

# FUNDAMENTALS *of* Engineering Examination 2010

Information for Applicants



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# Professional Engineers Registration Examination Fundamentals of Engineering Examination 2010

## Information for Applicants

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# Professional Engineers Registration Examination Fundamentals of Engineering Examination 2010 Information for Applicants

## 1 INTRODUCTION

The mission of the Professional Engineers Board is to safeguard life, property, and welfare of the public by setting and maintaining high standards for registering professional engineers and by regulating and advancing the practice of professional engineering.

The Professional Engineers Board registers professional engineers in the branches of civil, electrical and mechanical engineering. A person applying for registration as a professional engineer to the Professional Engineers Board is required to hold an approved degree or qualification listed in the [Professional Engineers \(Approved Qualifications\) Notification](#) and acquired not less than 4 years of relevant practical experience. He is also required to sit and pass examinations prescribed by the Board. The applicant is required to sit and pass the Fundamentals of Engineering Examination and following that, to sit and pass the Practice of Professional Engineering Examination. In addition, the applicant is required to attend an interview.

The following sections set out the requirements and details for the Fundamentals of Engineering Examination 2010 while details on other application requirements are available on the PEB website at [www.peb.gov.sg](http://www.peb.gov.sg).

## 2 ELIGIBILITY TO SIT FOR EXAMINATION

The Fundamentals of Engineering Examination tests an applicant's knowledge of fundamental engineering subjects in civil, electrical or mechanical engineering. A person may apply to sit for the Fundamentals of Engineering Examination after he has obtained an approved degree or qualification listed in the [Professional Engineers \(Approved Qualifications\) Notification](#) or has proper and recognised academic qualifications in engineering accepted by the Board.

## 3 FEES

The fees for an application to sit for the Fundamentals of Engineering Examination is \$350.

#### 4 DATES OF EXAMINATION

The dates for the Fundamentals of Engineering Examination 2010 are:

- a) Civil Engineering – 29 Sep 2010
- b) Electrical Engineering – 30 Sep 2010
- c) Mechanical Engineering – 30 Sep 2010

#### 5 VENUE

Details of the venue would be given to successful applicants at a later date.

#### 6 APPLICATION FORMS

Application forms can be downloaded from the PEB website at <http://www.peb.gov.sg>. All applications are to be submitted to PEB with applicable fees and documents by 30 Jun 2010 latest for the Fundamentals of Engineering Examination. Applicants are advised to send in their applications early to allow time for processing. They would be informed of the status of their applications and other details by post at least two weeks before the examinations.

#### 7 STRUCTURE OF EXAMINATION

A summary of the structure of the Fundamentals of Engineering Examination is shown in the table below. The examination is 'open book' and further details are given in [Annex A: Format and Syllabus](#).

Subjects	Time Allocated	Format
<u>FEE Part 1</u> Core engineering subjects in civil/mechanical/electrical engineering	3 hours (9 am - 12 noon)	<ul style="list-style-type: none"> <li>• 40 Multiple Choice Questions ( MCQ)</li> </ul>
<u>FEE Part 2</u> Core/Elective subjects in civil/mechanical/electrical engineering	3 hours (2 pm – 5 pm)	<ul style="list-style-type: none"> <li>• Answer 5 out of 9 questions (civil)</li> <li>• Answer 5 out of 7 questions (electrical, mechanical)</li> </ul>

## **8 FINAL RESULTS AND NOTIFICATION**

Examination results will be given to candidates on a Pass/Fail basis. No examination scores or marks will be given to candidates. Examination results are mailed to the candidates within twelve weeks after the examination.

## **9 EXAMINATION APPEALS**

A candidate who has failed the examination may submit a written appeal to review his/her performance together with a payment of \$25. The appeal is to be made within 2 weeks after the receipt of results and late appeals would not be considered. The result of the appeal/review will be sent by written mail to the appeal candidate.

## **10 REVIEW COURSES**

The Board does not endorse any review course or material provided as study aides.

