Module Code	Module Title	Modular Credits [MC]	Semester	Module Description	Learning Outcomes	Pre-requisites	Co-requisites	Preclusions	Cross Listing	Syllabus	Assessment	Illustrative Reading List
ME2102	Engineering Innovation and Modelling	4	2	This module introduces the students to the various standards and techniques of sketching, prepare engineering drawings and specifications, and interpreting drawings. Students also get to use advanced commercial CAD software to do 3D solid modeling. Above all, this module expands the students' creative talent and enhances their ability to communicate their ideas in a meaningful manner. Major topics include: Principles of projections; Isometric; Orthographic and Isometric sketching; 3D solid modeling; Sectioning and Dimensioning; Welding representations, Drawing standards; Limits, Fits and Geometrical Tolerances. This module also provides the student with the fundamental knowledge to do calculations on design components like bolts, screws, fasteners, weld joints, springs, gears, material selection, fatigue, bearings and shafts. This is a 100% CA core module for all Mechanical Engineering students.	On successful completion of this module, the student will: 1. Have acquired the basic knowledge in engineering drawing principles, tolerance, engineering conventions and representations. 2. Be able to use advanced 3D modeling software in solid modeling. 3. Be able to do calculations on design components	Nil	Nil	**Nil**	Nil	Introduction to engineering drawing, scale, title-block Principles of projection; 1st and 3rd angles. Isometric views. Sectioning and Dimensioning of parts. Isometric & orthographic sketching, Limits, Fits and Geometrical Tolerances, Symbols for machine elements, Conventions, Keys, coupling & Locking Devices, Welding symbols & representation. Screws, bolts and fasteners, Weld joints, Springs, Gears, Selection of materials, Design against fatigue; Selection of rolling bearings; Design of shafts	CA, Final Examination	**Compulsory reading:** K.S.Lee, "Introduction to 3D Solid Modeling with SolidWorks (Third edition)", McGraw-Hill Education (Asia), 2008. "Shigley's Mechanical Engineering Design" by Richard G Budynas and J Keith Nisbett (10th edition in SI units) ISBN 978-981-4595-28-5 McGraw Hill **Supplementary reading:** A.W. Boundy, "Engineering Drawing" Third edition, McGraw Hill, 2007. Pickup and Parker, "Engineering Drawing with Worked examples. Vol. I & II", Third edition, Hutchinson & Co. Ltd, 1985. Cecil Jansen, Jay D. Helsel & Dennis R. Short, "Engineering Drawing and Design", 6 edition, McGraw Hill, 2002 Frederick E. Giesecke, Alva Mitchell et. al., "Principles of Engineering Graphics", second edition, Macmillan Publishing Company, 1994. William P. Spence, "Engineering Graphics", Prentice Hall, 1984.
ME2112	Strength of Materials	4	1	This course provides basic mechanical engineering knowledge and theory of mechanics of materials, and how they are used to solve practical engineering problems. The course includes introduction to statics, concept of stress and strain, analysis of stresses and deflections in a loaded beam, torsion of a circular bar as well as analysis of frames and machines.	Students will be able to 1. Understand the concepts of statics, equilibrium of a rigid body, forces and moments. 2. Understand frames and machines in a structural component. 3. Understand and analyze two dimensional stress system. 4. Understand and analyze beam deflection. 5. Understand and analyze stresses in a loaded beam. 6. Understand and analyze torsion of a circular bar.	EG1111	Nil	Nil	Nil	• Introduction to Statics, Equilibrium of Rigid Bodies, Frames and machines. • Deformable Bodies; Stress and Strain and Sign Convention; Linear Elastic Stress-Strain Relationships. • Two -dimensional stress and strain systems. • Shear Force and Bending Moment in Beams. • Deflection of Laterally Loaded Symmetrical Beams. Statically Indeterminate Beams • Bending and Shear Stresses in Laterally Loaded Symmetrical Beams. Second moment of area. The flexure formula. • Torsion of Cylindrical Shafts.	Lab, Quiz, Final Examination	• C. Ugural, Mechanics of Materials, McGraw-Hill, Current edition • R. C. Hibbeler,Mechanics of Materials, Prentice Hall, SI 2nd Ed., 2005. • F. P. Beer, E. R. Johnston, Jr. and J. T. DeWolf, Mechanics of Materials, McGraw-Hiil, SI 3rd Ed., 2004. • J. M. Gere and S. P. Timoshenko, Mechanics of Materials, PWS Publishing Company, 4th ed., 1997. • R. R. Craig, Jr., Mechanics of Materials, McGraw-Hill, 2nd ed., 2000.
