

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Economics for Engineers

**Subject Code:** AF2617

**Number of Credits:** 3

**Hours Assigned:** Lectures 28 hours  
Tutorials 14 hours

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**Pre-requisite:** nil **Co-requisite:** nil **Exclusion:** Economics for Engineers (AF3901)

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### Role and Purpose:

This subject aims to provide students with fundamental concepts of economics/finance/costing and to develop students' ability to analyze the economic situations by application of these concepts. It also aims to explain how these concepts can be applied to affect the functioning of an engineering company and contribute to decision making in engineering operations. It provides a foundation for related higher level subjects in economics/finance.

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### Objectives:

#### Student Learning Outcomes:

On successfully completing this subject, students will be able to:

1. Understand the fundamental concepts of microeconomics/finance and costing.
  2. Develop the ability to understand economic and financial issues in reality.
  3. Apply the principles of demand and supply to analyze problems in the global economy.
  4. Understand the concepts of costs and revenues in business operation.
  5. Assess the strategies and behaviors of firms operating under various market structures.
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### Teaching Approach:

There will be a lecture of two hours per week that will be structured to help students to understand engineering economics concepts. Besides, there will be an one-hour tutorial per week, for which students are required to present answers from tutorial questions and discuss relevant cases and examples relating to the subject.

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### Indicative Content

1. Introduction to Microeconomics  
Scarcity, Choice and Opportunity Cost; Demand, Supply and Price; Profit-maximizing Objective of a Firm; Cost and Output of a Firm; Depreciation and Cost.
2. Engineering Economic Decisions  
Engineering Projects: Strategic Engineering Economic Decisions; Short-term Operational Economic Decisions.
3. Time Value of Money and Project Evaluation  
Economic Equivalence and Interest Formulas; Evaluation of Engineering Projects using Methods of Present Value, Annual Worth, and Internal Rate of Return.
4. Capital Budgeting Decision  
Methods of Financing Cost of Capital, and Evaluation of Investment Alternatives.

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**Method of Assessment:**

Coursework: 50%

Final Examination: 50%

Minimum Pass Grade: Coursework (D)  
Final Examination (D)

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**Textbook:**

1. S. Park Chan, *Contemporary Engineering Economics*, 3<sup>rd</sup> ed., Prentice-Hall. Michael Parkin, *Economics*, 7<sup>th</sup> ed., Addison-Wesley.

**Reference Books:**

1. G. Sullivan William, A. James Bontadelli and M. Elin. Wicks, *Engineering Economy*, 11<sup>th</sup> ed., Prentice-Hall.
2. Gregory Mankiw, *Principles of Economics*, Dryden Press.
3. Joseph Stiglitz, *Principles of Microeconomics*, 3<sup>rd</sup> ed., W.W. Norton and Company Inc.

**Other Readings:**

1. The Economist.
2. Far Eastern Economic Review.
3. Hong Kong Economic Journal.
4. Various newspaper articles.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Mathematics I

**Subject Code:** AMA201

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 42 hours  
Tutorials and Student  
Presentations 14 hours

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**Pre-requisite:** nil

**Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

To introduce the students to the fundamentals of engineering mathematics. The emphasis will be on the application of mathematical methods to solving engineering problems.

### Student Learning Outcomes:

Upon satisfactory completion of the subject, students are expected to be able to:

1. apply mathematical reasoning to analyse the essential features of different engineering problems;
2. extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations;
3. apply the appropriate mathematical techniques to model and solve problems in engineering;
4. develop and extrapolate the mathematical concepts in synthesizing and solving new problem;
5. search for useful information in solving problems;
6. undertake continuous learning.

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### Syllabus:

1. Algebra of Complex Number  
Complex numbers, Geometric representation, n-th roots of complex numbers.
2. Linear Algebra  
Matrices and determinants, vector spaces, elementary algebra of matrices, eigenvalues and eigenvectors, normalization and orthogonality.
3. Ordinary Differential Equations  
First and second order linear ordinary differential equations, Laplace transforms, convolution theorem, Fourier transforms.

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### Method of Assessment:

Continuous Assessment: 40%

Examination: 60%

Students are required to obtain Grade D or above in both the Continuous Assessment and the Examination components in order to pass this subject.

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### Textbooks and Reference Books:

1. Department of Applied Mathematics, *Basic Engineering Mathematics*, 2<sup>nd</sup> ed., The Hong Kong Polytechnic University, 2004.
2. H. Anton, *Elementary Linear Algebra*, 8<sup>th</sup> ed., John Wiley & Sons, 2000
3. G.B. Thomas, R.L. Finney, M.D. Weir and F.R. Giordano, *Thomas' Calculus*, 10<sup>th</sup> ed., Addison-Wesley, 2000.
4. G. James, *Modern Engineering Mathematics*, 3<sup>rd</sup> ed., Pearson Education, 2002
5. M.E. Van Valkenburg, *Network Analysis*, 3<sup>rd</sup> ed, Prentice-Hall, 1974.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Mathematics II	<b>Subject Code:</b> AMA202
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 42 hours Tutorials and Student Presentations 14 hours

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**Pre-requisite:** Mathematics I (AMA201)      **Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

To introduce the students to the fundamentals of engineering mathematics. The emphasis will be on the application of mathematical methods in solving engineering problems.

### Student Learning Outcomes:

Upon satisfactory completion of the subject, students are expected to be able to:

1. apply mathematical reasoning to analyse the essential features of different engineering problems;
2. extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations;
3. apply the appropriate mathematical techniques to model and solve problems in engineering;
4. develop and extrapolate the mathematical concepts in synthesizing and solving new problem;
5. search for useful information in solving problems;
6. undertake continuous learning.

To develop students' ability for logical thinking and effective communication, tutorial and presentation sessions will be held.

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### Syllabus:

1. Calculus and Functions of Several Variables  
Infinite series, power series, Fourier series, partial differentiation, maxima and minima, Lagrange multiplier, Taylor's theorem.
  2. Partial Differential Equations  
Formulation of partial differential equations, method of separation of variables, initial and boundary value problems.
  3. Vector Calculus  
Vectors, scalar and vector product, grad, div and curl operators, multiple integrals, line, surface and volume integrals, divergence theorem, Stokes' theorem.
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### Method of Assessment:

Continuous Assessment: 40%      Examination: 60%

Students are required to obtain Grade D or above in both the Continuous Assessment and the Examination components in order to pass this subject.

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### Textbooks and Reference Books:

1. G. James, *Modern Engineering Mathematics*, 3<sup>rd</sup> ed., Pearson Education. 2002.
2. R. Haberman, *Applied Partial Differential Equations*, 4<sup>th</sup> ed., Prentice-Hall, 2003.
3. E. Kreyszig, *Advanced Engineering Mathematics*, 8<sup>th</sup> ed., John Wiley & Sons, 1999.
4. H. Rogers, *Multivariable Calculus with Vectors*, 1<sup>st</sup> ed., Prentice-Hall, 1998.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Logic Design

**Subject Code:** EIE211

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 36 hours  
Laboratory 6 hours  
(Equivalent to 18 laboratory hours)

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**Pre-requisite:** nil

**Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

To provide students with a broad view in both hardware and software aspects of digital systems in general and microprocessor systems in particular, and enable them to gain understanding and skills that will be used in later computer related courses. Emphasis will be placed on topics such as

1. Common binary logic components found in a microcomputer system
2. Use and applications of programmable logic devices
3. Structure and organization of microprocessors
4. Basic assembly language programming techniques.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamentals of digital systems and associated technologies.
2. Solve problems and design simple system related to digital logic.
3. Apply theory to practice by using logic design techniques to develop simple digital systems.
4. Appreciate the importance of creativity and critical thinking, and to realize that there is no perfect digital system for any particular situation and that engineers have to find "good" solutions, or make good designs.

#### Category B: Attributes for all-roundedness

5. Present ideas and findings effectively.
  6. Think critically.
  7. Learn independently.
  8. Work in a team and collaborate effectively with others.
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### Syllabus:

1. Logic Circuit and ICs
  - 1.1 Decoders and encoders
  - 1.2 Multiplexers and demultiplexers
  - 1.3 Binary adders, binary adder-subtractors
  - 1.4 Binary multipliers
  - 1.5 HDL representation - Verilog HDL
  - 1.6 Sequential circuit analysis and design
  - 1.7 Registers and counters.
2. Memory and Programmable Logic Devices
  - 2.1 RAM: Write and read operations, timing waveforms, RAM integrated circuits, three-state buffers, DRAM ICs
  - 2.2 Programmable logic technologies
  - 2.3 ROM, PLA and PAL
  - 2.4 VLSI programmable logic devices: Xilinx FPGA.
3. Microprocessor
  - 3.1 Register transfer operations
  - 3.2 Microoperations
  - 3.3 Bus-based transfer
  - 3.4 ALU
  - 3.5 Shifter
  - 3.6 Datapath representation

- 3.7 Control word
- 3.8 Control unit
- 3.9 Algorithmic state machine
- 3.10 Hardwired control and microprogrammed control.
- 4. Basic Assembly Language Programming
  - 4.1 Concepts of assembly/machine languages
  - 4.2 Operand addressing
  - 4.3 Addressing modes
  - 4.4 Instruction set: Data transfer, data manipulation, program control

**Laboratory Experiment:**

- 1. Basic logic gates and their applications
  - 2. Hardware description language
  - 3. Programmable logic devices, Assembly language programming
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**Method of Assessment:**

Continuous Assessment: 40%

Examination: 60%

The continuous assessment will consist of a number of assignment, short quizzes, and two tests.

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**Textbook:**

- 1. M.M. Mano and C.R. Kime, *Logic and Computer Design Fundamentals*, 3<sup>rd</sup> ed., Upper Saddle River, NJ: Prentice-Hall, 2004.

**Reference Books:**

- 1. N.P. Cook, *Digital Electronics with PLD Integration*, Upper Saddle River, NJ: Prentice-Hall, 2001.
- 2. T.L. Flody, *Digital Fundamentals with VHDL*, Upper Saddle River, NJ: Prentice-Hall, 2003.
- 3. B.B. Brey, *The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4*, Upper Saddle River, NJ: Prentice-Hall, 2003.



3. Networking Essentials

Introduction to computer networking – LAN and WAN technologies, clients and servers, networking topologies. Networking models – OSI 7-layer model, IEEE 802 model . Network protocol case studies: Ethernet – cabling, topology, access methods; TCP/IP – application layer message passing, message assembling, port multiplexing, IP addressing, subnetting, routing and address resolution. Networking devices – modem, hub, bridge, switch, and router. (9 hours)

**Laboratory Experiments and other Practical Work (18 hours):**

1. Installation and use of Linux
2. Setting up a Web site with Apache/IIS and XHTML
3. Server-side programming with PHP/ASP
4. Database management using Microsoft Access / MySQL
5. Structured network cabling
6. Network Address Translation and IP Routing

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**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, laboratory reports and tests. The assessment criteria will be made known to the students prior to conducting the assessment.

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**Reference Books:**

1. P. Norton, *Introduction to Computers*, 3<sup>rd</sup> ed., McGraw-Hill, 1999.
2. S.M. Sarwar, *Linux, the Textbook*, 1<sup>st</sup> ed., Addison-Wesley, 2002.
3. H.M. Deitel, P.J. Deitel and T.R. Nieto, *Internet and World Wide Web: How to Program*, Prentice-Hall, 2002
4. W. Redmond, *MCSE Training Kit: Networking Essentials Plus*, Microsoft Press, 2000.
5. C.J. Date, *An Introduction to Database Systems*, 5<sup>th</sup> ed., Addison-Wesley, 2000.
6. K.C. Laudon and J.P. Laudon, *Management Information Systems*, 6<sup>th</sup> ed., Prentice-Hall, 2000.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Engineering Science	<b>Subject Code:</b> ENG232
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> 42 hours

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Pre-requisite: nil	Co-requisite: nil    Exclusion: nil
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### Objectives:

This subject aims :

1. To enable students to establish a broad knowledge base on the atomic structure and properties of materials and a few important engineering problems.
2. To enable students to understand the properties of pure substances, states, phase change, and behaviour of ideal gas.
3. To enable students to understand the forms of energy and their conversion.
4. To enable students to understand and apply the Law of Conservation of mass and Law of Conservation of energy and their applications to various kind of heat engines and heat pumps.
5. To provide a basic understanding of the manufacturing system, the relationship between material properties and manufacturing processes so that they (students) are able to select those that are appropriate taking into consideration green design and environmental issues.

### Student Learning Outcomes:

1. Identify different subsystems, indicate where there is work, heat transfer and the importance of temperature, pressure and density [1, 3].
2. Given a set of properties, find the correct phase and remaining properties for a substance [2].
3. Given a physical set up, find process and compute associated heat and work transfer that is the most reasonable approximation [2, 3].
4. Given a closed thermal system, compute the heat, work transfer and change of internal energy by 1st Law of Thermodynamics[2, 3, 4].
5. Given a physical setup, formulate the ideal approximation to the behavior and compute the corresponding work and heat transfer [4, 6].
6. Given an open thermal system, compute the heat, work transfer and change of enthalpy by 1st Law of Thermodynamics[2, 3, 4].
7. Apply by 1st Law of Thermodynamics to heat engines and refrigerators[2, 3, 4].
8. To design a basic manufacturing system, to recognise the basic inputs and outputs of the system, and their importance when designing products for the consumer market [5].
9. To be able to recognise the basic processes in manufacturing, and to select those that are appropriate recognising time, quality, and cost considerations [5].
10. To be able to select appropriate materials for particular manufacturing applications, and to understand the relationship between processing and material properties taking into consideration relevant issues, particularly green design and environmental issues [5].