## **11 REFUND OF FEES**

Where an applicant who has been accepted is unable to sit for the examination subsequently and informs the Board at least a week before the examination, the Board will refund \$100 to the applicant. There will be no refund if the applicant informs the Board less than a week before the examination or is absent from the examination.

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## Annex A: FORMAT AND SYLLABUS

### I Fundamentals Of Engineering Examination (Civil)

The examination will focus on testing the fundamentals of civil engineering. The 6-hour examination will comprise two parts. Part I catering for breadth, will comprise questions on core civil engineering subjects, typical of courses covered during the 1<sup>st</sup> and 2<sup>nd</sup> year of a 4-year civil engineering undergraduate course. Part II catering for depth, will comprise more core and elective civil engineering courses covered during the 3<sup>rd</sup> and 4<sup>th</sup> year of a 4-year civil engineering undergraduate course.

#### Format

- **FEE Part 1 (Civil) (3 hours) – 40 MCQ questions**
  - CE 101 Mechanics of Materials
  - CE 102 Structural Mechanics
  - CE 103 Structural Analysis
  - CE 104 Soil Mechanics
  - CE 105 Fluid Mechanics
  
- **FEE Part 2 (Civil) (3 hours) – 5 out of 9 questions**
  - CE 201 Reinforced and Prestressed Concrete Structures (2 Qs)
  - CE 202 Steel and Composite Structures (2 Qs)
  - CE 203 Geotechnical Engineering (2 Qs)
  - CE 204 Transportation (1 Q)
  - CE 205 Hydraulics and Hydrology (1 Q)
  - CE 206 Environmental Engineering (1 Q)

#### Syllabus

- **CE 101 Mechanics of Materials**
  - **Mechanics of Materials**  
Strength, stiffness and deformability; Stress-strain relations; ductility and brittle fracture; time-dependent properties; creep, creep rupture; relaxation; cyclic load behaviour.
  
  - **Concrete Technology**  
Concrete-making materials, properties of fresh and hardened concrete, mixing, placing, and curing, mix design, destructive and non-destructive tests, quality control, durability, and special concrete.

- **Steel**  
Basic metallurgy, mechanical properties and applications, welding technology and corrosion.
- **CE 102 Structural Mechanics**
  - **Structural Mechanics**  
Statics and kinetics of particles, equilibrium of rigid bodies, kinematics and plane motion of rigid bodies, analysis of simple trusses and beams, analysis of structural members subjected to tension, compression, torsion, and bending, including such fundamental concepts as stress, strain, and elastic behaviour. Bar forces in compound and complex trusses. Bending moment, shear and axial forces of beams and frames.
- **CE 103 Structural Analysis**
  - **Structural Analysis**  
Displacements of elastic determinate structures: principle of virtual work and energy theorems. Analysis of indeterminate structures. Deformation of indeterminate structures and influence line method. Displacement techniques using slope-deflection and moment distribution methods. Plastic theory and analysis. Theory and applications of modern structural analysis. Concepts of equilibrium, compatibility and force-displacement relationships. Direct stiffness method. Matrix formulation of trusses, beams and frames. Stability concepts and elastic stability analysis of framed structures.
- **CE 104 Soil Mechanics**
  - Basic geology, unified soil classification system, mechanical properties, effective stress principle, shear strength, compressibility, and seepage and consolidation; Mohr-Coulomb failure criterion (drained and undrained), settlement calculations, rate of consolidation using classical Terzaghi theory.
- **CE 105 Fluid Mechanics**
  - **Fluid Statics**  
Fluid properties; hydrostatic pressure and thrust; buoyancy; stability of floating bodies.
  - **Fluid Motion**  
Continuity equations; Bernoulli's equation; linear momentum equation.

