelson Education.
- Meigs, Meigs, and Lam, Accounting: The Basis for Business Decisions, McGraw-Hill.
- Roy C., Garrison R. H., Libby T., Webb R. A., Bergeron H., Fondements de la comptabilité de gestion, Chenelière McGraw- Hill.

23-Ind-B8 Computer Integrated Manufacturing (CIM)

Computerization in manufacturing. Manufacturing information systems. Hierarchical control. Just-in-time in the context of CIM. CIM Architecture. Technologies: operating systems, case technologies, robots and artificial intelligence, databases. Product Information Management: CAD positioning; Design File Management; Hardware & software; Product Data Models. Product Information Standards: PDES, IGES, EDIF.

SHORTENED (SIMPLIFIED)

Textbooks (most recent edition is recommended):

- U. Rembold, Computer Integrated Manufacturing Technology and Systems, Marcel Dekker Inc.
- M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson.

23-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 competitivity: 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.

Textbooks (most recent edition is recommended):

- G. Ghiani, G. Laporte, R. Musmanno, Introduction to Logistics Systems Management, Wiley.
- S. Chopra and P. Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson.

23-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.

Textbooks (most recent edition is recommended):

- Occupational Health and Safety Act Regulation for Industrial Establishment. 880 Bay St. Toronto, Ontario. M7B 1N8. Tel.: 416-326-5300, 1-800 668-9938.
- Willie Harruner, Occupational Safety Management and Engineering, Prentice Hall.

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, transhipment 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 ADD

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 variantes. 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.

ADD

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 competitivity: 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

RENAMED - NO CHANGE TO SCOPE.

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.

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.

17-Ind-A1 Operation Research

W.L. Winston, Operations Research Applications and Algorithms, 4th edition. Duxbury Press, 2003.
F. Hillier, Introduction to Operations Research, 10th edition. McGraw-Hill, 2014.

17-Ind-A2 Analysis and Design of Work

Ralph M. Barnes, Motion and Time Study Design and Measurement of Work, 7th edition. John Wiley and Sons Inc., 2002.

17-Ind-A3 Facilities Planning

R.L. Francis, L.F. McGinnis, and J. A. White, Facility Layout and Location: An Analytical Approach. Prentice-Hall.
D.R. Sule, Manufacturing Facilities. PWS-Kent Publishing, Boston.
J.A. Tompkins, J.A. White,Y.A. Bozer, and J.M.A. Tanchoco, Facilities Planning. 4th Edition, John Wiley and Sons Inc., 2010.
J.A. Tompkins, J.A. White,Y.A. Bozer, and J.M.A. Tanchoco, Facilities Planning. 4th Edition, John Wiley and Sons Inc., Online Version, 2011.

17-Ind-A4 Production Management

W.J. Hopp, M.L. Spearman, Factory Physics. 3rd edition. McGraw-Hill Irwin. 2008
M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing. 3rd Edition. 2007.
William Stevenson, Operation management, 12th Edition, McGraw-Hill Education, 2015
William Stevenson et Claudio Benedetti, La gestion des opérations

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

F.M. Gryna, Quality Planning and Analysis, 4th Edition, McGraw-Hill, 2000.
D.C. Montgomery, Introduction to Statistical Quality Control, 7th edition. John Wiley and Sons , 2013.

17-Ind-A6 Systems Simulation

A.M. Law, Simulation Modeling and Analysis, 5th edition. McGraw-Hill., 2014
C.D. Pegden, R.E. Shannon, and R.P. Sadowski, Introduction to Simulation Using Siman. McGraw-Hill Inc., 1995.
J. Banks, J. S. Carson II, Barry L. Nelson, David M. Nicol, Discrete-Event System Simulation (5th Edition) Paperback – Pearson, 2010.

17-Ind-B1 Applied Probability and Statistics

D.C. Montgomery and G.C. Runger, Applied Statistics and Probability for Engineers. John Wiley. 2013.

17-Ind-B2 Manufacturing Processes

L.E. Doyle, C.A. Kayser, J.L. Leanh, G.F. Schruder, and M.B. Singer, Manufacturing Processes and Materials for Engineers, 3rd edition. Prentice-Hall, 1985.
J.T. Black, and R.A. Kohser, DeGarmo's Materials and Processes in Manufacturing, 11th edition. Wiley, 2011.
M.P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 4th Edition, Wiley, 2010.

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

M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing. 3rd Edition.
2007.