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### Syllabus:

1. Materials Science  
Atomic structure, wave-particle duality, bonding and crystal structures and energy levels; optical properties of materials; conductors, insulators, semi-conductors and P/N junction; stress-strain behavior, elastic properties of materials, tensile properties, and compressive, shear, and torsional deformation. (15 hours)
2. Thermodynamics  
Basic concepts and definitions, state, thermal properties, temperature closed and open systems, work and heat, processes and cycles. Equation of state of perfect gas and gas constant, phase (p-v-T) diagram of a pure substance, phase changes and latent heat, vapour and liquid, table of properties of pure substances. The First Law of Thermodynamics, energy and mass conservation in systems, internal energy and enthalpy, applications to closed or steady flow processes. Applications of the First Law of thermodynamics. (15 hours)
3. Manufacturing Technology  
Manufacturing as a system. Product design activity. The product and the marketplace. Evolution of engineering materials. The role of materials in manufacturing. The relationship between

manufacturing processes and material properties. Process capability. Cost consideration in materials selection. Procedures for selecting materials and processes. Green manufacturing and environmentally conscious design. (12 hours)

**Laboratory Experiment:**

Tensile strength of metallic and plastic materials.

**Case study:**

Selection of manufacturing process and material using the Cambridge Engineering Selector.

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**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

Continuous Assessment may include assignments and short tests

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**Textbooks and references:**

1. Bolton, W, *Engineering Science*, 4<sup>th</sup> ed., Newnes, Oxford, 2001.
2. Callister, W.D. Jr, *Material Science and Engineering – an Introduction*, 5<sup>th</sup> ed., Wiley., 2001.
3. Sonntag, Borgnakke & Wylen, *Fundamentals of Thermodynamics*, Wiley & Sons, 2003.
4. Eastop, T.D. and McConkey, A., *Applied Thermodynamics for Engineering Technologists*, 5<sup>th</sup> ed., Longman Group UK, 1993.
5. William D. Callister, Jr., *Materials Science and Engineering – An Introduction*, 6<sup>th</sup> ed., John Wiley & Sons, Inc., 2003.
6. *Manufacturing with Materials*, by Open University, Butterworths, 1<sup>st</sup> ed., 1990.
7. Sherif D. El Wakil, *Processes and Design for Manufacture*, PWS Publishing Company, 1998.
8. The materials selector on CD-ROM [interactive multimedia], Edited by Norman A. Waterman and Michael F. Ashby, Chapman & Hall, 1999.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Computer Programming	<b>Subject Code:</b> ENG236
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/Tutorial/ Laboratory 42 hours

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<b>Pre-requisite:</b> nil	<b>Co-requisite:</b> nil	<b>Exclusion:</b> nil
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### Objectives:

1. To introduce the fundamental concepts of computer programming.
2. To equip students with sound skills in C/C++ programming language.
3. To equip students with techniques for developing structured computer programs.
4. To demonstrate the techniques for implementing engineering applications using computer programs.

### Student Learning Outcomes:

#### Category A: Professional/academic knowledge and skills

After taking this subject, the students should be able to develop a good computer program using C/C++ programming language. To be specific, the students should be able to achieve the following:

1. Familiarize themselves with at least one C/C++ programming environment.
2. Be proficient in using the basic constructs of C/C++, such as variables and expressions, looping, arrays and pointers, to develop a computer program.
3. Be able to develop a structured and documented computer program.
4. Understand the fundamentals of object-oriented programming and be able to apply it in computer program development.
5. Be able to apply the computer programming techniques to solve practical engineering problems.

#### Category B: Attributes for all-roundedness

6. Solve problems by using systematic approaches.
  7. Write technical reports and present the findings.
  8. Learn team working skills.
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### Syllabus:

1. Introduction to programming  
Software components of a computer – Operating system, directories, files. Evolution of programming languages. Programming environment – Compiler, linker and loader. Building the first program – Hello World. (3 hours)
2. Bolts and Nuts of C/C++  
Preprocessor, program codes, functions, comments. Variables and constants. Expressions and statements. Operators. (3 hours)
3. Program Flow Control  
If, else, switch, case. Looping – for, while, do. Functions, parameters passing, return values. Local and global variables. Scope of variables. (4.5 hours)
4. Program Design and Debugging  
Structured program design. Improving program readability. Flow chart. Modular programming – static library. Programming bugs, errors, mistakes and code rot. Exceptions and debugging. Case study: Using Visual C++ debugger. (4.5 hours)
5. Basic Object Oriented Programming  
Objects and classes. Encapsulation. Private versus public. Implementing class methods. Constructors and destructors. (4.5 hours)
6. Pointer and Array  
The stack and free store. Create and delete objects in free store. Pointer arithmetic. Passing function arguments by pointer. Returning values by pointer. Array of Objects. Multidimensional array. Array and pointer. Array of pointers. Pointer of array. Character array – Strings. Command line processing. (9 hours)

7. Stream I/O  
Input and Output. Input using cin. Output using cout. File I/O using streams. (6 hours)
  8. Using C/C++ in Engineering Applications  
Solving numerical problems using C/C++. Developing graphical user interfaces for Engineering applications. Control I/O devices using C/C++. (7.5 hours)
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**Method of Assessment:**

Continuous Assessment: 100%

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**Textbook:**

1. H.M. Deitel and P.J. Deitel, *C++ How To Program*, 5<sup>th</sup> ed., Prentice-Hall, 2005.

**Reference Book:**

1. K. Gregory, *Microsoft® Visual C++®.NET 2003 Kick Start*, Sams Publishing, 2003.



**Laboratory Experiments:** (15 hours, 3 hours each)

1. Introduction to Laboratory instrumentation
  2. Thevenin and Norton theorems
  3. Time dependent circuit analysis
  4. Simple op-amp circuits
  5. Simple digital circuits
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**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

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**Textbook:**

1. G. Rizzoni, *Principles and Applications of Electrical Engineering*, McGraw-Hill Higher Education, 4<sup>th</sup> ed., 2003.

**Reference Books:**

1. R.A. DeCarlo and P.M. Lin, *Linear Circuit Analysis*, Oxford University Press, 2<sup>nd</sup> ed., 2001.
2. A.H. Robbins and W.C. Miller, *Circuit Analysis: Theory and Practice*, Thomson Learning, 2<sup>nd</sup> ed., 2000.
3. M.B. Histan and D.G. Alciatore, *Introduction to Mechatronics and Measurement Systems*, McGraw-Hill, 1999.
4. E. Hughes, *Electrical Technology*, Addison-Wesley Longman Limited, 1997.
5. Donald A. Neamen, *Electronic Circuit Analysis and Design*, Boston, McGraw-Hill, 2<sup>nd</sup> ed., 2002.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Basic Electricity and Electronics II	<b>Subject Code:</b> ENG238
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 42 hours Laboratory 12 hours

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**Pre-requisite:** Basic Electricity and Electronics I (ENG237)      **Co-requisite:** nil      Exclusion: nil

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### Objectives:

To introduce students to the operating principles of electrical machines and electronic circuits. Several classes of electronic circuits will be covered in this subject – diode circuits, BJT transistor circuits, FET transistor circuits, and operational amplifier circuits. The fundamentals of power electronics and simple electric machines will also be introduced.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

1. Understand basic pn junction characteristics, load line concept and the design of basic diode circuits;
  2. Understand fundamentals of DC biasing of BJT and FET circuits;
  3. Understand the basic operation principles of BJT and FET transistor circuits and design;
  4. Understand the basic operation principles of operational amplifiers;
  5. Understand the basic frequency response of amplifiers;
  6. Understand the basic principles of power electronics and operating principles of dc, stepping and servo motors.
  7. Develop their application skills by doing laboratory experiments.
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### Syllabus:

1. Operational Amplifiers  
Integrator and differentiator circuits; analog computers; instrumentation amplifiers; current-to-voltage and voltage-to-current converters; non-ideal op-amp characteristics.
2. Diode Fundamentals  
p-n junction basics; various I-V characteristics of diodes; circuit models for non-ideal semiconductor diodes; load line concept.
3. Transistor Fundamentals  
The bipolar junction transistors (BJT); DC biasing and analysis of BJT circuits; MOS field-effect transistors (MOSFET); junction field effect transistors (JFET); load line and graphical large-signal analysis; transistor amplification concept.
4. Amplifier Circuit Design  
Analog signals and linear transistor amplifiers; basic BJT and MOSFET amplifier configurations; small-signal parameters; voltage and current gains evaluation; input and output impedances, transconductance.
5. Frequency Domain Analysis  
Exponential excitations; s-domain; applications to circuits; RC/RL filters.
6. Frequency Response of Amplifiers  
Equivalent circuits; cut-off frequency; unity-gain bandwidth; system transfer functions, Bode plots; short-circuit and open-circuit time constants; frequency response of amplifiers with coupling; by pass capacitors.
7. Introduction to Electrical Machines  
Star and Delta connections; measuring three-phase power; two-wattmeter method, DC motors; stepping and servo motors; selection criteria of stepping motor and servo motor; basic power electronics.

**Laboratory Experiments:**

1. Op-amps as analog computers and as current-to-voltage converters.
  2. DC transistor biasing/load line and diode clamping circuits.
  3. Transistor amplifier circuits.
  4. Three phase system.
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**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments and tests.

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**Reference Books:**

1. Donald A. Neamen, *Electronic Circuit Analysis and Design*, Boston, McGraw-Hill, 2<sup>nd</sup> ed., 2002.
2. Giorgio Rizzoni, *Principles and Applications of Electrical Engineering*, Boston, McGraw-Hill, 4<sup>th</sup> ed., 2002.
3. E. Hughes, *Electrical Technology*, Addison Wesley Longman L imited, 1997.
4. R.W. Goody, *PSPICE for Windows – A Circuit Simulation Primer*, Englewood Cliff: Prentice-Hall, 1995.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** China Studies

**Subject Code :** GEC2801

**Number of Credits:** 2

**Hours Assigned:** Lecture 28 hours

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**Pre-requisite:** nil

**Co-requisite:** nil **Exclusion:** nil

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### Role and Purpose:

The objective of this subject is to arouse students' interest in pursuing an understanding of China and to help students acquire a broad-based knowledge about China.

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### Learning Outcomes:

Upon completion of the subject, students shall be able to develop interest in:

1. the understanding of China, including its culture, legal system, social and political institutions, economy and business, science and technology, etc.;
  2. the relationship and linkage of the past and the present Chinese Mainland; and
  3. the latest development and trends of the Mainland that shape the future of China.
- 

### Teaching/Learning Approach:

The teaching purpose is to provide students with some overall threads about the aspects of development or institutions of the Mainland. The aim is to present a framework for analysis and understanding as well as some learning guidelines on the topic for the students to go on learning after the lectures. The starting point for the lectures is the present, from which students will be introduced to the historical evolution that has shaped the present and upon which students may be helped to learn about the various factors that would affect the future and how the future might unfold under the interplay of these factors.

Learning should mean thinking, not force feeding of facts and information. Students will not be required to do prerequisite reading, but after the lectures they are encouraged to pursue the topic further by the help of the reference lists and more importantly by the use of relevant web-sites of databanks on the topics. During the lectures, time will be reserved, as an integral part of the lectures, for interaction between students and lectures through Q & A.

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### Indicative Content:

The subject will have 10 theme lectures, each for 4 hours, as follows:

- Theme 1 : Recent Development of Chinese Economy 中國經濟最新發展  
Theme 2 : Business Environment in China 中國商貿環境  
Theme 3 : Economic Geography of China 中國經濟地理  
Theme 4 : Legal System and Laws of the PRC 中國法律體制  
Theme 5 : Political System and Institutions of the PRC 中國政治制度及組織架構  
Theme 6 : Science and Technology in China 中國科技發展  
Theme 7 : Contemporary Chinese Society 當代中國社會  
Theme 8 : Topics in Chinese Traditional Culture 中國傳統文化 – including but not limited to:  
a. Architecture and Design 建築及設計  
b. Food and Cuisines 飲食文化  
Theme 9: Evolution of Chinese Characters 漢字演變  
Theme 10: Chinese Philosophy: Confucianism, Buddhism, and Taoism 中國哲學：儒釋道

(Note 1: For Theme 8, students need to choose either 8a or 8b for submission of the reflective writing/ worksheet. Only one of them will be counted towards the minimum 5 submissions.)

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**Method of Assessment:**

To complete the subject, students are required to:

1. achieve at least 70% attendance, that means to complete at least 5 out of the 7 theme lectures selected;
2. submit and pass a brief reflective writing or pass a quiz, for each of these 5 themes lectures (see Note 1 below); and
3. submit an essay (about 2,500 characters for essay written in Chinese) on one selected theme at the end of the semester and get a pass.