- **Similitude**  
Dimensional analysis; design of hydraulic models.
- **CE 201 Reinforced and Prestressed Concrete Structures**
  - **RC Design**  
Basic structural members and structural systems. Loads and load effects. Section analysis and design for bending. Design for shear, torsion and bond. Corbels. Serviceability and durability requirements. Design of short and slender columns. Design of slab systems. Concentrated loads on slabs. Design of foundations. Retaining walls. Reinforced concrete detailing.
  - **Prestressed Concrete Design**  
Basic concepts of prestressing. Materials and prestressing systems. Prestressed losses and time dependent deformation. Behaviour and design of members subject to flexure, shear and combined axial and bending action.
- **CE 202 Steel and Composite Structures**
  - **Steel Design**  
Limit state design. Material properties and structural responses. Local buckling and section classifications. Design of fully restrained beams. Shear buckling and design of plate girder. Web bearing and buckling. Design of web stiffeners. Lateral-torsional buckling and design of laterally unrestrained beams. Tension and compression members. Axially loaded members with end moments. Design of steel connections. Plastic design of portal frames. Continuous multi-storey frames.
  - **Composite (Steel-Concrete) Design**  
Structural modeling and design concepts. Moment capacity and shear resistance, full and partial connection of composite beams. Design of composite slab. Design of composite columns.
- **CE 203 Geotechnical Engineering**
  - **Slope Stability and Earth Retaining Structures**  
Introduction to slope stability and earth retaining structures; slopes and embankments; earth pressure and retaining structures; deep excavations; calculation of active and passive earth pressures; design considerations pertaining to deep excavations.



- **Foundation Engineering**  
Site investigation and interpretation of soil reports; shallow foundations and deep foundations; selection of appropriate foundation type; capacity and settlement requirements.
- **CE 204 Transportation**
  - **Transportation Engineering**  
Transportation systems, planning and management; geometric design of roads and intersections; design of flexible and rigid pavements.
  - **Traffic Engineering**  
Traffic flow studies; traffic data analysis; traffic management; highway and intersection capacity; traffic signal control. Parking.
- **CE 205 Hydraulics and Hydrology**
  - **Hydraulics**  
Friction and minor losses in pipe flow; pipe and pump systems; pipe network analysis; open channel flow; uniform flow, Manning's equation; critical flow; energy and momentum principles; hydraulic jumps; gradually varied flows, backwater computation.
  - **Hydrology**  
Processes in the hydrologic cycle: basic meteorology, rainfall precipitation, evaporation and transpiration, infiltration, sub-surface flow, surface runoff, streamflow measurement and hydrograph analysis; unit hydrograph principles and applications; frequency analysis of rainfall or flood data; reservoir and channel flood routing; urban storm drainage design, flood peak estimation.
- **CE 206 Environmental Engineering**
  - **Environmental Engineering**  
Basic physical, chemical and biological water quality parameters; physical, chemical, and biological processes for water and wastewater treatment; water treatment principles and design; water distribution systems; wastewater collection and pumping systems; wastewater treatment design; pretreatment, primary, secondary, tertiary treatment, and anaerobic digestion.

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## **II Fundamentals Of Engineering Examination (Electrical)**

The examination will focus on testing the fundamentals of electrical power engineering. The 6-hour examination will comprise two parts.

### **Format**

- **FEE Part 1 (Electrical) (3 hours) – 40 MCQ questions**
  - EE 101 Principles of Power Engineering
- **FEE Part 2 (Electrical) (3 hours) – 5 out of 7 questions**
  - EE 201 Power System Analysis and Utilization

### **Syllabus**

- **EE 101 Principles of Power Engineering**
  - **Three-phase Circuits and Systems**  
Review of single-phase circuits. Three-phase voltage generation. Phasor diagrams. Wye and delta connections. Balanced three-phase loads. Active, reactive and apparent power. Power measurements. Power factor correction.
  - **Magnetism and Magnetic Circuits**  
Magnetic fields. Magnetic materials and magnetization curves. Magnetic equivalent circuits. Electromagnetic induction. Sinusoidal excitation. Magnetic losses.
  - **Transformers**  
Ideal transformer. Equivalent circuits. Phasor diagrams. Determination of parameters. Performance evaluation. Autotransformers. Three-phase transformers.
  - **AC and DC Machines**  
DC Machines: operating principle, voltage and torque equations, classification, torque-speed characteristics, losses and efficiency. Three-phase induction motors: operating principle, equivalent circuit, torque-speed characteristics, losses and efficiency.
  - **Power Electronics and Drives**  
Introduction to power conversion. Harmonics. AC to DC conversion. DC to DC conversion. DC to AC conversion. DC servo motor drive systems. AC variable-speed induction motor

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drive systems. Permanent magnet and stepping motor drive systems.