ME2121	Engineering Thermodynamics	4	2	This module develops a good understanding of the basic concepts and application of thermodynamics, required for the analysis, modeling and design of processes and thermal-fluid systems in engineering practice. Major topics include a review and the application of the First and Second Laws of Thermodynamics, reversible and irreversible processes, entropy, non-flow and flow processes, cycles involving entropy changes, power and refrigeration cycles, ideal gas mixtures, psychrometry and its applications.	On successful completion of this module, the student will be able to: 1. Apply principles of thermodynamics in analyzing non-flow and flow processes. 2. Analyze, model and design power plants using water or air as working fluids. 3. Analyze, model and design vapour compression refrigeration systems. 4. Analyze processes involving non-reacting gaseous and gas-vapour mixtures.	PC1431	Nil	Nil	Nil	Properties of pure substances, steam tables (4 hrs) Review and Applications of First Law: First Law applied to non-flow, flow processes and cycles. Ideal gas and condensible substances. (4 hrs) Second Law of Thermodynamics: Direct and reversed heat engines. Reversibility, processes and cycles. Carnot cycle. Clausius inequality. Absolute temperature. Entropy of substances. (5 hrs) Application to processes and cycles: Entropy changes for pure substances in non-flow, flow processes and cycles. P-v and T-s diagrams. Isentropic efficiency. (4 hrs) Power and refrigeration cycles: Water as working fluid for power cycles. Rankine cycle, superheating and reheating. Vapour compression cycle. (3 hrs) Air standard cycles: Analysis of Otto, Diesel and Mixed cycles. Gas turbine cycle. (4 hrs) Mixtures: Dalton's law. Ideal gas and vapour mixtures. (2 hrs)	Lab, Quiz, Final Examination	**Compulsory reading:** Cengel Y.A. and Boles, M.A., "Thermodynamics: an engineering approach", 6th edition in S.I. units, McGraw-Hill Book Company, 2007. **Supplementary reading:** Van Wylen, G.J. and Sonntag, R.E., "Fundamentals of Classical Thermodynamics", 6th edition, John Wiley & Sons, Inc, 2003. Rogers, G.F.C. and Mayhew, Y.R., "Engineering Thermodynamics", 4th edition, Longman Group Ltd, 1992. Jones, J. B. and Dugan, R.E., "Engineering Thermodynamics", Prentice-Hall International, Inc., 1996.
ME2134	Fluid Mechanics I	4	1	This is an introductory course to fluid mechanics as applied to engineering. After introducing the basic terminology and a classification of fluid and flow, students are taught fluid statics, which cover hydrostatic forces on submerged bodies, surface tension forces, buoyancy, metacentric height and stability of floating bodies. Numerous examples of engineering applications pertaining to each aspect of fluid statics are presented. In the section on fluid dynamics, basic principles of fluid motion are introduced. This covers the continuity equation, Bernoulli and energy equations. The momentum equation and its engineering application using the control volume approach are included. In the analysis of fluid-mechanics problems, dimensional analysis and similitude are taught with engineering examples. On viscous flow in pipes, laminar and turbulent pipe flows, Hagen-Poiseuille law, friction factor, losses in pipe fittings and use of Moody's Chart will be covered. This module ends with an introduction to pumps, their elementary theory and matching pump and system.	On successful completion of this module, the student will be able to: 1. classify different types of fluid, identify different types of flow regimes, define stress and rate of strain in a fluid, and understand the phenomenon of surface tension. 2. analyze hydrostatic forces on submerged plane or curved surfaces, evaluate stability of floating bodies and identify the states of equilibrium of floating bodies. 3. define streamlines and establish energy equation and derive Bernoulli equation from it. 4. analyze equilibrium of moving fluid in translation and rotation, and apply continuity, linear and angular momentum equations to analyze fluid mechanics problems. 5. formulate dimensional groups using Rayleigh techniques and Buckingham Pi Theorem, and analyze fluid mechanics problems using the concept of modelling and similitude. 6. analyze energy loss and velocity	PC1431, PC1431FC, PC1431X	Nil	Nil	Nil	1. Introduction to Fluid Mechanics. 2. Classification of Fluid and Flow: Real and ideal; Newtonian and non-Newtonian; Uniform and non-uniform; Steady and unsteady; Laminar and turbulent; Incompressible and compressible. 