**Grading:** Pass/Fail

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**Learning Support:**

1. General Education Centre's Project Room (located at A529)
2. Online resources database accessible via PolyU campus network
  - a. Infobank China 中國資訊行 <http://www.chinainfobank.com/>
  - b. Sinowisdom 中華智庫網 [http://www.sinowisdom.com/index\\_c.htm](http://www.sinowisdom.com/index_c.htm)
3. Other electronic database on "China Studies" accessible via the website of PolyU library <http://www.lib.polyu.edu.hk/electdb/cdsubject.htm#CHINA>
4. List of Educational Videos (China Studies) <http://www.polyu.edu.hk/~gec/video>

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Industrial Centre Training I

**Subject Code:** IC272

**Number of Credits:** 9 training credits

**Hours Assigned:** 9 weeks  
(Refer to Training Pattern)

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**Pre-requisite:** nil

**Co-requisite:** nil

**Exclusion:** nil

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### Objectives:

Industrial Centre Training I is offered by The Hong Kong Polytechnic University Industrial Centre. The objective of the subject is to equip students with practical skills, techniques and technologies which are general and essential in the practice of electronic and information engineering (EIE). The training comprised of three parts; technology training, engineering graphic communication and industrial safety.

1. Technology training provides training in engineering practice in electronic and information engineering. Students should be able to acquire fundamental knowledge in electronic product design and prototype fabrication with an appreciation of electronic product manufacturing process and practise. On completion of the engineering practice, student should be able to handle projects and fabricate prototype for electronic design and development. Furthermore, students also receive training in fundamental practical skills in different types of computer software that is essential in engineering, which include computer operating systems, clientserver operation, data networking, basic scientific computing, computer graphics and animations, Web authoring and Internet search, database and spreadsheets.
2. Engineering graphic communication provides an opportunity for student to learn and use technical graphics as a media to express ideas and describe objects. The emphasis is put on practicing the principle and interpretation of technical drawing and to communicate design idea using simple sketch and computer graphics. In addition to computer based technical graphics, students are expected to be familiar with using electronic design automation (EDA) software to capture and design electronic circuit boards and comprehend different types of electrical drawings that are frequently encountered in electronic and electrical engineering.
3. Industrial Safety provides students with an understanding of industrial hazards and their control in practicing engineering in industry.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Acquire practical professional skills and best practice in electronic and information engineering for application on the design, construction, operation and maintenance of electronic and information equipment and system.
2. Acquire fundamentals in using commercial available software to solve problems.
3. Demonstrate technical competence in handling electronic projects and produce prototypes for design and development.
4. Understand the importance of safety, responsibility and regulation in the practice of engineering.
5. Application of fundamental principles in electronic and information engineering and develop practical methods to solve circuit or product on development problems.

#### Category B: Attributes for all-roundedness

6. Communicate effectively and work in harmony with other members in a team and develop leadership capability.
7. Communicate effectively with engineering graphics and computer graphics.
8. Demonstrate critical and creative thinking in electronic project development and handling.
9. Understand the importance of training and the needs for continue professional development in professional engineering career.
10. Practice and demonstrate initiative and learn by practice interactively and produce solutions on open-ended problems.

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## Syllabus:

### I. Technology Training (7 weeks)

1. IC 0705 – Automation and Robotics (1 week)
  - 1.1 Introduction to industrial robots, programming and interface.
  - 1.2 Introduction to electronic motion control systems, programmable logic controller, servo and stepping motors. Data communication for industrial robots.
  - 1.3 Applications of sensors for automation and control. Application of electro-pneumatic components and system for automation and control.
  - 1.4 Introduction to material handling devices and Automatic Storage and Retrieval System (ASRS). Introduction to Computer Integrated Manufacturing system (CIM).
2. IC 1101 – Basic Electronic Practice for Electronics and Information Engineering (1 week)
  - 2.1 Introduction to common electronics parts, use of basic test instruments, best practices and basic troubleshooting techniques, electronics workshop safety.
  - 2.2 Soldering and de-soldering techniques, mounting and installation of electronic circuits, wiring of subassemblies.
  - 2.3 PCB design, hands on practice on PCB circuit design in EDA
  - 2.4 Circuit artwork, etching process, PCB prototype fabrication.
  - 2.5 Introduction to embedded devices, hands on embedded device programming and testing practice.
3. IC 1102 – Advanced Electronic Practice for Electronics and Information Engineering (1 week)
  - 3.1 Introduction to electronic circuit interconnect technologies: SMT, COB and wave-soldering.
  - 3.2 Introduction to electronic assembly design and manufacturing process, components, tools and machines.
  - 3.3 Hands-on practice on wave-soldering, SMT process, chip level wire bonding, chip-on-board encapsulation, LCD display attachment with heat seal connector.
  - 3.4 Application and use of electronic test instruments: current and voltage measurements, two wire and four wire techniques, power and signal sources, oscilloscope probes, analogue and digital oscilloscopes.
  - 3.5 Introduction to Virtual Instrument, application and hands -on practice on Labview or equivalent software package.
4. IC3003 - Basic Scientific Computing (30 hours)
  - 4.1 Approach and techniques in using the MATLAB Development Environment.
  - 4.2 Mathematical Operations, matrices, linear algebra, polynomials and interpolation, data analysis and statistics, function functions, differential equations.
  - 4.3 Programming, M-files programming and application examples, flow control statements, function files
  - 4.4 Graphical user interface, data structures, input/output, and object-oriented capabilities .
  - 4.5 Graphics, data plotting, formatting, basic printing and exporting interfaces with examples in basic scientific applications, pie chart, bar chart, area chart, linear and log plots, 3D-View plot experiment with fitting curves to data.
5. IC3004 - General Computer and Network Skills (30 hours)
  - 5.1 General skills on installing software from Internet; file decompressing; general troubleshooting in PC; virus scan and cleaning; creating PDF documents, Installing, upgrading, configuring, managing and troubleshooting Microsoft Windows (contemporary version).
  - 5.2 Managing access to resources, system configuring and data, files and disks management.
  - 5.3 Network Configuration, TCP/IP addressing, name resolution and IP routing.
  - 5.4 Remote access configuring and mobile computing.
6. IC3007 - Web Design, Animation and Presentation (30 hours)
  - 6.1 Create and manual edit HTML files in a typical web site with style sheets .
  - 6.2 Design web pages with DREAMWEAVER using graphics, fonts, layers and interactive features with multimedia, embed Java applets and apply JavaScript onto web pages .
  - 6.3 Differentiate and use appropriately different link methods. Create, upload and maintain web pages in web servers .
  - 6.4 FLASH web animations using timeline and visual effects and POWERPOINT presentations .
7. IC3008 - Database, Spreadsheet and Graphic Illustration (30 hours)
  - 7.1 Application of ACCESS in simple database creation, data sorting and retrieval and reporting.
  - 7.2 Application of EXCEL spreadsheets for basic business and scientific analysis with charts and graph illustrations.

- 7.3 Application of ILLUSTRATOR to create simple graphics in pixel-based and vector-based formats with simple graphic rendering techniques; colour, gradient, and pattern fill.
- 7.4 Application of PHOTOSHOP with basic photo-editing techniques; selection, adjustment, transformation and masking.

## II. Engineering Drawing and Computer Graphics (46 hours)

1. Computer Based Technical Graphics (36 hours)
  - 1.1 Overview and Technical Sketching
    - Engineering graphics as a communication medium, geometrical sketching, problems and visualization.
  - 1.2 Appreciation of Engineering Drawing
    - Orthographic Projection Systems, Sectioning, Auxiliary Projections.
  - 1.3 Technical Sketching
    - Axonometric projections and standard practices; dimension and tolerance.
  - 1.4 Application of CAD in Engineering Drawing
    - CAD command system and drawing aids, computer based documentation; export, import, attachment.
  - 1.5 Three-dimensional Modelling and Presentation
    - Three-dimensional visualization; wire frame, surface and solid models; constructive solid geometry; primitives, Boolean operations.
  - 1.6 Orthographic projection from solid models; viewpoints, model space.
    - Appreciation of parametric solid modelling, parametric constraints; NURBS surface modelling.
2. Engineering Drawing in Electronic & Information Engineering (10 hours)
  - 2.1 Introduction to electronic circuit schematics and logic diagrams; electronic design automation software, placement of components, capturing, annotation, labelling, net list generation.
  - 2.2 Electronic parts library, symbols, physical packages, discrete components, integrated circuits, logic and analogue circuits, gate and pin definition, swappability.
  - 2.3 Electrical & electronic device symbols and layout, system block diagrams and representation, architectural wiring diagram, wiring table and diagrams for electronic and electrical installations.

## III. Industrial Safety (15 hours)

1. Safety Management
  - 1.1 Overview in safety management
  - 1.2 Development of safety in Hong Kong and Government's current safety policy; safety training.
  - 1.3 Principles of safety management.
  - 1.4 Essential elements of safety management; causes of accidents and prevention methods; accident reporting procedures.
  - 1.5 Job safety analysis and fault tree analysis.
2. Safety Law
  - 2.1 F&IU Ordinance and Principal Regulations.
  - 2.2 Construction Sites (Safety) Regulations.
3. Occupational Hygiene
  - 3.1 Noise hazard and control.
  - 3.2 Dust hazard and control.
  - 3.3 Personal protective equipment.
  - 3.4 First aid and emergency procedures.
4. Safety Technology
  - 4.1 Manual and mechanical handling.
  - 4.2 Fire prevention.
  - 4.3 Dangerous substances and chemical safety.
  - 4.4 Machinery hazards and principles of guarding.
  - 4.5 Electrical safety.
  - 4.6 Construction safety - Potential hazards and risks associated with construction sites; safety codes of practice at work.

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**Training Pattern:**

- (I) Technology Training : 2 - 4 weeks in Year 1 term time for computer, networking, and software training elected by student, balance to be scheduled in Year 1 Summer
- (II) Engineering Drawing and Computer Graphics : 30 hours in Year 1 term time.
- (III) Industrial Safety : 15 hours in Year 1 term time.
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**Method of Assessment:**

The assessment is comprised of 100% continuous assessment with the following weighting:-

Assignment: 50%                      Report: 30%                      Test: 20%

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**Reference Books:**

1. Villanucci, Robert S., Avtgis, Alexander W., et al, *Electronic Techniques : Shop Practices and Construction*, 6<sup>th</sup> ed., Prentice-Hall, 1999.
2. Ronald K. Jurgen., *Digital Consumer Electronics Handbook*, McGraw-Hill, New York, 1997.
3. Tooley, Michael H., *Electronic Circuits: Fundamentals and Applications*, 2<sup>nd</sup> ed., Newnes, Oxford, Boston, 2002.
4. Stadtmiller, D. Joseph, *Applied Electronic Design*, Prentice-Hall, N.J., 2003.
5. O'Hara, Martin, *EMC at Component and PCB Level*, Newnes, Oxford , 1998
6. Harper, Charles A., *Electronic Packaging and Interconnection Handbook*, 4<sup>th</sup> ed., McGraw-Hill, 2005.
7. Klein Wassink, R. J., *Soldering in Electronics : A Comprehensive Treatise on Soldering Technology for Surface Mounting and Through-hole Techniques*, 2<sup>nd</sup>ed., Electrochemical Publications Limited, Ayr, Scotland, 1989.
8. Martin, Perry L., *Electronic Failure Analysis Handbook : Techniques and Applications for Electronic and Electrical Packages, Components and Assemblies*, McGraw-Hill, New York, 1999.
9. Meeldijk, Victor, *Electronic Components: Selection and Application Guidelines*, Wiley, New York, 1996.
10. Loveday, George., *Electronic Fault Diagnosis*, 4<sup>th</sup> ed., Pitman, London, 1994.
11. *The ARRL Handbook for Radio Communications*, ARRL, Newington, Conn., 2004.
12. *Microsoft Official Curriculum in Windows*, Microsoft, Redmond.
13. Giesecke, Frederick E., et al., *Modern Graphics Communication*, 2<sup>nd</sup> ed., Prentice-Hall, N.J., 2001.
14. Cheng, Ron, *Maximizing Autodesk Mechanical Desktop 2005*, Delmar Learning, N.Y., 2005.
15. Edward, A. Lacy, *Complete Guide to Understanding Electronics Diagrams*, Prentice-Hall, N.J., 1989.
16. Raskhodoff, Nicholas M., *Electronic Drafting and Design*, 5<sup>th</sup> ed., Prentice-Hall, N.J., 1987.
17. *Code of Practice for the Electricity (wiring) Regulations*, EMSD, The Government of the HKSAR.
18. Julia Pryor Belinski, Charles F. Belinski and Scott J. Wilson, *Dreamweaver 4: Inside Macromedia*, ISBN: 0766820041.
19. Derek Franklin and Brooks Patton, *Flash 5 Creative Web Animation*, Macromedia Press, ISBN: 020171969.
20. Steven Holzner, *Inside JavaScript, Indianapolis, Ind. : New Riders*, 1<sup>st</sup> ed., ISBN: 0735712859.
21. Hakon Wium Lie and Bert Bos, *Cascading Style Sheets: Designing for the Web* , Addison Wesley, 3<sup>rd</sup> ed., ISBN: 0321193121.
22. Ed Bott, Woody Leonhard, *Special Edition Using Microsoft Office 2000 (Special Edition Using)*, QUE, ISBN:0789718421.
23. Michael halverson, Michael J. Young, *Running Microsoft Office 2000 Professional*, Microsoft Press, ISBN: 0735608180.
24. Adobe Creative Team, *Adobe Illustrator 9.0 Classroom in a Book*, Adobe Press, ISBN: 0201710153.
25. Adobe Creative Team, *Adobe Photoshop 6.0 Classroom in a Book*, Adobe Press, ISBN: 0201710161.



**Teaching / Learning Approach:**

In the lectures the general principles of the syllabus topic will be presented and developed. In the seminars, students will develop and apply the general principles of the topic in student-centred activities.