- **Fundamental of Power System**

Energy sources. Per unit system. Power system components and representation: synchronous generators, transmission lines and cables. Load representations. Power transfer.

- **Power Flow Modelling**

System components modelling. Formulation of power flow equations. Methods of power flow solution. Case studies.

- **EE 201 Power System Analysis and Utilizations**

- **Active Power and Frequency Control**

Governor control systems. Area control errors and load frequency control. Energy offers. Transmission losses, penalty factors and loss coefficients. Economic dispatch. Automatic generation control. Electricity market environment. Active power control devices.

- **Reactive Power and Voltage Control**

Production and absorption of reactive power. Methods of voltage control. Reactive power and voltage control devices. Application to transmission and distribution systems.

- **Analysis of Unsymmetrical Faults**

Three-phase faults and fault level calculations. Symmetrical components. Sequence impedances and sequence networks. Unsymmetrical faults.

- **Electric Power Distribution Systems**

Distribution system configurations. Primary and secondary distribution. Ring, radial and inter-connected systems. Distribution substation layout. Planning criteria and network design. Fault diagnosis and restoration of supply. Expert system applications.

- **Building Services Engineering**

Estimation of power demand. LV cables and busway systems. Conductor sizing factors. Circuit protective conductor. Earth leakage and touch voltage. Inspection and testing. Lightning protection.

- **General Protection Principles**

Basic protection principles Instrument transformers. Coordination of overcurrent and earth protection for

distribution systems. Pilot-wire differential protection of feeders.

- **Applications of High-voltage Engineering**

Acceptance and routine tests on apparatus. Fault locating methods. Condition monitoring and aging assessment. Case studies.

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### **III Fundamentals Of Engineering Examination (Mechanical)**

The examination will focus on testing the fundamentals of mechanical engineering. The 6-hour examination will comprise two parts:

#### **Format**

- **FEE Part 1 (Mechanical) (3 hours) – 40 MCQ questions**
  - ME 101 Control and Instrumentations
  - ME 102 Dynamics and Vibrations
  - ME 103 Fluid Mechanics
  - ME 104 Mechanics and Materials
  - ME 105 Manufacturing Technology
  - ME 106 Thermodynamics and Heat Transfer
  
- **FEE Part 2 (Mechanical) (3 hours) – 5 out of 7 questions**
  - ME 201 Control and Instrumentations
  - ME 202 Dynamics and Vibrations
  - ME 203 Fluid Mechanics
  - ME 204 Mechanics and Materials
  - ME 205 Manufacturing Technology
  - ME 206 Thermodynamics and Heat Transfer

#### **Syllabus**

- **ME 101/201 Control And Instrumentations**
  - **Modelling of Linear Systems**  
Introduction to control systems. Mathematical modelling of electro-mechanical systems. Transfer functions representation of physical components. Block diagram manipulation.
  - **Dynamic Response Analysis**  
Transient response analysis and performance indices. Poles and zeros concept, dominant pole concept of high order systems. Characteristic equation. Steady state errors and system types.
  - **Principles of Feedback Control**  
Open loop versus closed loop control. Analysis of system type. Error elimination and disturbance rejection. Types of feedback systems. PID controller. Stability and Routh-Hurwitz method.