3. Fluid Statics: Hydrostatic forces on submerged body, buoyancy, metacentric height, stability of floating bodies. 4. Principles of Fluid Motion: Definition of streamline. Continuity equation, Bernoulli equation and Energy equations. Equilibrium of moving fluid (in translation and rotation). Momentum equation and its applications. 5. Dimensional Analysis and Similitude: Rayleigh's method, Buckingham's Π theorem, Dimensionless numbers. Type of physical similarities: geometric, kinematic and dynamic. Reynolds number, Froude number, etc and their simple applications. 6. Laminar and Turbulent Pipe Flows: Hagen-Poiseuille equation, Darcy friction factor, Darcy-Weisbach equation, turbulent flow in smooth and rough pipes, application of Moody's chart and minor losses in pipe system. 7. An Introduction to Pumps: Classification of pumps, elementary pump theory, and analysis of matching pump and system characteristics	Lab reports/Assignment, Final Examination	**Compulsory reading:** 1. "Fluid Mechanics" by F.M. White, 7th edition (McGraw Hill) 2011. 2. "Fundamentals of Fluid Mechanics" by B. R. Munson, D. F. Young, T. H. Okiishi & W. W. Huebsch,, John Wiley & Sons, Inc., 7th Edition, 2013. **Supplementary reading:** 3. "Introduction to Fluid Mechanics" by R. W. Fox, A. T. McDonald & P. J. Pritchard, John Wiley & Sons, 8th Edition, 2012. 4. "Fluid Mechanics: Fundamentals and Applications" by Y. A. Cengel and J. M. Cimbala, Mcgraw-Hill, 3rd Edition, 2014. 5. "Mechanics of Fluids" by M. C. Potter, D. C. Wiggert & M. Hondzo, Prentice Hall, 4th Edition, 2012. 6. "A Physical Introduction to Fluid Mechanics" by A. J. Smits, John Wiley & Sons, 1st Edition, 2000. 7. "Mechanics of Fluids" by I. H. Shames, McGraw-Hill, 4th Edition, 2003. 8. "Engineering Fluid Mechanics" by C. T. Crowe, D. F. Elger, J. A. Roberson & B. C. Williams, John Wiley & Sons, 9th Edition, 2010. 9. "Fluid Mechanics" by J. F. Douglas, J. M. Gasiorek, J. A. Swaffield & L. B. Jack, Prentice Hall, 5th Edition, 2005. 10. "Fluid Mechanics with Engineering Applications" by J. B. Franzini & E. J. Finnemore, McGraw-Hill, 10th Edition, 2002. 11. "Mechanics of Fluids" by B. S. Massey, Taylor & Francis, 9th Edition, 2012. 12. "Applied Fluid Mechanics" by R. L. Mott, Prentice Hall, 6th Edition, 2006. 13. "Elementary Fluid Mechanics" by R. L. Street, G. Z. Watters & J. K. Vennard, John Wiley & Sons, 7th Edition, 1996. 14. "Fluid Mechanics" by V. L. Streeter, E. B. Wylie & K. W. Bedford, McGraw-Hill, 9th Edition, 1997

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ME2142	Feedback Control Systems	4	1 & 2	This module introduces students to fundamental concepts in control system analysis and design. Topics include mathematical modeling of dynamical systems, time responses of first and second-order systems, steady-state error analysis, frequency response analysis of systems and design methodologies in both the time and the frequency domains.	**On successful completion of this module, the student will be able to:** 1. Obtain the dynamic models of simple physical systems, particularly mechanical and electrical systems and obtain the transfer functions of these systems. 2. Determine the transient response of first and second order systems. 3. Determine the stability characteristics of a system using Routh's stability criterion and the root locus method. 4. Determine the steady state error characteristics of systems. 5. Determine the steady state frequency response of physical systems and represent the frequency response graphically in terms of Bode and Nyquist plots. 6. Determine the stability of physical systems through the frequency response using the Nyquist stability criterion. 7. To determine also the relative stability measures such as gain and phase margins and to translate these values in terms of transient response. 8. To conduct simple experiments determining performance of control systems	MA1512+ MA1513	Nil	ME2142E, EE2010 and EE2010E	Nil	**1. General Introduction to Automatic Control:** Definitions. Closed-loop and Open-loop Control. Examples **2. Review of Mathematical Background:** Review of Laplace Transformation. Inverse Laplace Transformation. Solution of Differential Equations. **3. Mathematical Model of Physical Systems:** Transfer functions. Block diagrams. Modeling of mechanical systems, electrical systems, motors. **4. Transient Response Analysis:** Standard time response test functions. Time responses of first-order, second-order and higher-order systems. **5. System Stability and Steady State Characteristics:** Routh's stability criterion. Root locus Method. System Types. Steady state error analysis **6. Frequency Response Analysis:** Forced sinusoidal response. Graphical frequency response methods – Bode and Nyquist plots. Nyquist stability criterion. Gain and phase margins. Closed-loop frequency response.	