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**Method of Assessment:**

Coursework: 50%

Final Examination: 50%

Minimum Pass Grade: Coursework (D)  
Final Examination (D)

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**Indicative Reading:****Recommended Textbook:**

1. Robbins, S.P. and Coulter, M., *Management*, 8<sup>th</sup> ed., Prentice-Hall, 2005.

**References:**

1. Certo, *Modern Management*, 9<sup>th</sup> ed., Prentice-Hall, 2003.
2. Jones, *Contemporary Management*, 3<sup>rd</sup> ed., McGraw-Hill, 2003.
3. Kinicki & Williams, *Management : A Practical Introduction*, McGraw-Hill, 2003.
4. McShane, *Organizational Behavior*, 2<sup>nd</sup> ed., McGraw-Hill, 2003.
5. Robbins, *Essentials of Organizational Behavior*, 7<sup>th</sup> ed., Prentice-Hall, 2003.
6. Sieren, Boos and Boos, *China Management Handbook*, MacMillan, 2002.

**Recommended periodicals, newspapers:**

1. The Asian Wall Street Journal
2. The Economist
3. South China Morning Post
4. World Executive' s Digest
5. Company Annual Reports (see library collection)



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**Textbooks and Reference Books:**

1. R.E. Walpole, R.H. Myers, S.L. Myers and K.Y. Ye, *Probability and Statistics for Engineers and Scientists*, 7<sup>th</sup> ed., Prentice Hall, 2002.
2. A.V. Balakrishnan, *Introduction to Random Processes in Engineering*, 2<sup>nd</sup> ed., John Wiley & Sons, 2005.
3. W.A. Gardner, *Introduction to Random Processes: with Applications to Signals and Systems*, 2<sup>nd</sup> ed., McGraw-Hill, 1990.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Electronic Circuits

**Subject Code:** EIE304

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

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**Pre-requisite:** Basic Electricity and Electronics I (ENG237)  
Basic Electricity and Electronics II (ENG238)

**Co-requisite:** nil      **Exclusion:** nil

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### **Objectives:**

This is the main foundation subject introducing the working principles and constructions of analog electronic circuits. The specific aim is to familiarize students with the design and operation of analog building blocks (e.g., mirrors, differential stages, output stages), practical operational amplifiers, feedback amplifiers and oscillators.

### **Student Learning Outcomes:**

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the operations of transistor devices, e.g., BJT and MOSFET
2. Analyze the small-signal characteristics of transistor amplifiers
3. Design basic analogue building blocks
4. Understand the operations and limitations of operational amplifiers
5. Analyze and design feedback circuits and oscillators

#### Category B: Attributes for all-roundedness

6. Communicate effectively
  7. Think critically and creatively
  8. Assimilate new technological development in related field
- 

### **Syllabus:**

1. Analog Building Blocks
  - 1.1 Simple current mirrors; problem due to Early effect and non-ideality; Wilson and Widlar mirrors; use of mirrors as active loads.
  - 1.2 Differential amplifier (DA) stage; analysis using half-circuit models, common-mode and differential-mode gains; common-mode rejection ratio (CMRR).
  - 1.3 Output stages; class A, class B and class AB output stages; efficiency; harmonic distortions.
2. Operational Amplifier Design
  - 2.1 Typical operational amplifier circuit: input differential stage, CE gain stage, and output stage; details of internal circuit design: active loading, level shift, current sourcing.
  - 2.2 Non-idealities: dc offset, input bias current (causing offset); finite input impedance, etc.
  - 2.3 Slew-rate limitation; gain-bandwidth product; stability design; concept of unity-gain feedback; phase margin; design of low-frequency pole and use of Miller effect for internal compensation.
3. Feedback Circuits and Oscillators
  - 3.1 General feedback configuration; basic amplifier gain, loop gain and closed-loop (overall) gain.
  - 3.2 Effects of feedback on gain, frequency response, distortion, input and output impedances.
  - 3.3 Feedback circuit configurations: shunt-series, shunt-shunt, series-shunt and series-series feedback; stability analysis; phase margins and compensation methods; analysis of feedback circuits via two-port models.
  - 3.4 Oscillation criteria; amplitude limiting and sustained oscillation; Colpitts, Hartley, Wien bridge, phase-shift and crystal oscillators.

**Laboratory Experiments:**

Each student is required to complete the following three laboratory experiments:

1. Title: Negative Feedback Amplifier  
Objective: To design the feedback network for a given amplifier in order to meet certain specifications.
  2. Title: Oscillator  
Objective: To design a Wien-bridge oscillator using an IC amplifier.
  3. Title: Characteristics of Operational Amplifier  
Objective: To study the internal operation of an operation amplifier and measure the characteristics of the responses.
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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, lab reports, and a test.

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**Textbooks:**

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, *Analysis and Design of Analog Integrated Circuits*, New York: Wiley, 2001.
2. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, New York: McGraw-Hill, 1994.

**Reference Books:**

1. D.A. Jones and K. Martin, *Analog Integrated Circuit Design*, New York: Wiley, 1997.
2. D.A. Neamen, *Electronic Circuit Analysis and Design*, 2<sup>nd</sup> ed., New York: McGraw-Hill, 2001.
3. R.W. Goody, *PSpICE for Windows - A Circuit Simulation Primer*, Englewood Cliffs: Prentice-Hall 1995.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Integrated Analogue and Digital Circuits

**Subject Code:** EIE305

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

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**Pre-requisite:** Basic Electricity and Electronics I (ENG237)  
Basic Electricity and Electronics II (ENG238)  
Electronic Circuits (EIE304)

**Co-requisite:** nil **Exclusion:** nil

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### Objectives:

To develop an in-depth understanding of the design principles and applications of integrated analogue and digital circuits.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamental principles and applications of digital logic circuits.
2. Design periodic signal generators from digital logic circuits.
3. Understand filter design principles and circuit technologies.
4. Apply theory and realize analog filter circuits.
5. Understand the Verilog style digital design.
6. Perform logic synthesis using FPGA tools.

#### Category B: Attributes for all-roundedness

7. Communicate effectively
8. Think critically and creatively
9. Assimilate new technological development in related field

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### Syllabus:

1. Digital Circuits
  - 1.1 Digital logic circuit families: Transistor-transistor logic (TTL), emitter-coupled logic (ECL), and CMOS logic. Input and output characteristics. Fan-in (in CMOS) and fan-out (in TTL). Noise margin. Time delay. Power loss. Switching speed.
  - 1.2 Multi-vibrators: Mono-stable, bi-stable and astable circuits. Saturating and non-saturating multi-vibrators. Schmitt trigger and 555 timer.
  - 1.3 Memory circuits: RAMs, ROMs and EPROMs.
2. Analog Filter Design
  - 2.1 Basic filter principles. Filter approximations (e.g., Butterworth, Chebychev, elliptic, Cauer, etc.). Transfer functions for low-pass, band-pass, high-pass, and band-stop filters. Frequency responses (magnitude and phase).
  - 2.2 Analogue filters: lossless passive realization and active RC realization. Standard first-order filters and biquads.
  - 2.3 Discrete-time realizations. zdomain functions. Active switched-capacitor realization. Standard first-order filters and biquads.
3. Introduction to Verilog Styles Digital Design and Synthesis
  - 3.1 Basic language structures: data types and modules. Structural and behavioural specifications: basic gates, user-defined primitives, modelling levels, synthesizable operations, continuous assignments. Procedural specifications: blocks, functions and tasks, blocking and non-blocking assignments, control and conditional constructs.
  - 3.2 Basic design methodology: small module design, module validation, finite state machines. Managing large complexity leading to large designs.
  - 3.3 Synthesis to FPGA: timing, area and power considerations.

**Laboratory Experiments:**

1. Design of electronic circuits using Xilinx FPGA tools.
  2. Simulation of filter design using SPICE.
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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, quizzes, and two tests.

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**Textbooks:**

1. R. Schaumann and M.E. Van Valkenburg, *Design of Analog Filters*, New York: Oxford University Press, 2001.
2. D.R. Smith and P.D. Franzon, *Verilog Styles for Synthesis of Digital Systems*, Englewood Cliffs: Prentice-Hall, 2000.
3. J.P. Hayes, *Introduction to Digital Logic Design*, Reading: Addison-Wesley, 1993.

**Reference Books:**

1. P.R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, *Analysis and Design of Analog Integrated Circuits*, New York: Wiley, 2001.
2. D. Van den Bout, *The Practical Xilinx Designer Lab Book*, Englewood Cliffs: Prentice-Hall, 1999.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** IC Technology and Processes

**Subject Code:** EIE306

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

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**Pre-requisite:** nil

**Co-requisite:** nil    **Exclusion:** nil

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### Objectives:

To enable students to gain basic knowledge and understanding in the following aspects:

1. Fundamentals of semiconductors
2. The operating principles of pn junctions and MOSFETs
3. CMOS processes and basic CMOS logic gates
4. Fabrication processes of semiconductor devices

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand basic electronic properties of semiconductors.
2. Design structures of pn junctions to meet a given specification.
3. Fabricate basic semiconductor devices.
4. Appreciate the effects of defects and impurities on the properties of semiconductor devices.
5. Optimize the physical structure of a MOSFET .

#### Category B: Attributes for all-roundedness

6. Present ideas and findings effectively.
  7. Think critically.
  8. Learn independently.
  9. Work in a team and collaborate effectively with others .
- 

### Syllabus:

1. Semiconductor Fundamentals  
Energy band, extrinsic semiconductor, carrier concentration, mobility, drift and diffusion currents, Einstein Relationship.
2. P-N Junctions  
Energy band diagram, electrostatics of pn junctions, capacitance, forward and reverse current characteristics, applications in optoelectronics.
3. Bipolar Junction Transistors  
Energy band diagram at equilibrium and under bias, current components, dependence of current gain on transistor parameters, Ebers-Moll model, Charge control model.
4. MOS Field-Effect Transistors  
MOS structure, capacitance of MOS system, operation of MOSFETs, oxide and interface charge, derivation of the threshold voltage, I-V characteristics, short channel effects.

### Laboratory Experiments:

#### Fabrication of Semiconductor Device

Session 1: Cleaning of wafers and oxidation and windows opening and doping;

Session 2: Thin film deposition, photolithography, mask alignment, pattern definition and etching; and

Session 3: Device characterization

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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, quizzes, and two tests.

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**Textbook:**

1. Robert F. Pierret, *Semiconductor Device Fundamentals*, Addison Wesley, 1966.

**Reference Book:**

1. Betty Lise Anderson and Richard L. Anderson, *Fundamentals of Semiconductor Devices*, McGraw-Hill, 2005

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Computer System Fundamentals	<b>Subject Code:</b> EIE311
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 39 hours Laboratory 3 hours (Equivalent to 9 laboratory hours)

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<b>Pre-requisite:</b> Logic Design (EIE211)	<b>Co-requisite:</b> nil	<b>Exclusion:</b> nil
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### Objectives:

To provide a broad treatment of the fundamentals of computer systems.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamentals of computer systems and associated technologies.
2. Solve problems and design simple systems related to computer systems.
3. Apply different important computer interfacing techniques in designing a computer system.
4. Develop a simple assembly program with an assembler.

#### Category B: Attributes for all-roundedness

5. Present ideas and findings effectively.
  6. Think critically.
  7. Learn independently.
  8. Work in a team and collaborate effectively with others.
- 

### Syllabus:

1. **Microprocessors and Microcomputers**  
The following topics will be discussed in detail with references to one or two well-established (contemporary) microprocessor systems.
  - 1.1 CPU architecture; memory space and I/O space; instruction fetch and execution; pipelining; essential assembly language instruction types; working principle of assembler; assembler directives/pseudocodes; examples of assembly language programs.
  - 1.2 Memory interface: Memory devices; address decoding; memory interface; banking; bus buffering and driving; wait state, bus cycle, instruction cycle.
  - 1.3 Basic I/O interface: Memory-mapped I/O; I/O port address decoding; programmable peripheral interface; handshaking.
  - 1.4 Interrupts: polling, programmed I/O, interrupt I/O; Basic interrupt processing, software interrupt, expanding the interrupt structure, interrupt controller.
  - 1.5 Serial interface: Asynchronous/synchronous interface, RS232C serial interface and handshaking.
  - 1.6 Direct memory Access and DMA-controlled I/O: Basic DMA operation, DMA controller, shared-bus operation, disk memory systems, video displays.
  - 1.7 Cache memory: mapping, associativity; replacement policies; write policies; performance.
2. **Disk Operating System**
  - 2.1 Roles of basic input/output system (BIOS) and basic disk operating system(DOS); power-up sequence; bootstrap; command processor; system control, automatic program execution (e.g. batch file); operating system calls via software interrupts; system utilities; file operating commands; device driver.
  - 2.2 File system: space management e.g. file allocation table; File management; directory entry and file control block.
  - 2.3 Multitasking and time-sharing: time-slicing; process states and process control block; context-switching mechanism; scheduling schemes and process priorities.

3. Computer Arithmetic

- 3.1 Data formats: signed/unsigned numbers, binary/decimal/BCD numbers, ASCII, fixed/floating point numbers, IEEE standard; Arithmetic algorithms: Fast addition, multiplication and division algorithms.

**Laboratory Experiment:**

Six of the following topics or others.

1. Memory manipulation & Data representation
2. Serial communication
3. Parallel communication
4. Interrupt I/O
5. DMA I/O
6. BIOS
7. Device driver
8. Power-up procedures
9. User interface

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**Method of Assessment:**

Continuous Assessment: 40%

Examination: 60%

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**Textbook:**

1. Barry B. Brey, *The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor: Architecture, Programming and Interfacing*, 6<sup>th</sup> ed., Prentice-Hall, 2003.