- **Root Locus Techniques**  
Qualitative analysis of the Root Locus. Guidelines for sketching a Root Locus. General concepts of dynamics compensator design. Design by Root Locus: PI, PD, PID, Lead and Lag compensators. Feedback compensation and realisation.
  - **Frequency Domain Analysis**  
Concept of frequency response. Bode plots. Nyquist plot and Nyquist stability criterion. Stability margins. Closed loop frequency domain characteristics. Design of compensator via Bode plots - Lead, Lag & Lag-lead controller. Design examples.
  - **Measurement System**  
Models and classification for measurement systems and their time and frequency domain behaviours. Performance specifications.
  - **Analog Devices and Measurement**  
Introduction to basic measurement devices for analog signals and measurement principles. Conditioning of analog signals for transmission and processing.
  - **Digital Devices and Measurement**  
Fundamental differences between analog and digital systems. Sampling theorem and fundamentals of data acquisition.
  - **Sensors**  
Measurement for common engineering applications: position, speed, stress, strain, temperature, vibration and acceleration, pressure and flow. Semiconductor sensors and micromechanical devices.
- **ME 102/202 Dynamics And Vibrations**
    - **Dynamics**
      - **Kinematics of Particle**  
Uniform rectilinear motion; Uniform accelerated rectilinear motion; Rectangular components of velocity and acceleration; Motion relative to a frame in translation; Tangential and normal components; Radial and transverse components. Newton's second law; Equations of motion; Angular momentum of a particle; Principle of conservation of energy; Principle of conservation of momentum.

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### **Kinematics of Rigid Bodies**

General plane motion; Coriolis acceleration. Equations of plane motion for a rigid body; Angular momentum of a rigid body in plane motion; Principle of work and energy for a rigid body; Principle of impulse and momentum for the plane motion of a rigid body; Conservation of angular momentum.

### ▪ **Mechanical Vibrations**

#### **Vibration Without Damping**

Simple harmonic motion; Energy method; forced vibration.

#### **Damped Vibration**

Damped free vibration; Damped forced vibration.

### • **ME 103/203 Fluid Mechanics**

#### ▪ **Basic concepts**

Understanding fluids as compared to solids and gases. Properties of fluids: Density, pressure and viscosity. Pressure measurements. Buoyant forces and Archimedes' Principle. Stability of submerged and floating bodies. Stability of a ship.

#### ▪ **Fluid Motion**

Real and ideal fluids. Momentum and forces in fluid flow: Continuity equation, momentum equation, energy equation, Bernoulli's equation.

#### ▪ **Pipe Flow**

Laminar and turbulent flows in pipes. Moody diagram, losses and fittings, energy equation for real laminar flow in pipes. Equation of motion for turbulent flow. Mixing length hypothesis. Fully turbulent flow in pipes. Head and flow calculations in pump-piping systems.

#### ▪ **Fluid Machinery**

Fundamental theory and performance. Pumps and fans, turbines: Concepts and performance characteristics. Cavitation and surge phenomena.

#### ▪ **Flow Resistance and Propulsion**

Boundary layer, surface roughness, form drag. Water jet theory: Basic principle, fundamental thrust equation. Ship propulsion: Introduction to propulsion system, powering of ship, propeller theory, propeller-hull interaction.

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- **ME 104/204 Mechanics And Materials**
    - **Material properties and behaviour**

Yield and ultimate tensile stress, proof stress, elastic modulus. Yield and Strength failure criteria- Tresca and Von-Mises.

Temperature effects- temperature expansion coefficient, creep and stress relaxation. Post-yield effects- elastic-plastic, bilinear hardening and strain hardening. Fatigue effects- S/N curves.
    - **Stress and Strain**

Basic stress and strain for elastic bodies- direct stress and strain, shear stress and strain, Mohr's circle. Stress and Strain transformations - two and three-dimensional, 4 elastic constants  $E$ ,  $\nu$ ,  $k$  and  $G$ .
    - **Bending of beams**

Second moments of area of structural sections, Free body, shear force and bending moment diagrams. Elastic and inelastic bending of beams. Combined tension and bending of beams, Deflection and slopes of beams. Shear stress in beams, Statically indeterminate beams.
    - **Bending of plates and cylindrical shells**