Lab, Final Examination	1. Course Notes. 2. R.C.Dorf and R.H. Bishop, "Modern Control Systems," Prentice Hall Inc., 2008 3. K. Ogata, "Modern Control Engineering," Prentice-Hall, Inc., 2002. 4. B.C. Kuo, "Automatic Control Systems," Prentice Hall, Inc., 1995
ME2151	Principles of Mechanical Engineering Materials	4	1	This module provides the foundation for understanding the structure-property-processing relationship in materials common in mechanical engineering. Topics explore the mechanical properties of metals and their alloys, the means of modifying such properties, as well as the failure and environmental degradation of materials. Practical applications are demonstrated through laboratory experiments to illustrate the concepts taught during lectures.	Describe the mechanical properties of metals and their alloys and how they are tested; Correlate the microstructures of metals to mechanical properties; Explain the mechanics of failure in metals, including environmental degradation; Apply the knowledge of phase transformations to predict microstructures and desired properties.	Nil	Nil	MLE1101	Nil	Mechanical properties: stiffness, strength, hardness; testing methods: tensile test, indentation. Material structures: atomic bonding; crystal structures; imperfections. Deformation mechanisms in metals: dislocation motion, slip; strengthening/hardening mechanisms. Failure: fracture, crack propagation, ductile-to-brittle transitions, impact testing; fatigue, fatigue testing. Environmental degradation: oxidation; corrosion. Phase equilibria; phase diagrams; invariant reactions; development of microstructures. Kinetics of phase transformations: nucleation and growth; time-temperature transformation diagrams; continuous-cooling-transformation diagrams.	Laboratory, Final Examination	**Compulsory Reading:** Donald R Askeland Pradeep P Fulay and Wendelin J Wright, The Science and Engineering of Materials, 6th Edition, SI Edition, Cengage Learning, 2011; **Supplementary Reading:** William D Callister Jr. and David G. Rethwisch, Materials Science and Engineering, 8th Edition, SI Version, John Wiley and Sons, 2011.; James F. Shackelford, Introduction to Materials Science for Engineers, 7th Edition, Pearson Prentice Hall, 2009.; William F. Smith and Javad Hashemi, Foundations of Materials Science and Engineering, 5th Edition in SI Units, Mc-Graw Hill, 2011
ME3103	Mechanical Systems Design	8	1 & 2	This module consists of a project which is either (i) an industry-sponsored project, (ii) an in-house project linked to external competitions, or, (iii) a project according to a prescribed theme proposed by a group of students. The students will work in groups to complete the design of a mechanical product/system in the first half of the semester to be followed by the fabrication/testing of prototype(s) in the second half. In the course of project work, students will be exposed to the working of team dynamics, the engineering design process, report writing, oral presentation and project management.	1. Students have been exposed to technical proposal preparation, problem solving, the design process, the use of computer-based tools in the design and preparation of design documentation. 2. Students have been exposed to the non-technical issues in a group project such as time management, scheduling, costing, team co-ordination, team dynamics, and informal communication. 3. Students are able to present the design concepts and final design technically (in drawings and CAD models) through reports and oral presentations. 4. Students have been exposed to the verification of designs through the building of a workable prototype that involves hands-on fabrication, prototyping, outsourcing, assembly and testing. 5. Students are able to present the proof-of-concept prototypes through demonstrations, reports and oral presentations.	