**Reference Books:**

1. C. Hamacher, Z. Vranesic and S. Zaky, *Computer Organization*, 5<sup>th</sup> ed., McGraw-Hill, 2002.
2. Hans-Peter Messmer, *The Indispensable PC Hardware Book*, 4<sup>th</sup> ed., Addison-Wesley, 2002.
3. Silberschatz and P.B. Galvin, *Operating System Concepts*, 5<sup>th</sup> ed., John Wiley & Son, 1999.
4. W. Stallings, *Operating Systems: Internals and Design Principles*, 3<sup>rd</sup> ed., Prentice-Hall, 1998.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Linear Systems

**Subject Code:** EIE312

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 36 hours  
Laboratory 6 hours  
(Equivalent to 18 laboratory hours)

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**Pre-requisite:** Mathematics I (AMA201)

**Co-requisite:** nil      **Exclusion:** nil

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**Objectives:**

1. To provide students with basic concepts and techniques for the modelling and analysis of linear continuous-time and discrete-time signals and systems.
2. To provide students with an analytical foundation for further studies in Communication Engineering and Digital Signal Processing.

**Student Learning Outcomes:**

On successful completion of this subject, the students will be able to:

Category A: Professional/academic knowledge and skills

1. Understand the representations and classifications of the signals and systems.
2. Model linear systems using time and frequency domain approaches for both continuous-time and discrete-time models.
3. Analyze signals and systems using both time domain and frequency domain techniques.
4. Understand the generation of a discrete-time signal by sampling a continuous-time signal.
5. Understand the design of analogue filters.
6. Apply software tools, particularly MATLAB, to laboratory exercises for experimenting with theories, and to the analysis and design of signals and systems.
7. Appreciate the advantages and disadvantages of using the different representations and modeling approaches.

Category B: Attributes for all-roundedness

8. Present ideas and findings effectively.
  9. Think critically.
  10. Learn independently.
  11. Work in a team and collaborate effectively with others.
- 

**Syllabus:**

1. Signal Representation  
Signal Classification, Continuous and Discrete-Time Signals, Random Signals. Time-Domain and Frequency-Domain Representations.
2. Continuous-Time and Discrete-Time Systems  
Impulse Representation and Convolution, Linear Time-Invariant Systems. Properties of Systems: Causality, Time Invariance, Linearity, Systems with Memory, Inverse of a System, Stability. LTI Systems: Differential and Difference Equation Representation, Block Diagram Representations.
3. Fourier Representations for Signals  
Reviews on Periodic and Nonperiodic Signals, Continuous and Discrete Signal, Fourier Series and Transform, Frequency Spectra. Properties of Fourier Representations, Time Functions, Applications on System Frequency Response and Signal Frequency Spectrum. Frequency Response of LTI Systems, Sampling. Discrete-Time Fourier Transform, Discrete Fourier Transform, Circular Convolution.
4. Laplace Transform  
Definition and Properties of Laplace Transform, Inversion of Laplace Transform, Bilateral Laplace Transform. Transform Analysis of LTI Systems, Poles and Zeros. Relationship of Laplace Transform and Fourier Transform.

5. z-Transform  
Definition and properties of z-Transform. Inverse z-Transform: Power Series Expansion, Partial-Fraction Expansion. z-Transfer Analysis of LTI Systems, Frequency Response. Mapping between z-Plane and s-Plane.
6. Analogue Filters  
Ideal Filters, Bode Plots. Filter Design: Butterworth Filters, Chebyshev Filters, Frequency Transformations.

**Laboratory Experiments:**

1. Fundamentals of Signals
  2. Linear Time Invariant Systems
  3. Fourier Analysis of Continuous-time Signals
  4. Sampling
  5. Fourier Analysis of Discrete-time Signals
  6. Laplace Transform
- 

**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments, laboratory reports, and two tests.

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**Reference Books:**

1. Ed. Kamen and Bonnie Heck, *Fundamentals of Signals and Systems Using the Web and Matlab*, 2/e, Prentice-Hall, 2000.
2. Simon Haykin and Barry Van Veen, *Signals and Systems*, Wiley, 2003.
3. M.J. Roberts, *Signals and Systems: Analysis Using Transform Methods and MATLAB*, McGraw-Hill, 2003.
4. Charles L. Phillips, et al., *Signals, Systems, and Transforms*, 3/e, Prentice-Hall, 2003.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Object-Oriented Design and Programming

**Subject Code:** EIE320

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 36 hours  
Laboratory 6 hours  
(Equivalent to 18 laboratory hours)

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**Pre-requisite:** Computer Programming (ENG236)

**Co-requisite:** nil **Exclusion:** nil

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### Objectives:

This subject will provide students with the principles of object orientation from the perspective of Java implementation and UML. Students are expected to learn the concepts of and practical approaches to object-oriented analysis, design and programming using UML and Java.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the principles of object oriented design.
2. Apply the programming language Java in object oriented software development.
3. Apply the tool UML in object oriented software modeling.
4. Develop a simple software application using the object oriented approach.

#### Category B: Attributes for all-roundedness

5. Learn independently and be able to search for the information required in solving problems.
  6. Present ideas and findings effectively.
  7. Think critically.
  8. Work in a team and collaborate effectively with others.
- 

### Syllabus:

1. Introduction to Software Engineering  
Software products; the software process; process models; process visibility.
2. Java Programming Basic  
Java technologies; Java platform; Java language basic: variables, operators, expressions, statements, blocks, control flow, methods, arrays
3. Object-Oriented Programming with Java  
Objects and classes; class definition; fields, constructors and methods; object interaction; grouping objects; array and collections; designing classes; inheritance and polymorphism; managing inheritance: creating subclasses and super-classes, hiding member variables, overriding methods. Interfaces and packages.
4. Web Programming with Java  
Java applets: creating custom applet subclasses, HTML applet tag syntax, passing information from Web pages to applets. Java Servlets: architecture of servlets, client interaction, life cycle of servlets, saving client states; servlet communications, session tracking, and using server resources.
5. Unified Modelling Language (UML)  
Purposes of modeling. Structural Modeling: classes, relationships, class Diagrams, interfaces, packages, and object diagrams. Behavioral modeling interactions, use cases, use case diagrams, interaction diagrams, activity diagrams, events, signals, processes and threads. Architectural modeling: components, deployment, collaborations, patterns, frameworks, component diagrams, and deployment diagrams. Mapping UML diagrams to Java Code.

**Laboratory Experiment:**1. Laboratory Work

Students will implement an on-line shopping system using Java Servlets and Tomcat Web server. Students will use a UML software tool to write requirement specifications and design documents for the on-line shopping system.

2. Practical Work

Students will be requested to write and debug Java programs during tutorial and lab sessions.

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**Method of Assessment:**

Coursework: 40%

Examination: 60%

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**Textbooks:**

1. G. Booch, I. Jacobson, and J. Rumbaugh, *The Unified Modeling Language User Guide*, Addison-Wesley, 1999.
2. D.J. Barnes and M. Kolling, *Objects First with Java: A Practical Introduction using BlueJ*, Prentice-Hall, 2003.

**Reference Books:**

1. H.M. Deitel and P.J. Deitel, *Java: How To Program*, 5<sup>th</sup> ed., Prentice-Hall, 2002.
2. R.C. Lee and W.M. Tepfenhart, *Practical Object-Oriented Development with UML and Java*, Prentice-Hall, 2003.
3. J. Rumbaugh, I. Jacobson, and G. Booch, *The Unified Modeling Language Reference Manual*, Addison-Wesley, 1999.
4. <http://java.sum.com>.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Interface and Embedded Systems	<b>Subject Code:</b> EIE322
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 37 hours Laboratory 5 hours (Equivalent to 15 laboratory hours)

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<b>Pre-requisite:</b> Computer System Fundamentals (EIE311)	<b>Co-requisite:</b> nil	<b>Exclusion:</b> nil
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### Objectives:

To provide students with the concepts and techniques in designing embedded software and hardware interfaces.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Identify and model real-time requirements of products.
2. Apply embedded software techniques to satisfy functional and response-time requirements.
3. Apply circuit and computer knowledge onto product design.
4. Practice self-learning through reading of manuals and component specifications.
5. Demonstrate practical skills in the construction of prototypes.
6. Design under tradeoffs among various constraints such as manpower, program size and hardware complexity.

#### Category B: Attributes for all-roundedness

7. Pursue life-long learning through searching and reading technical materials.
  8. Design and solve problems in general.
  9. Present ideas and findings effectively.
  10. Think critically.
  11. Work in a team and collaborate effectively with others.
- 

### Syllabus:

1. Embedded System Hardware  
Microcontroller-based, microprocessor-based and PC-based approaches; Details of a typical microcontroller architecture e.g. the 8051 or AVR family.
2. I/O Interfacing  
Output-pin driving limitations; Current driving; inductive load driving; Pulse generation and measurement; Keyboard multiplexing, display multiplexing; LCD controllers; analog signals sensing, processing and generation.
3. Embedded Software Development and Testing  
Embedded software issues; tasks and events; Interrupt system: nesting, priority and latencies; inter-task communication, the shared-variables problem and solutions; Multitask embedded software architectures and scheduling schemes; task latencies, CPU utilization, RMS theorem; program simulator, debugger, emulator and logic/state analysis tools; hardware/software co-design issues.
4. Real-time Operating System  
Kernel services; semaphores; task priority and scheduling; priority inversion.
5. Industrial I/O Standards  
Signalling, transaction protocols, timing specifications and arbitration. e.g. RS485, PS2, I<sup>2</sup>C, CAN and USB. Case studies on USB.
6. Bus Interfacing  
Synchronous and asynchronous transfers; bus events and states, electrical buffering; storage buffering; dynamic bus sizing; data ordering and alignment; pipelined and burst transfers;  $\alpha$  loading effects; switching-current effects; Memory device interfaces: dynamic memory, flash memory and application-specific memories.

**Laboratory Experiments:**

1. Serial I/O and timer-based baud rate generation
  2. Timer-based pulse width measurement
  3. Timer-triggered multitasking
  4. Pulse-Width-Modulated output generation.
  5. USB development tool and programming.
- 

**Method of Assessment:**

Continuous Assessment: 50%                      Examination: 50%

The continuous assessment will consist of assignments, tests and laboratory work.

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**Reference Books:**

1. M. J. Pont, *Embedded C*, Addison-Wesley, 2002.
2. D.E. Simon, *An Embedded Software Primer*, Addison-Wesley, 1999.
3. K. Arnold, *Embedded Controller Hardware Design*, Newnes, 2001.
4. S. R. Ball, *Embedded Microprocessor System s: Real World Design*, 3<sup>rd</sup> ed., Newnes, 2002.
5. Rai Kamal, *Embedded Systems: Architecture, Programming and Design*, McGraw-Hill, 2004.
6. S. R. Ball, *Analog Interfacing to Embedded Microprocessors: Real World Design*, 2<sup>nd</sup> ed., 2004.
7. Betty Prince, *High Performance Memories*, John Wiley & Sons, 1996.
8. W. Buchana, *PC Interfacing, Comm and Windows Programming*, Addison -Wesley, 1999.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Integrated Project

**Subject Code:** EIE330

**Number of Credits:** 2

**Hours Assigned:**

Lecture	12 hours
Laboratory	9 hours
Mini-project Work	69 hours
Total	90 hours

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**Pre-requisite:** Electronics Design (EIE210)  
Computer Systems Fundamentals (EIE311)

**Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

At a mid-stage of the programme, this subject plays the role of applying knowledge acquired in other subjects in an integrated manner. While the emphasis will mainly be placed on the technical challenges that may encompass component evaluation, circuit design, software development and troubleshooting, students will also be given opportunities to face various non-technical difficulties behind the implementation/fabrication of electronic/information products.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Integrate and apply knowledge acquired in previous subjects.
2. Design under cost constraints and with component limitations/tolerances in mind.
3. Critically evaluate the cost-performance benefits of available components.
4. Locate and resolve problems, in both circuits and software.

#### Category B: Attributes for all-roundedness

5. Search, self-learn and try untaught solutions.
  6. Exercise discipline and time-planning to meet deadlines.
  7. Present ideas and findings effectively.
  8. Think critically.
  9. Learn independently.
  10. Work in a team, collaborate effectively with others, and exercise leadership.
  11. Exercise entrepreneurship while designing the project by addressing cost effectiveness, market position, entry barrier, user acceptance...etc.
- 

### Syllabus / Operation:

The project(s) shall be of engineering development in nature with objectively defined milestones (or **Subtasks**). The scope to be covered shall include embedded software development and circuit design, but does not exclude the possibilities of extending into areas such as DSP or RF. The project(s) shall not be close-ended in nature and shall provide ample headroom for the more enthusiastic students to excel. Students shall work in groups of two or three. Each **Subtask** will be given a certain period of time to complete. Each student will take turn in serving as the Team Leader to lead the group to complete a subtask assigned. Progress will be measured by functional **Demonstrations**, and one or two written **Progress Reports**. Upon the completion of the project, each group should give a demonstration/presentation of the completed product and submit a **Final Report**. Students are required to individually keep a **Logbook** on the work performed during the entire period. The logbooks are to be evaluated and signed by the supervisor /assessor on a monthly or more frequent basis. At the end of the project, the logbook will be collected and graded.