Symmetric membrane bending theory of circular plates and shells under fixed and freely supported boundaries. Discontinuity stresses of cylinder to flat, cone or hemispherical shells junctions.
    - **Torsion of prismatic bars and closed sections**

Torsion of circular solid section and open thin walled sections, shear stresses and deformation, shear flow in thin walled open and closed sections.
    - **Buckling of columns**

Euler buckling theory, perfect and imperfect columns, effect of end fixings on critical buckling loads.
    - **Thermal loading**

Thermal stresses in beams and cylinders due to a through thickness temperature gradient, thermal stresses in compound bars of different materials under uniform temperature.
    - **Internal pressure loading**

Membrane theory, thin and thick walled cylinders under pressure.



- **ME 105/205 Manufacturing Technology**

- **Introduction**

Cutting tool materials. Single and multi-point tools. Types of wear. Manufacturing processes: cold and hot working, rolling, extrusion, forging, sheet and metal blanking and forming, cold forming, welding, brazing, soldering, casting, powder metallurgy, plastics technology. Non-conventional machining: electro-discharge machining.

- **Metal Removal**

Introduction to machine tools and machining operations – Generating motions of machine tools, machines using single point tools, machines using multipoint tools, machines using abrasive wheels. Mechanics of metal cutting – Chip formation, forces acting on the cutting tool and their measurement, the apparent mean shear strength of the work material, chip thickness, friction in metal cutting. Cutting tool materials – Major tool material types. Tool life and tool wear – Forms of wear in metal cutting. Economics of metal cutting operations – Choice of feed, speed and depth of cut, tool life for minimum cost and minimum production time, estimation of factors needed to determine optimum conditions.

- **Metrology**

Basic measuring instruments and their applications (Linear and angular measurement, roundness, flatness and surface finish measurement).

- **Manufacturing Processes**

Introduction to cold and hot working. Rolling - 2, 3 and 4-high rolls, cluster and planetary rolls, manufacture of blooms, billets and slabs. Extrusion - Direct and indirect extrusion, hollow extrusion, hydrostatic extrusion. Forging - Hammer, press, roll forging, open and closed die forging. Sheet metal bending and deep-drawing, punch load, drawability, Crane's constants. Shearing of sheet metal - types of shearing operation, punch and die clearance, punch force. Cold forming processes - Marforming, Guerin process, hydroforming. Welding, brazing, soldering - Arc and gas welding, pressure welding, MIG, TIG, submerged-arc, friction, resistance, laser and electron-beam welding. Casting - Sand casting, patterns, defects, die-casting, centrifugal casting, investment casting, continuous casting. Powder metallurgy - Production of powders, fabrication processes, sintering, comparison with other processes. Electro-discharge machining. Plastics technology – Properties of

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plastics, thermoplastics and thermosets, manufacturing of plastics.

- **ME 106/206 Thermodynamics And Heat Transfer**

- **Thermodynamics**

- **Fundamental concepts**

Simple concept of thermodynamic system. Types of energy interaction between system and surroundings. Properties of simple pure substances –understand the general form of property diagrams. Empirical temperature scales and thermometry. Ideal and perfect gases. Use of steam tables for substance such as water.

- **First Law of Thermodynamics**

The concept of fully-resisted or quasi-static processes; work and heat interactions in adiabatic boundaries with the introduction of internal energy, kinetic, potential and enthalpy. Statement of the First law of Thermodynamics: applications relating to non-flow and simple unsteady flow (e.g., the filling of a rigid vessel) processes. First law applied to simple thermodynamic plants, e.g. power plant, compressors and expanders (without detailed knowledge of plant construction). Steady flow energy equation and its application to demonstrate the significant of enthalpy changes.

- **Second Law of Thermodynamics**

Alternative statements of the Second Law. Reversible and irreversible processes. Internal and external irreversibility. Heat engines operating in temperature reservoirs and the efficiency of reversible engines. Entropy as a property and its relationship to heat transfer. The Clausius inequality. Isentropic and non-isentropic processes.