ME2101 Fundamentals of Mechanical Design ME2103 Engineering Visualisation and Modelling	NA	ME3101 Mechanical Systems Design I ME3102 Mechanical Systems Design II	NA	Team dynamics The design process, comprising: identifying requirements, conceptual design and evaluation, embodiment design and designing for X, analysis/simulation and detailed design. The prototyping process, comprising: experiments, machining, rapid prototyping, outsourcing of specialised fabrication works, sourcing of off-the-shelf components, assembly and integration of components/subsystems, testing and refinement to verify workability. Report writing and oral presentation skills Project planning and management	Tutorials/Seminars, IVLE quizzes, Final report, others (quality of project and its execution, peer review)	**Compulsory reading:** E-learning courseware on ME3103 IVLE Engineering Design Process, Cengage Learning 2nd International Ed., Yousef Haik & Tamer M. Shahin, 2011
ME3112	Mechanics of Machines	4	2	This course covers the fundamental engineering principles on kinematics and kinetics. The topics of rigid body dynamics and vibration will be covered, including the theoretical development and practical application to mechanisms and machinery. The salient features of dynamics to be applied for each instance will be clearly explained and the interpretation of the results obtained will be highlighted.	1. Understand the principles of kinematics and kinetics of rigid body motion. 2. Apply the knowledge of dynamics to solve mechanical vibration problems. 3. Apply the knowledge of kinematics and kinetics to the analysis of machines and mechanisms.	PC1431	Nil	Nil	Nil	1. Revision for kinematics and dynamics of particles 2. Kinematics for rigid bodies 3. Kinetics for rigid bodies 4. Work and energy principle for rigid bodies 5. Vibration of single degree of freedom system 6. Analysis of mechanisms and linkages.	Lab, Final Examination	**Compulsory reading:** Beer, Johnston and Clausen, "Vector mechanics for Engineers - dynamics", McGraw-Hill. **Supplementary reading:** J.L. Meriam and L.G. Kraige, "Engineering Mechaics, Vol 2, Dynamics", John Wiley & Sons. R.C. Hibbler, "Engineering Mechanics, Dynamics", Prentice Hall.

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ME3162	Manufacturing Processes	4	1	Manufacturing processes: cold and hot working, rolling, extrusion, forgoing, sheet and metal blanking and forming, cold forming, welding, brazing, soldering, casting, powder metallurgy, plastics technology. Machine tools: RP, 3-D printing, Lathes, Milling, Drill press, Grinding and laser machining, etc.	On successful completion of this module, the student will be able to: 1. The student will know the principles and applications of various manufacturing processes, and be able to compare them 2. The student will know the principles and applications of plastics manufacture 3. The student will know the principles and applications of metal machining	Nil	Nil	Nil	Nil	A) 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 plastics, thermoplastics and thermosets, manufacturing of plastics B) Machine tools: • Introduction to machine tools and machining operations, Saws (band, abrasive and toothed circular), Drill presses, Lathes, Milling machines and machining centres, Grinders, Single point, multi-point and abrasive material removal Generating motions of machine tools • Cutting tool materials Major tool material types. • Introduction to rapid prototyping Additive manufacturing technologies (fused filament deposition, photo-curing, powder fusing/binding, polymer jetting) • Introduction to laser cutting Laser cutting of sheet material (metal and polymer)	Lab, Final Examination	
ME4101A	B.Eng. Dissertation	8	1 & 2	This module consists mainly of an industrial or research-based project carried out under the supervision of one or more faculty members. It introduces students to the basic methodology of research in the context of a problem of current research interest. The module is normally taken over two consecutive semesters, and is a core requirement of the B.Eng. (Mech) program.	On successful completion of this module, the student will be able to: (1) Undertake research projects in a methodological manner including literature search, formulation of problems, conduct experiments, and analysis. (2) Think critically and acquire independent research skills that are vital for life life-long learning. (3) Communicate effectively through technical report writing on the achievements of the final year project. (4) Achieve confidence in communication skills through various project oral presentations.	Stage 4 standing	Nil	Nil	Nil	NA	100% CA	Dependent on project selected.