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**Lectures:**

Lectures are to be conducted during the first half of the semester. During these lectures, the instructor shall give clear explanation on the functional and technical requirements, with a schedule for submitting deliverables. Concepts specific to the project(s), which are not yet learnt by the students, are to be covered in these lectures. Concepts behind critical use of tools and equipment will also be strengthened.

**Guided Laboratory Experiments:**

The project will normally require the students to use specific tools and/or equipment. Laboratory demonstrations and exercises will be arranged in the early weeks. Below are some examples:

1. Troubleshooting and measurement techniques using typical equipment.
2. Use of project-specific development tools, software and hardware.
3. Use of specialized equipment for project-specific measurements.

**Self-Paced Work:**

The class could well be composed of a good mix of students with different timetables. Multiple sessions of laboratory, inevitably some evening slots, will be scheduled to cater for self-paced work in the laboratory, particularly during the second half of the semester.

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**Method of Assessment:**

Continuous assessment: 100%

Throughout the project, the subject lecturer will conduct periodic interview discussions with the student groups. On these occasions, assessment on individual student's ability and contribution will be conducted, according to the attributes detailed below.

INSIGHT	as evidenced by how well issues are understood and resolved
DRIVE	as evidenced by initiative, diligence and tenacity
CREATIVITY	as evidenced by ingenuity and imagination
COMMUNICATION	as evidenced by an ability to express ideas clearly and succinctly

At the completion of each subtask, one member of a team will be asked to give a demonstration to the assessor. Based on the presentation and response to questions addressed to the members, the assessor shall rate the contribution, achievement, and performance of each member.

Below is a recommended assessment scheme:

<b>Assessment type</b>	<b>Weighting</b>	<b>Number of times</b>
Attendance	10 %	= 5
Quiz/Test	10 %	= 2
Progress Demonstrations	20 %	= 2
Logbook & Presentation	20 %	= 2
Progress& Final Reports	20 %	= 2
Final Demonstration	20 %	1

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**Reference Books:**

*To be specified by the subject lecturer for each project.*

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Communication Fundamentals	<b>Subject Code:</b> EIE331
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 36 hours Laboratory 6 hours (Equivalent to 18 laboratory hours)

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**Pre-requisite:** Mathematics I (AMA201)  
Mathematics II (AMA202)      **Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

Telecommunication occupies an important role in every society. The major objectives of this subject are to establish the foundations for the students so that they understand the telecommunication industry, its historical development, and the future trend; the fundamental principles governing the operation of telecommunication systems.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Identify various elements in a typical communication system.
2. Perform quantitative measurement for information.
3. Describe the operational details of various modulation and demodulation schemes.
4. Relate the performance of a communication to features such as signal to noise ratio and bandwidth.
5. Design a simple communication system consisting the basic building blocks.

#### Category B: Attributes for all-roundedness

6. Communicate effectively.
  7. Think critically and creatively.
  8. Work in a team collaboratively.
  9. Assimilate new technological development in related field.
- 

### Syllabus:

1. Introduction
  - 1.1 Introduction to communication systems. Elements of a basic communication system. Examples of wired and wireless systems.
2. Information Theory
  - 2.1 Measure of information. Entropy.
  - 2.2 Conditional, joint and mutual information. Channel capacity.
3. Analogue Communications
  - 3.1 Amplitude modulation: double sideband, single sideband and vestigial sideband modulation, frequency spectrum and power relationship of the amplitude modulation signal, envelope detector, coherent detector, superheterodyne receiver.
  - 3.2 Angular modulation: phase and frequency modulation, frequency spectrum of the angular modulation signals, discriminator, PLL detector. Stereo FM.
  - 3.3 Noise in analogue modulation: Output S/N ratios in various analogue modulation systems. S/N ratio improvement through pre-emphasis/de-emphasis.
4. Pulse Modulation
  - 4.1 Pulse amplitude modulation, quantizing and coding, quantization noise, uniform and non-uniform quantization, pulse code modulation, delta modulation. Comparison of pulse code modulation and delta modulation systems.
  - 4.2 Time division multiplexing: concept of framing and synchronization, TDM-PCM telephone system, comparison of TDM and FDM

**Laboratory Experiment:**Experiments

1. Amplitude Modulation
2. Frequency Modulation
3. Pulse Modulation

Mini Project

1. Superheterodyne receiver
- 

**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

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**Textbook:**

1. F.G. Stremler, *Introduction to Communication Systems* Addison-Wesley, 1990.

**Reference Books:**

1. A.B. Carlson, P.B. Crilly and J.C. Ruthledge, *Communication Systems*, 4<sup>th</sup> ed., McGraw-Hill, 2002.
2. S. Haykin, *Communication Systems* 4<sup>th</sup> ed., John Wiley & Sons, 2001.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Data and Computer Communications      **Subject Code:** EIE333  
**Number of Credits:** 3      **Hours Assigned:** Lecture/tutorial 36 hours  
Laboratory 6 hours  
(Equivalent to 18 laboratory hours)

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**Pre-requisite:** Communication Fundamentals (EIE331)      **Co-requisite:** nil  
**Exclusion:** Data and Computer Communications (EIE442)

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### **Objectives:**

This subject is designed to:

1. provide a solid foundation to the students about architectural concepts of data communications and computer networking
2. enable the students to master the knowledge about data communications and computer networking in the context of real-life applications
3. prepare the students for understanding, evaluating critically, and assimilating new knowledge and emerging technology about data communications
4. enable the students to understand the impact of new computer and communication technology on human society

### **Student Learning Outcomes:**

On completion of this subject, the students will be able to:

Category A: Professional/academic knowledge and skills

1. Describe the services, functions, and inter-relationship of different components within an architectural model such as Open System Interconnection (OSI) seven layer model and TCP/IP model.
2. Describe how components and subsystems in the physical layer, data link layer, and network layer inter-operate; and analyze their performance.
3. Evaluate critically the performance of some common data communications systems.
4. Design solutions to solve engineering problems that require the application of data communications technology.

Category B: Attributes for all-roundedness

5. Take up new knowledge by reading related magazines, journal papers, and trade brochure, and by analyzing new situations while taking into account various constraints.
  6. Describe how rapid progress of computer and communication technology can impact on the society in various aspects, such as culture and economics.
- 

### **Syllabus:**

1. Communication Networks, Services, and Layered Architectures  
Evolution of networking and switching technologies. Protocols and services. Layered network architectures: OSI 7-layer model, TCP/IP architecture
2. Digital Transmission  
Baseband data transmission and line coding. Digital modulation and its applications in modems. Transmission media. Transmission impairment, data rate limit, error detection and correction.
3. Protocols in Data Link Layer  
Automatic Repeat Request (ARQ) protocol and reliable data transfer service. Sliding-Window flow control. Framing and point-to-point protocol.

4. Local Area Networks  
Media Access Control (MAC) protocols: the IEEE802.3 and IEEE802.11 standard. Interconnection of LANs: bridge, switch, and virtual LAN
5. Packet Switching Technology  
Connectionless (datagram) packet switching and virtual-circuit switching. Routing in packet networks.
6. TCP/IP Protocols  
IP packet format, addressing, subnetting, and IP routing. TCP protocol: connection management and congestion control. Dynamic Host Configuration, Network Address Translation, and mobile IP.
7. Case Studies (conducted in tutorial sessions)  
Recent development in data Communications and computer Networking.  
Selected topics: Voice over IP, Virtual Private Network, Internet2, High Speed Router design ... etc.

**Laboratory Experiments:**

1. FSK Modem
  2. Microcontroller communication over EIA323 interface
  3. Protocol Analysis
  4. Network Address Translation
  5. Routing simulation study
  6. Terminal Server over the Ethernet
- 

**Method of Assessment:**

Continuous assessment: 50%                      Examination: 50%

The continuous assessment will consist of a number of assignments, laboratory reports, case study reports (administered in tutorial sessions), and two tests.

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**Textbook:**

1. Leon-Garcia, Alberto, *Communication networks : fundamental concepts and key architectures*, 2<sup>nd</sup> ed., New York : McGraw-Hill Higher Education, 2004. (PolyU Call No.: TK5101 .L46 2004)

**Reference Books:**

1. Stallings, William, *Data and computer communications*, 7<sup>th</sup> ed., Pearson/Prentice-Hall, 2004. (PolyU Call No.: TK5105 .S73 2004)
2. Tanenbaum, Andrew S., *Computer networks*, 4<sup>th</sup> ed., Prentice-Hall, 2003. (PolyU Call No.: TK5105.5 .T36 2003)
3. Comer, Douglas, *Computer networks and internets: with Internet applications*, 4<sup>th</sup> ed., Pearson/Prentice-Hall, 2004. (PolyU Call No.: TK5105.5 .C5897 2004)
4. Bertsekas, Dimitri P., *Data networks*, 2<sup>nd</sup> ed., Prentice-Hall, 1992. (This reference is selected as a classics) (PolyU Call No.: TK5105 .B478 1992)

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Applied Electromagnetics

**Subject Code:** EIE338

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

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**Pre-requisite:** nil

**Co-requisite:** nil

**Exclusion:** nil

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### Objectives:

1. To introduce to students the physical laws that govern the electromagnetic phenomena commonly encountered in electrical engineering systems.
2. To familiarise students with the techniques for solving problems in electromagnetics.
3. To provide students the foundation of electromagnetic field theory required for pursuing the EE programme.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional / academic knowledge and skills:

1. Apply mathematical techniques to formulate the fundamental field equations and to analyse electromagnetic phenomena related to electrical engineering systems.
2. Select the most appropriate laws/theorems/solution techniques for electromagnetic field analysis.
3. Appreciate the effect of material media and boundary conditions on the behaviour of field quantities.
4. Apply electromagnetic theory to the design of practical electromagnetic devices and components.
5. Appreciate recent developments in computational electromagnetics.
6. Have had hands-on experience in electromagnetic measurements and be able to compare/appreciate different kinds of field plotting mechanisms, e.g., to verify Laplace's equation with a resistance network.

#### Category B: Attributes for all-roundedness:

7. Appreciate the engineering applications of electromagnetic theory.
  8. Appreciate the importance of electromagnetics from a historical perspective.
  9. Interpret the physical meaning and phenomena behind mathematical equations and computed results.
  10. Describe a physical problem mathematically and to apply mathematical tools to analyse and solve physical problems.
- 

### Syllabus:

1. Static fields: Electrostatics  
Electric fields, Coulomb's law, Gauss's law, potential, capacitance and energy storage. Magnetostatics: Biot-Savart law, magnetic fields, Ampere's circuital law, force on a current-carrying conductor, Lorentz force and energy storage.
2. Time-varying Fields  
Faraday's Law and Lenz's Law; self-inductance, mutual inductance and stored energy.
3. Mathematical Preliminaries  
Vectors, vector and scalar product. The operators, grad, div and curl. Concept of line, surface and volume integrals. Stokes's and divergence theorems.
4. Maxwell's Equations and EM Waves  
Maxwell's equations in integral form as a restatement of fundamentals. Differential form. The continuity equation. The displacement current. The wave equation, plane polarized wave, velocity of propagation and energy flows.
5. Material Media  
Dipole, polarisation, permittivity, dielectrics and capacitors. MMF, ferromagnetism, permeability, reluctance and permeance, magnetisation curve and hysteresis. Magnetic circuits.

6. Solution of Static Field Problems

Hand-mapping, method of images, numerical and computer-based methods. Field analogues. Estimation of conductance, inductance, capacitance and field quantities from field plots.

7. Electromagnetic Design

Magnetic circuit design for inductors, actuators and rotating machines. Design of cable insulation and capacitors. Concepts of electromagnetic interference and screening.

**Laboratory Experiments:**

1. Field plotting using resistance and impedance networks.
  2. Field plotting using the Electrolytic tank.
  3. Field plotting using the resistive paper.
- 

**Method of Assessment:**

Continuous Assessment: 30%                      Examination: 70%

The continuous assessment will consist of assignments, tests and laboratory reports.

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**Reference Books:**

1. W. H. Hayt, Jr. and J. A. Buck, *Engineering Electromagnetics*. 6<sup>th</sup> ed., Boston: McGraw Hill, 2001



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### Teaching and Learning Approach and Teaching Schedule:

The subject is designed to introduce students to the communication skills, both oral and written, that they may be expected to need to function effectively in their future professions. These skills will be necessary for successful employment in any organisation where internal and/or external communication is conducted in English.

The study method is primarily based on seminars which will include discussions, role-play, individual and group activities. In addition to learning materials specially prepared by English Language Centre staff, use will be made of information technology and the ELC's Centre for Independent Language Learning. Teachers will also recommend additional reference materials as required. A considerable amount of individual self-access learning is expected of students.

Classes will be for 2 hours/ bi-weekly x 14 sessions = 28 hours. They will therefore run from Week 1, Week 3, and so on. Two hours bi-weekly is more appropriate than one hour per week since the former allows a more in-depth coverage and students can be given private study in one week and be required to hand it in two weeks later when they have the next class.