- **Heat Transfer**

- **Conduction**

Heat transfer by conduction. Steady-state conduction through slab, compound walls, cylinders and spheres. Unsteady state conduction in homogeneous solids.

- **Convection**

Heat Transfer by convection, in fluids and films. Overall heat transfer coefficients. Natural and forced convection on plane

surfaces, fins, pipes and around round bundles. Heat transfer in extended surfaces- combining conduction and convection.

### **Radiation**

Heat transfer by radiation. Laws of radiant heat transfer, black and gray bodies, geometric factors, absorptivity and

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## Fundamentals of Engineering Examination Sep 10

### Recommended Reading List for Civil Engineering FEE Part 1 (Civil)

#### **CE101 Mechanics of Materials**

- 1) W. D. Callister, Jr, "Materials Science and Engineering: An Introduction", John Wiley 1999, 5th Edition. (or equivalent)

#### **CE102 Structural Mechanics**

- 1) Fundamentals of Structural Analysis, 2<sup>nd</sup> Edition (2002), H.H. West and L.F. Geshwinder, John Wiley & Sons, Inc.

#### **CE103 Structural Analysis**

- 1) Fundamentals of Structural Analysis, 2<sup>nd</sup> Edition (2002), H.H. West and L.F. Geshwinder, John Wiley & Sons, Inc.

#### **CE104 Soil Mechanics**

- 1) Soil Mechanics, R F Craig, 7<sup>th</sup> Edition, Taylor & Francis Inc.

#### **CE105 Fluid Mechanics**

- 1) Fluid Mechanics with Engineering Applications, EJ Finnemore and JB Franzini, 10<sup>th</sup> Edition, Int Edition McGraw Hill, 2002

### FEE Part 2 (Civil)

#### **CE201 Reinforced and Pre-stressed Concrete Structures**

- 1) Reinforced and Prestressed Concrete. 3rd Edition (1987), Kong FK and Evans RH, Van Nostrand Reinhold UK.

#### **CE202 Steel and Composite Structures**

- 1) Structural Steelwork Design to Limit State Theory, 3rd Edition (2004), Lam D, Ang TC and Chiew SP, Elsevier Butterworth-Heinemann, Oxford.
- 2) Composite Structures of Steel and Concrete, Vol. I – Beams, Slabs, Columns and Frames for Buildings, 2<sup>nd</sup> Edition (1994), Johnson RP, Blackwell Scientific Publications, Oxford.

#### **CE203 Geotechnical Engineering**

- 1) Foundation Design and Construction, M J Tomlinson, 7<sup>th</sup> Edition, Prentice-Hall
- 2) Soil Mechanics, R F Craig, 7<sup>th</sup> Edition, Taylor & Francis Inc.

#### **CE204 Transportation**

- 1) Introduction to Transportation Engineering, Banks, J.H., 2nd ed., McGraw-Hill, 2002.

#### **CE205 Hydraulics and Hydrology**

- 1) Hydrology For Engineers, Linsley, RK; Kohler, MA and Paulhus, JLH, SI edition, McGraw-Hill Book Co, Singapore, 1988
- 2) Fluid Mechanics with Engineering Applications, EJ Finnemore and JB Franzini, 10<sup>th</sup> Edition, Int Edition McGraw Hill, 2002

#### **CE206 Environmental Engineering**

- 1) Water Supply and Pollution Control, Viessman and Hammer, 7th ed., Pearson Prentice Hall, 2004.

**Fundamentals of Engineering Examination Sep 10  
Recommended Reading List for Electrical Engineering**

**FEE Part 1 (Electrical)**

**EE 101 Principles of Power Engineering**

- 1) Guru Bhag S and Hiziroglu Huseyin R, Electric Machinery and Transformers, 3rd Edition, Oxford University Press, 2001.
- 2) Sen Paresh Chandra, Principles of Electric Machines and Power Electronics, 2nd Edition, John Wiley, 1997.
- 3) Chapman Stephen J, Electric Machinery and Power System Fundamentals, 1st Edition, McGraw-Hill, 2002.
- 4) Wildi Theodore, Electrical Machines, Drives and Power Systems, 6th Edition, Pearson/Prentice-Hall, 2006.