ME4102	Standards in Mechanical Engineering	4	1	Standards provide requirements, specifications, guidelines or characteristics that can be used consistently to ensure that products, processes and services are fit for their purposes. We aim to create awareness of, demonstrate and teach various standards currently used in mechanical engineering practices. In this module, three key categories in mechanical engineering are selected, namely smart manufacturing, sustainable energy and medical technology. After giving a broad overview of the standards landscape in mechanical engineering, it will focus on the standards associated with the 3 identified categories. They will be discussed in lectures, industrial talks by experts, student group discussions/projects etc.	1. Able to identify and describe some of the standards in the field of mechanical engineering, both at local and international levels. 2. Able to interpret and apply standards in real world applications. 3. Able to apply standards pertaining to smart manufacturing system and its ecosystem for process design, production planning, shop floor management and operational evaluation. 4. Able to apply engineering knowledge to evaluate the performance of selected energy consuming systems, and assess the compliance of such systems with relevant energy standards. 5. Able to apply the knowledge of standards in medical technology acquired to real world applications pertaining to healthcare infrastructure and ageing population.	Nil	Nil	Nil	Nil	In this module, we understand that the standards in mechanical engineering cover a wide range, they include but not limited to the following three categories, namely smart manufacturing, sustainable energy and medical technology. After giving a broad overview of the standards landscape in mechanical engineering, this module will focus on the standards associated with the 3 identified categories. Smart Manufacturing: Smart manufacturing is the next-generation manufacturing systems that enhance production agility, quality and efficiency by integrating information, technology and human ingenuity as a fully autonomous system. For majors shifts from traditional manufacturing practices, standards and conformance minimize the risks for companies that provide solutions, improve adoption of these solutions among the manufacturing community and increase consumer confidence in the products produced. In this course, students will be exposed to a wide range of standards related to Smart Manufacturing System and its ecosystem including: i) Business Cycle; ii) Product Lifecycle; iii) Production System Lifecycle; iv) Supply Chain Cycle; and v) System Integration. Sustainable Energy: Introduction: Global and local trend of energy consumption; Impact of increasing energy consumption; Steps taken in Singapore for energy sustainability; Benefits of energy sustainability; What is Energy Standard; Importance of Energy Standards in energy sustainability. Energy Standards: Commonly used local and global Energy Standards; Importance of local Energy Standards; Are Energy Standards mandatory?; How to use Energy Standards; Evaluation of energy performance of selected energy consuming systems; Calculation of energy performance indicators; Compliance of Energy Standards; Performance enhancement of selected energy systems to comply Energy Standards. Examples of Energy Standards application: Design and performance evaluation of air-conditioning systems; Green Mark project; Energy Conservation Act; Development of Energy Management System; Benefits and success stories.	100% CA	**Compulsory reading:** • Lecture Notes • Industry 4.0: The Industrial Internet of Things, Alasdair Gilchrist, Apress 1st Edition, 2016. • Smart Manufacturing Innovation and Transformation: Interconnection and Intelligence, Zongwei Luo, IGI Global 1st Edition, 2014 • The Internet of Things: Industrie 4.0 vs. the Industrial Internet, K. Bledowski, 2015. (https://www.mapi.net/research/publications/industrie-4-0-vs-industrial-internet) • Singapore Standard SS 530, SS 553, SS 554, SS 591, ISO 50001. • ASHRAE Standard 14 & 90.1; AHRI 551/591 • Code for Environmental Sustainability for Buildings, 3rd Ed, 2012 • ISO 14971:2012 Medical devices. Application of risk management to medical devices • ISO 14644-1:2015 Cleanrooms and associated controlled environments **Supplementary reading:** • Modelling Practice Standards: IEC/ISO 81714, IPC-D-325, ISO 16792 • Product Model and Data Exchange Standards: ISO 10303, ISO/ASTM 52915 • Manufacturing Model Data Standards: ISO 14649 • Manufacturing Resource and Process Domain Standards: IEC 62424, ISO 18629, IEC61987 • Production System Engineering Standards: IEC 61511, ISO 13849, ISO 18828 • Production Lifecycle Data Management Standards: ISO 15926, IEC 62890 • Production System O&M Standards: ISO 13374 • Modeling and Executing Business Processes: BPMN, ebXML, UBL, WSDL, OAGIS, B2MML • Enterprise Level Standards: ISO 15704, ISO 19439, ISO 19440, ISO 20140 • MOM Level Standards: IEC 62264, IEC 62541, ISO 22400, QIF • SCADA and Device Level Standards: IEC 62541, IEC 61158, IEC 61784, IEC 62591