Session	Topic Area
1 <sup>st</sup>	Technical writing: describing products and procedures
2 <sup>nd</sup>	Technical writing: explaining, comparing and contrasting
3 <sup>rd</sup>	Technical writing: presenting problems and solutions
4 <sup>th</sup>	Report writing: describing aims, background, procedure
5 <sup>th</sup>	Report writing: presenting findings and conclusions
6 <sup>th</sup>	Report writing: writing a summary (abstract)
7 <sup>th</sup>	Oral presentation: planning
8 <sup>th</sup>	Oral presentation: delivery
9 <sup>th</sup>	Oral presentation: language practice
10 <sup>th</sup>	Workplace writing: letters of enquiry
11 <sup>th</sup>	Workplace writing: letters of adjustment
12 <sup>th</sup>	Workplace writing: memo reports
13 <sup>th</sup>	Workplace writing: office memos
14 <sup>th</sup>	Assessment (oral/ written)

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**Method of Assessment:** Continuous Assessment: 100%

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### Reference Books:

#### Written Communication

1. Bilbow, G.T, *Business Writing for Hong Kong*, Hong Kong: Longman, 2000.
2. Guffey, M.E., *Essentials of Business Communication*, 6<sup>th</sup> ed., Ohio:South-Western College Pub, 2004.
3. Houp, K.W. (et al.), *Reporting Technical Information*, New York: Oxford University Press, 2002.
4. White, F.D., *Communicating Technology: Dynamic Processes and Models for Writers*, New York: Harper Collins College Publishers, 1996.

#### Spoken Communication

1. Conradi, M. and Hall, R., *That Presentation Sensation*, London: Pearson Education Ltd, 2001.
2. Sampson, E., *Creative Business Presentation: Inventive Ideas for Making an Instant Impact*, London: Kogan Page, 2003.
3. Walther, G. R., *Power Talking Skills: How to Say What You Mean and Get What you Want*, A video seminar. Newcastle, WA: Speaking From Experience, Inc, 1996.
4. *Longman Dictionary of Contemporary English*, Harlow: Longman, 2003.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Engineering Management

**Subject Code:** ENG306

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 42 hours

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**Pre-requisite:** nil

**Co-requisite:** nil

**Exclusion:** nil

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### Objectives:

This subject will provide students with:

1. Skills for analysing and applying the basic principles and techniques involved in management of people and engineering activities in the production of goods and services. Techniques learned will enable students to carry out operations in an organization for the purposes of organizing, planning and control of project and process activities.
2. Skills in the use and understanding of different quality management tools and techniques in an organisation, hence enable students to interpret the quality work content of typical jobs.
3. The ability to apply ethical and business behaviours in engineering organizations in the changing environment in which they operate.
4. The ability to apply the change management techniques and enable students to evaluate the changing factors that affect the change process before implementation of any changes.

### Student Learning Outcomes:

Category A: Professional/academic knowledge and skills

Category B: Attributes for all-roundedness

1. To analyse the organisation structure, and identify the planning and strategic management factors affecting the success of organizations in both manufacturing, and service sectors. (Objective 1 and Syllabus Item 1). Category A
  2. To apply appropriate management techniques to improve organization structure and procedures, and quality management. (Objective 2 and Syllabus Item 2). Category A
  3. To describe and differentiate between the project management objectives and requirements, and select an appropriate project management technique and apply it to analyze project activities. (Objective 1 and Syllabus Item 3). Category A
  4. To be able to analyse factors affecting the changes in the work environment, and be able to control
  5. To discuss the environmental factors that affect on operations of engineering organizations in Hong Kong, and to recognise ethics and business behaviours in conducting business. (Objective 4 and Syllabus Item 5). Categories A & B
- 

### Syllabus:

1. Introduction.  
General management concepts in organizations; functions & types of industrial organizations, structure, corporate objectives, strategy and policy
2. Industrial Management  
Roles of managers. Process of management, planning, organising, motivating, leading and controlling of social and engineering activities. Quality management and tools
3. Industrial Engineering Planning  
Project management, project specifications, scope and objectives, work breakdown structure and organizational breakdown structure. Tools that support engineering operations; scheduling, business process re-engineering, etc
4. The Management of Change  
Changes due to technical innovation, political-legal, economic and social issues. Factors that affect the execution of changes
5. Effects of Environmental Factors  
The effects of environmental factors on the operations of engineering organizations in Hong Kong, e.g. legal aspects of employment; professional codes of conduct for engineers; contracting; product liability; sources, effect and control of environmental pollutants.

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**Teaching and Learning Approach:**

A mixture of lectures, tutorial exercises, and case studies will be used to deliver the various topics in this subject. Some of which will be covered in a problem-based format where this enhances the learning objectives. Others will be covered through directed study in order to enhance the students' ability of "learning to learn". Some case studies, largely based on real experience will be used to integrate these topics and thus demonstrate to students how the various techniques are inter-related and how they apply in real life situations.

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**Method of Assessment:**

Coursework: 40%

Examination: 60%

Coursework comprises assignments with individual and group components; and team work is an essential element in the Coursework assessment. All assessment components will require students to apply what they have learnt to realistic work applications.

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**Reference Books:**

1. Babcock, Daniel L., *Managing Engineering and Technology: An Introduction to Management for Engineers*, Upper Saddle River, N.J.: Prentice Hall, 1995
2. Kerzner, Harold, *Project Management*, John Wiley & Sons, Inc., 1998.
3. Mazda, F.F., *Engineering Management*, Harlow, England : Addison-Wesley, 1998
4. Robbins, S.P. and Conlton, M., *Management*, Prentice-Hall International, 1999
5. Schermerhorn, J.R., *Management*, John Wiley & Sons, 2004.
6. Stone. J.A.F., Freeman, R.E. and Gilbert, D.R., *Management*, Prentice-Hall, 1995

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Industrial Centre Training II	<b>Subject Code:</b> IC367
<b>Number of Credits:</b> 4	<b>Hours Assigned:</b> 4 weeks (Year 2 Summer)

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<b>Pre-requisite:</b> Industrial Centre Training I (IC272)	<b>Co-requisite:</b> nil	<b>Exclusion:</b> nil
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### Objectives:

In succession to IC272, Industrial Centre Training II provided by The Hong Kong Polytechnic University Industrial Centre focus on the training for undergraduate professional engineer in the area of electronic and information engineering. The objectives of this course are:-

1. To apply and consolidate the practical skills and best practices acquired in previous training and coalesce with academic knowledge to work on engineering projects in an industrial environment.
2. To develop the technical and managerial skills of undergraduate engineer to tackle open-ended problem with preparation to participate in engineering project in their future career.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the process and develop the skills of planning, market survey, and delivery of an engineering project in addition to the technical aspects.
2. Consolidate, gain confidence and demonstrate technical competence in handling engineering projects and producing prototypes for design and development in the area of electronic and information engineering.
3. Understand the importance of safety, responsibility and regulation in the practice of engineering.
4. Apply fundamental principles and knowledge in electronic and information engineering and to develop practical solutions to solve problems in the development phase of an engineering project.
5. Deploy available resource to fabricate working prototype with relevant engineering documentation under a multidisciplinary industrial environment.

#### Category B: Attributes for all-roundedness

6. Communicate effectively and work in harmony with other members in a team and develop leadership capability.
  7. Communicate effectively using Internet.
  8. Demonstrate critical and creative thinking in electronic project development and handling.
  9. Practise creativity and demonstrate initiative with a learn-by-practice approach to produce solutions for open-ended problems in an engineering context.
  10. Understand the importance of training and the needs for continual professional development in professional engineering career.
- 

### Syllabus:

1. IC 1103 – Integrated Training in Electronic & Information Engineering (4 weeks)
  - 1.1 Industrial Centre Training II takes the form of technical projects with typically 4 to 6 students in a team working in the Industrial Centre for a minimum of 4 weeks.
    - The project approach of Integrated Training II provides an arena for students to develop their personal ability and attitude in teamwork and leadership in real world industrial environment. Projects are structured so that student can bring their training, knowledge, creativity and experience together and consolidate them into one coherent activity.
    - Project work is an important and integral part in the working lives that virtually all engineers will come across at various stages in their career path. These engineering projects may include software and hardware design, planning, costing, parts manufacture, printed circuit board (PCB) and chassis assembly, testing, documentation, evaluation and presentation.
    - The team will simulate a project team or a young company being assigned the task of design and manufacture a prototype of a consumer electronic or IT product for a client. The team has to conduct a market research to come up with an appropriate design and marketing strategy. At the

end of the training period, the team has to create a Web site and present their achievement, manufacturing plan and business plan of this product.

- A professional engineer, particularly in the role of project leader, must have a sound appreciation of all these elements. By accomplishment of a project, students should be able to polish their creativity, understand and appreciate the elements, difficulties and open-ended type problems and solutions that are common in their future career as a professional engineer.

In general, the following task or activities will be required for each project group:-

1. Create new equipment, product or service in the area of electronic and information engineering.
2. Review an existing equipment, design prototype, product or service in the area of electronic and information engineering and deliver an improved prototype.
3. Planning and utilize resources in a multidiscipline industrial environment and deliver the output of the project.
4. Produce engineering documentation for client.
5. Produce and present the project on the Internet for investors or prospective clients.

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**Method of Assessment:**

The assessment is comprised of 100% continuous assessment based on the performance of project deliverables. In an industrial environment, student will experience the discipline and devotion of working condition of junior engineer. Personal ability including creativity, leadership, working attitude, courage, responsibility, problem solving power and presentation style of student will be assessed together with the technical part of the project.

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**Reference Book:**

To be specified according to the nature and contents of individual project.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** VLSI & Computer-Aided Circuit Design

**Subject Code:** EIE401

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 35 hours  
Laboratory 7 hours  
(Equivalent to 21 laboratory hours)

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**Pre-requisite:** Electronic Circuits (EIE304)

**Co-requisite:** nil

**Exclusion:** nil

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### Objectives:

To provide students with

1. insights into the area of VLSI circuits and systems based on silicon;
2. a broad spectrum of awareness of the many facets of VLSI design using CAD tools;
3. hands-on experience on VLSI design.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamentals of CMOS VLSI and associated technologies.
2. Solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
3. Acquire hands-on skills of using CAD tools in VLSI design.
4. Appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system.

#### Category B: Attributes for all-roundedness

5. Communicate effectively.
  6. Think critically and creatively.
  7. Assimilate new technological and development in related field.
- 

### Syllabus:

1. Overview of VLSI Design  
VLSI design methodology; functional, logic and physical design; gate arrays and standard cells, programmable logic devices; system-on-chip.
2. CMOS Fabrication and Layout  
Fabrication processes in CMOS VLSI; latch-up; characteristics of devices in VLSI; mask layout techniques and design rules.
3. CMOS Logic Circuits  
Transmission gates; static and dynamic gates and flip flops; domino logic; low power design; design for testability.
4. High Speed CMOS Logic Design  
Delay estimation and transistor sizing; device and interconnect capacitance; optimal delay design of buffers; power supply grid; clock distribution.
5. CAD Techniques in VLSI Design  
Circuit and logic simulation, mask layout, layout extraction and verification; standard cell placement and routing.
6. Sub-system Design  
Examples to illustrate sub-system design in VLSI: data path in a microprocessor, random-access-memory.

### Laboratory Experiment:

1. Practice of CAD tools for VLSI design: circuit simulation, mask layout, layout extraction and verification, placement and routing.
2. Mini-project: design of a sub-system for computer or communication applications.

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**Method of Assessment:**

Continuous assessment: 50%                      Examination: 50%

The continuous assessment will consist of a mini-project, a number of assignments, and two tests.

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**Reference Books:**

1. N.H. E. Weste and D. Harris, *CMOS VLSI Design – A Circuits and Systems Perspective*, 3<sup>rd</sup> ed., Reading: Addison Wesley, 2005.
2. M.M. Vai, *VLSI Design*, 1<sup>st</sup> ed., Boca Raton: CRC Press, 2001.
3. D.A. Hodges, H.G. Jackson and R.A. Saleh, *Analysis and Design of Digital Integrated Circuits*, 3<sup>rd</sup> ed., New York: McGraw-Hill, 2003.
4. W. Wolf, *Modern VLSI Design: System-on-chip Design*, 3<sup>rd</sup> ed., Englewood Cliffs: Prentice-Hall, 2002.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Power Electronics

**Subject Code:** EIE402

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

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**Pre-requisite:** Basic Electricity and Electronics I (ENG237)  
Basic Electricity and Electronics II (ENG238)  
Electronic Circuits (EIE304)

**Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

To introduce the fundamental principles, concepts, techniques, methods, and circuits of power electronics and to familiarize students with the design procedures of power electronic systems.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamental principles and applications of power electronics circuits.
2. Solve problems and design switching regulators according to specifications.
3. Use Computer-aided techniques for the design of power converter circuits.
4. Appreciate the latest developments in power electronics.

#### Category B: Attributes for all-roundedness

5. Communicate effectively.
6. Think critically and creatively.
7. Assimilate new technological and development in related field.

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### Syllabus:

1. Introduction to Power Electronics  
Overview of power electronics systems: applications and areas of future development.
2. Basic Switching Regulator Topologies  
Basic operations. Critical inductance criterion. Continuous- and discontinuous-conduction modes. Practical considerations. Merits and drawbacks.
3. State-Space Averaging and Linearization  
State equations. State-space models. State-space averaging for continuity. Small-signal approximation for linearity. Applications of approximation techniques. Switching regulator transfer functions.
4. Switching Regulators with Transformer Isolation  
Flyback converter. Forward converter. Half- and full-bridge converters. Push-pull converter. Areas of application.
5. Feedback Control Design  
Classical control design. Bode plot and Nyquist stability criterion. Voltage- and current-mode controls.
6. Magnetic Components  
Inductor. Transformer. Saturation, hysteresis, and residual flux.
7. Latest Development in Power Electronics

### Laboratory Experiments:

1. Computer-aided design of switching regulator.
2. Design of a buck converter.

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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, quizzes, and two tests.