17-Ind-B4 Design of Information Systems

Laudon & Laudon, Management Information Systems: A Contemporary Perspective, latest edition. MacMillan.
R. McLeod, Management Information Systems: A Study of Computer Based Information Systems, latest edition. Prentice Hall.

17-Ind-B5 Ergonomics

R.S. Bridger, Introduction to Ergonomics. Latest edition. CRC Press.
Kodak Ergonomics Group, Ergonomic Design for People at Work, Volumes I and II. Van Nostrand Reinhold Co. Ltd.

17-Ind-B6 Workplace Design

M.S. Sanders, E. McCormick, Human Factors in Engineering and Design, 7th Edition. McGraw-Hill, 1993.
E. Grandjean, Fitting The Task To The Human: A Textbook Of Occupational Ergonomics. 5th Edition. CRC Press, 1997.

17-Ind-B7 Financial and Managerial Accounting

Meigs, Meigs, and Lam, Accounting: The Basis for Business Decisions, 6th Edition (Canadian). McGraw-Hill.
R.M. Mallouk, Problems Plus Solutions In Financial Accounting. McGraw-Hill.

17-Ind-B8 Computer Integrated Manufacturing (CIM)

Ulrich Rembold, Computer Integrated Manufacturing Technology and Systems, latest edition. Marcel Dekker, Inc. ISBN # 0-8247-7403-5.
M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing. 4th edition. Pearson, 2014.

17-Ind-B9 Logistics: Transportation Aspects

Not available at this time.

17-Ind-B10 Workplace Health and Safety

Occupational Health and Safety Act Regulation for Industrial Establishment. 880 Bay St. Toronto, Ontario. M7B 1N8. Tel.: 416-326-5300, 1-800 668-9938.
Willie Harruner, Occupational Safety Management and Engineering, latest edition. Prentice-Hall. ISBN 0-13-629437-5.

4.10 INTRODUCTION

Seventeen engineering disciplines are included in the Examination Syllabus issued by the Canadian Engineering Qualifications Board of the Canadian Council of Professional Engineers.

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/Ordre.

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/Ordre.

4.10.1 INDUSTRIAL ENGINEERING EXAMINATIONS

GROUP A

COMPULSORY EXAMINATIONS (SIX REQUIRED)

98-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, transhipment 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.

98-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.

98-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.

98-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.

98-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.

98-Ind-A6 Systems Simulation

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

GROUP B

ELECTIVE EXAMINATIONS (THREE REQUIRED)

98-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, etc. 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.

98-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.

98-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 manufacturing systems, computer aided manufacturing (CAM), support systems for manufacturing, group technology, and flexible manufacturing systems.

98-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 sub-systems, organizational structure and management information systems, development and evaluation of management information systems, distributed systems, local area networks, data communications. Data acquisition and transmission. Economic evaluation.

98-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.

98-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.

98-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.

98-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.

98-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 competitivity: 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.

98-Ind-B10 Industrial Safety and Health

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.

98-Ind-A1- Operation Research

Winston, Operations Research Applications and Algorithms, latest edition. Duxbury Press, Belmont, Calif.
Hillier and Lieberman, Introduction to Operations Research, latest edition. McGraw-Hill.

98-Ind-A2- Analysis and Design of Work

Ralph M. Barnes, Motion and Time Study Design and Measurement of Work, 7th Edition. John Wiley and Sons Inc.

98-Ind-A3- Facilities Planning

S. Heragu, Facilities Design, PWS Publishing Company (20 Park Plaza; Boston MA 02116-4324), 1997. ISBN # 0-534-95183-X

D.R. Sule, Manufacturing Facilities. PWS-Kent Publishing, Boston.

J.A. Tompkins and J.A. White, Facilities Planning. John Wiley and Sons Inc.

98-Ind-A4 - Production Management

Stephenson, J. Williams, Production Operations Management, 6th Ed., CD Rom On-Line Card, McGraw Hill. ISBN 007 2359587

Stevenson & Hojati, Operations Management, 2nd Edition, McGraw-Hill Publishing Co. ISBN# 0-07-091189-4, 2004

98-Ind-A5 - Quality Planning, Control, and Assurance

J.M. Juran and F.M. Gryna, Quality Planning and Analysis, latest edition. McGraw-Hill.

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Occupational Health and Safety Act Regulation for Industrial Establishment. 880 Bay St. Toronto, Ontario. M7B 1N8. Tel.: 416-326-5300, 1-800 668-9938.

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