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										Medical Technology: Medical technology, or medtech, encompasses a wide range of healthcare products or services. It may broadly include information technology, biotech, healthcare service infrastructure, and medical devices. In this section, we will focus on two areas in medical technology, which are closely related to mechanical engineering, namely the healthcare service infrastructure, and medical devices. Problem-based learning is adopted so that the students could relate the knowledge acquired in this section to real life experience. i) The SARS epidemics between 2002-2003 will be used as a case study to highlight the importance of air-conditioning system design and indoor air quality control for a better and safer healthcare environment. Overcrowding in the ward and poor ventilation systems were to blame for the high affection rate of hospital care workers. Hence, a review on the industry standards were conducted after SARS to tackle the health problems associated with air-conditioning systems and indoor air quality. ii) In the last decade, Singapore resident population has grown older with more elderly and fewer younger people. As a result, industry standards on the medical devices, with a special focus on the mobility aid involving mechanical engineering knowledge will be highlighted in this section. Mechanical engineering considerations, safety issues in designing a mobility aid will be introduced. Students will get the opportunity to role play a mobility impaired patient, using an off-the-shelf mobility aid device, and are tasked to improve the current design based on their own user experience within the boundary of the related standards for medical devices. The improved design could better assist the mobility of people with a mobility impairment or enhance their rehabilitation experience.		62591 • Cross-level Standards: ERC 62443, ISO 9000, ISO 50001, ISO 14000 • Energy-Efficient Building Systems, Jayamaha L., McGraw-Hill Inc., 2006, ISBN 978-0-07-148282-0
ME4103	Mechanical Engineering and Society	4	2	Part 1 – Introduction to Project Management In addition to leadership, motivation and communications skills, Project Management involves task planning, cost estimation, measuring and controlling the execution of tasks. Through a combination of lectures, seminars, case studies/tutorials, students will be introduced to the relevant quantitative processes and tools of project managements. Part 2 – Humanitarian Engineering To understand the roles of engineers in advancing the society, student will first be introduced to Professional Engineering Societies to understand how they help them advance their careers. Students will then work on a group project to address one of the grand challenges in Humanitarian Engineering.	Part 1 (1) Able to describe the nature of project management and its related activities, i.e., planning, estimating, project life cycle, management roles, project authority, etc. (2) Able to plan the execution of a project through exercises and seminar using some typical project management software, e.g., Microsoft Project, etc. Part 2 (3) Able to to explain the roles of engineers in advancing society (4) Able to describe grand challenges in engineering, specifically in humanitarian engineering (5) Able to design engineering systems taking into considerations the non-technical factors from humanitarian point of view.	Nil	Nil	Nil	Nil	Part 1 – Introduction to Project Management • Understanding the nature of the projects • Project Management Process • Role of project manager • Effective Planning • Estimating • Preparing a Project Plan • Project Life Cycle • Planning Tools • Management Roles • Reviewing and Reporting Process • Project Authority • Effective Delegation Part 2 – Humanitarian Engineering • Reviews on the roles of engineer in advancing the society. • Discussions on the Grand Challenges for engineers, specifically in humanitarian engineering. • Writing an effective engineering project proposal.	100% CA	N.A.