**FEE Part 2 (Electrical)**

**EE 201 Power System Analysis and Utilizations**

- 1) Grainger John J and Stevenson William D, Power System Analysis, McGraw-Hill, 1994.
- 2) Bergen Arthur R and Vittal Vijay, Power System Analysis, 2nd Edition, Prentice-Hall, 2000.
- 3) Weedy Birron Mathew and Cory Brian John, Electric Power Systems, 4th Edition, John Wiley, 1998.
- 4) Pabla A S, Electric Power Distribution, 5th Edition, McGraw-Hill, 2005.
- 5) Code of Practice for Electrical Installations, (Singapore Standards, CP5 1998), Singapore Productivity and Standards Board, 1998.
- 6) Lakervi Erkki and Holmes E J, Electricity Distribution Network Design, (IEE Power Engineering Series), 2nd Edition, Peter Peregrinus, 1995.
- 7) Haddad A and Warne D F, Advances in High Voltage Engineering, IEE (IEE Power and Energy Series), 2004.
- 8) Gers Juan M, Protection of Electricity Distribution Networks, 2nd Edition, Institution of Electrical Engineers, 2004.
- 9) Naidu M S and Kamaraju V, High Voltage Engineering, 2nd Edition, McGraw-Hill, 1996.
- 10) Ram Badri and Vishwakarma D N, Power System Protection and Switchgear, 2nd Edition, McGraw-Hill, 1997.
- 11) Teo Cheng Yu, Principles and Design of Low Voltage Systems, 2nd Edition, fifth print, Byte Power Publications, 2005.

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## Fundamentals of Engineering Examination Sep 10 Recommended Reading List for Mechanical Engineering

### FEE Part 1 & Part 2 (Mechanical)

#### **ME 101/201 Control and Instrumentations**

- 1) Katsuhiko Ogata, Modern Control Engineering, Prentice Hall
- 2) Benjamin Kuo , Automatic Control Systems, Prentice Hall International Editions
- 3) A K Sawhney , A Course In Mechanical Measurements And Instrumentations, Dhanpat Rai & Sons

#### **ME 102/202 Dynamics and Vibrations**

- 1) F. B. Beer, E. R. Johnston, and W. E. Clausen, Vector Mechanics for Engineers, Dynamic, McGraw-Hill
- 2) J. L. Meriam, Dynamics, Wiley International Edition.

#### **ME 103/203 Fluid Mechanics**

- 1) Robert W. Fox, Alan T. McDonald and Philip J. Pritchard, "Introduction to Fluid Mechanics", 6th Edition, John Wiley & Sons, Inc., 2004
- 2) E. John Finnemore and Joseph B. Franzini, "Fluid Mechanics with Engineering Applications", 10th Edition, McGraw Hill, 2002
- 3) John A. Roberson and Clayton T. Crowe, "Engineering Fluid Mechanics", 5th Edition, Houghton Mifflin Co., 1993.

#### **ME 104/204 Mechanics and Materials**

- 1) Beer, FP, Johnston, ER, and DeWolf, JT, Mechanics of Materials, 3rd Edition, McGraw-Hill, 2002.
- 2) Gere, JM, Mechanics of Materials, 5th Edition, Brooks/Cole, 2001.

#### **ME 105/205 Manufacturing Technology**

- 1) Manufacturing Engineering and Technology 5th Edition by Kalpakjian and Schmid
- 2) Fundamentals of Metal Cutting and Machine Tools by Boothroyd and Winston A Knight

#### **ME 106/206 Thermodynamics and Heat Transfer**

- 1) Thermodynamics: an engineering approach, YA Cengel and MA Boles, 5th Edition, McGrawhill.
- 2) Engineering Thermodynamics by GFC Rogers and YR Mayhew, Longmann, 1992.