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**Reference Books:**

1. Y.S. Lee, *Computer-Aided Analysis and Design of Switch-Mode Power Supplies*, Marcel Dekker, New York, 1993.
2. J.P. Agarwal, *Power Electronic Systems: Theory and Design*, Prentice-Hall, 2001.
3. S. Cuk and R.D. Middlebrook, *Advances in Switched-Mode Power Conversion, Vol. 1, 2 and 3*, Teslaco, 1983.
4. J.G. Kassakian, M.F. Schlecht and G.C. Verghese, *Principles of Power Electronics*, Addison-Wesley, 1991.
5. A.I. Pressman, *Switching Power Supply Design*, 2<sup>nd</sup> ed., McGraw-Hill, 1999.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> High Frequency Circuit Design	<b>Subject Code:</b> EIE403
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 39 hours Laboratory 3 hours (Equivalent to 9 laboratory hours)

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**Pre-requisite:** Basic Electricity and Electronics I (ENG237)  
Basic Electricity and Electronics II (ENG238)  
Electronic Circuits (EIE304)      **Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

Designing electronic circuits in the tens and hundreds of MHz range can be a challenge because the presence of parasitics poses a lot of problems in the physical circuits. This makes designing high-frequency circuits a rather specialized subject, although much can still be resolved under the lumped circuit assumption. But as the frequency moves up to the GHz range, the use of lumped circuit models can be seriously handicapped because voltage and current change within the physical boundary of the circuit as a result of the wavelength being comparable to the dimension of the physical circuits. A different approach must be used to look at the problem. This course will look mainly at circuit design in the tens to hundreds MHz range and will touch upon some basics for the GHz range design.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the characteristics of transistor devices at high frequencies
2. Analyze high-frequency roll-off problems in transistor amplifiers
3. Design amplifier circuits for high-frequency applications
4. Design matching filters
5. Solve design problems using Smith charts, e.g., transmission line and antenna matching
6. Understand the stability problems in power amplifiers

#### Category B: Attributes for all-roundedness

7. Communicate effectively
  8. Think critically and creatively
  9. Assimilate new technological development in related field
- 

### Syllabus:

1. Analogue Circuit Fundamentals  
Review of BJT and MOSFET characteristics and models. Basic amplifier configurations and building blocks. Frequency response of transistor amplifiers. Pole splitting. Basic feedback configurations and compensations methods. Review of op-amp circuits and non-ideal behaviours.
2. Radio Frequency Circuit Design  
Effects of load capacitance and feedback capacitance (Miller effect). Important characteristics of transistor capacitances. Choice of transistors for high-frequency design. Configurations of high-frequency amplifiers. e.g., shunt-series pair, follower plus CE, CE plus CB (cascode), follower plus CB (DA). Equivalent ac models for calculation of amplifier response roll-off. Design examples: wideband differential amplifiers and op-amps.
3. High-frequency Filter Design  
Operational Transconductance Amplifier (OTA or gm). OTA design principles. BJT and MOS OTAs. Gm-C filter design principles. Method of signal flow graphs.

4. Distortion Analysis  
Power series analysis of frequency-independent circuits (due to only resistive nonlinearity). Harmonic distortion. Gain expansion and compression. Effects of odd and even order terms. Typical spectra of input and output signals. Inter-modulation (IM) under two sinusoids. Generation of sum and difference components. Interaction of third IM with fundamental frequencies. Problems in receiver design.
5. Impedance Matching  
Principles of narrowband impedance matching. Maximum power transfer. Methods via Q-factor. L-circuits, T-circuits, pi-circuits, tapped capacitor circuits, double-tuned circuits.
6. Transmission Line Matching  
Modelling of transmission lines. Telegraphic equations. Use of Smith chart for matching. Matching of antennae.
7. Power Amplifier Design  
Basic principles of tuned amplifiers. Design procedures. Use of scattering parameters and other 2-port parameters. Concept of power gains. Stability factors. Neutralization and internal feedback.

**Mini-project:**

Each student is required to complete a mini-project on either one of the following topics:

Topic 1: High frequency roll-off of transistor amplifiers

Topic 2: Design of matching circuits

Topic 3: Transmission line matching

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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment consists of assignments, mini-projects, and a test.

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**Textbooks:**

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, *Analysis and Design of Analog Integrated Circuits*, New York: Wiley, 2001.
2. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, New York: McGraw-Hill, 1994.

**Reference Books:**

1. Herbert L. Krauss, Charles W. Bostian and Frederick H. Raab, *Solid State Radio Engineering*, New York: Wiley, 1980. (Classic reference)
2. W. Alan Davis and Krishna K. Agarwal, *Radio Frequency Circuit Design*, New York: Wiley, 2001.
3. P. Horowitz and W. Hill, *The Art of Electronics*, New York: Cambridge University Press, 1989. (Classic reference)

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Digital Signal Processing	<b>Subject Code:</b> EIE413
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 39 hours Laboratory 3 hours (Equivalent to 9 laboratory hours)

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<b>Pre-requisite:</b> Mathematics I (AMA201) Mathematics II (AMA202) Linear Systems (EIE312)	<b>Co-requisite:</b> nil	<b>Exclusion:</b> nil
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### Objectives:

This is an essential subject to provide fundamental signal processing techniques important to many communications and multimedia subjects. Both theory and practical realisation are stressed. After completion of the subject, the student should be able to understand the design principles and the implementation of digital filters and DFT/FFT, and be able to make use of random signal processing concepts and wavelets to perform some simple applications.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the theories behind and to be able to realize filter equations and DFT/FFT for practical applications.
2. Design FIR/IIR filters on paper by using MATLAB, and implement the design using a programming language and/or digital processor.
3. Understand the basic theory of wavelet transform and the concepts of using simple wavelets for data compression and feature extraction.
4. Understand the importance of random signal processing in DSP, and its application on statistical measures and data modelling.
5. Possess basic background in the DSP area sufficiently for supporting subjects such as: communication principles, computer networks, speech processing, image processing, multimedia, and video technology.
6. Possess necessary background for advance studies in DSP, especially for taking the subject Advanced Digital Signal Processing, or other multimedia signal processing subjects.

#### Category B: Attributes for all-roundedness

7. Present ideas and findings effectively.
  8. Think critically.
  9. Learn independently.
  10. Work in a team and collaborate effectively with others.
- 

### Syllabus:

1. Revision on the Discrete-time Systems and General Realization Techniques
  - 1.1 Basic definition of discrete-time signal. Sampling of continuous-time signal. Time invariance, causality, linearity, convolution. The z-transform and its inverse, delay property and its meaning in the time domain, frequency response and stability.
  - 1.2 Realization of digital filter structures, direct realization, canonic form, cascade and parallel realization of digital systems.
2. Design of Infinite Impulse-response (IIR) and Finite Impulse-response (FIR) Digital Filters
  - 2.1 Revision of analog systems, Butterworth filters and Chebyshev filters. Types of digital filters: IIR and FIR. IIR filter design, bilinear transformation, frequency scaling, transformation from prototype low-pass filter to high-pass filter and band-pass filter. Impulse-invariant and step-invariant approaches.
  - 2.2 FIR filter analysis, Fourier series approach, windowing, Gibbs phenomenon, commonly used windows, concept of linear phase, frequency transformation, low-pass, band-pass, high-pass filters and filter band design.

3. Discrete Fourier Transform and Convolution
  - 3.1 Convolutions and its applications, circular convolution, convolution by section, overlap-add method and overlap-save method.
  - 3.2 Fourier series and continuous-time Fourier transform. Discrete Fourier series and discrete Fourier transform (DFT), properties of the DFT, Fourier analysis using the DFT, convolution theorem, the fast Fourier transform (FFT) algorithm and implementation of the FFT.
4. Wavelets
  - 4.1 Short-time Fourier transform, continuous wavelet theory, dyadic structure, discrete wavelet transform, wavelet and scaling functions, multi-resolution analysis, sample applications of wavelet transform.
5. Random Signal Processing
  - 5.1 Revision on Random Processes, cross- and auto-correlations, bias and consistence. Power spectrum estimation, non-parametric and parametric approaches, AR, ARMA models.
6. Advanced DSP and Applications

To discuss not less than one of the following topics,

  - 6.1 Architectures of digital signal processors and DSP chips.
  - 6.2 Adaptive digital filters: Concepts of adaptive filtering, basic Wiener filter theory, basic LMS adaptive algorithm. Application example.
  - 6.3 Multirate digital signal processing: Concepts of multirate signal processing, design of practical sampling rate converters. Application examples.

#### **Laboratory Experiments:**

The student will carry out at least three laboratory exercises on the topics below:

1. Laboratory 1: MATLAB for DSP laboratory exercises.
2. Laboratory 2: FIR filter analysis and design.
3. Laboratory 3: IIR filter analysis and design.
4. Laboratory 4: Properties of DFT and the fast Fourier transform.
5. Laboratory 5: Wavelet properties and its applications.
6. Laboratory 6: Parametric power spectrum estimation.

#### **Method of Assessment:**

Continuous Assessment: 40%

Examination: 60%

#### **Textbooks:**

1. S.K. Mitra, *Digital Signal Processing* McGraw-Hill Education (Asia), 3<sup>rd</sup> ed., 2006 Edition.
2. E.C. Ifeachor and B.W. Jervis, *Digital Signal Processing - A Practical Approach*, Prentice-Hall (Pearson Education), 2002.

#### **Reference Books:**

1. W.D. Stanley, G.R. Dougherty, and R. Dougherty, *Digital Signal Processing*, Reston Pub. Co. Ltd, Prentice-Hall International, Inc., 1984.
2. J.G. Proakis and D.G. Manolakis, *Digital Signal Processing*, 3/e., Prentice-Hall, 1996.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Computer Architecture and Systems

**Subject Code:** EIE414

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 37 hours  
Laboratory 5 hours  
(Equivalent to 15 laboratory hours)

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**Pre-requisite:** Computer System Fundamentals (EIE311)

**Co-requisite:** nil

**Exclusion:** nil

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### Objectives:

To provide students with

1. concepts and design techniques of high performance computer architectures and
2. techniques to analyse performance in time domain.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Appreciate the techniques deployed in the design of modern high performance computers.
2. Develop analytical ability in the concurrency domain.
3. Identify and resolve problems arising from concurrent hardware functional units.
4. Identify and resolve problems arising from the concurrent execution of cooperating software structures.
5. Critically evaluate the performance of computers and real-time embedded systems.

#### Category B: Attributes for all-roundedness

6. Present ideas and findings effectively.
  7. Think critically.
  8. Learn independently.
  9. Work in a team and collaborate effectively with others.
- 

### Syllabus:

1. Taxonomy of Computer Architectures
  - 1.1 Revision on the classifications of computer architectures: ISA and HAS, Von Neumann, RISC and CISC.
  - 1.2 Performance issues, examples of evaluation using simulators.
2. Memory System
  - 2.1 Memory system hierarchy: locality principles; cache organizations, replacement policies and write policies; virtual memory, disk latencies and thrashing.
  - 2.2 Memory management: Logical and physical space; address translation, protection and sharing; paging and segmentation; replacement policies.
3. Pipelined Processors
  - 3.1 Pipelined ILP organization: classifications, instruction pipeline, arithmetic pipelines and pre-fetch buffers.
  - 3.2 Dependencies: data dependencies, control dependencies and resource dependencies.
4. Superscalar Processors
  - 4.1 Concurrent instruction execution: decode, issue and dispatch stages; pre-decoding; out-of-order issue and dispatch; operand availability; shelving; register renaming.
  - 4.2 Speculative execution: preserving processor consistency; the reorder buffer.
  - 4.3 Branch processing: detection, speculation and recovery schemes.
5. Concurrent Real-Time Systems
  - 5.1 Mutual exclusion and process synchronization.
  - 5.2 RTOS: Tasks and scheduling; inter-task communication methods; events; memory management user-ISR;
  - 5.3 RTOS services: Case study e.g. uC/OSII.

6. Application-Oriented Processors for Advanced Embedded Systems
  - 6.1 High performance embedded processors e.g. ARM
  - 6.2 Embedded DSP and media processors e.g. TMS 320Cxxxx & Nexperia
7. Multiprocessor Systems
  - 7.1 Cache coherence and memory consistency.
  - 7.2 Multiprocessor bus; Case study e.g. PCI.

**Laboratory Experiments:**

1. Superscalar simulation tool.
2. Tracing the operation of superscalar CPU by simulation.
3. Multitasking under a RTOS.
4. Handling user's hardware interrupts under a RTOS.

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**Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

The continuous assessment will consist of assignments, tests, laboratory work and a mini-project.

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**Reference Books:**

1. D. Sima, T. Fountain, and P Kasuk, *Advanced Computer Architectures*, Addison-Wesley, 1997.
2. J.L. Hennessy and D.A. Patterson, *Computer Architecture - A Quantitative Approach*, Morgan Kaufmann, 1996.
3. A. Siberschatz and P. Galvin, *Operating System Concepts*, 5<sup>th</sup> ed., Addison -Wesley, 1999.
4. J. Labrosse, *Micro C/OS-II*, R & D Books, Miller Freeman, 1999.
5. R. Hamal, *Embedded Systems - Architecture, Programming and Design*, McGraw-Hill, 2004.
6. D. Anderson, *PCI System Architecture*, 4<sup>th</sup> ed., Addison-Wesley, 1999.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Multimedia Technology

**Subject Code:** EIE415

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 37 hours  
Laboratory 5 hours  
(Equivalent to 15 laboratory hours)

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**Pre-requisite:** nil

**Co-requisite:** nil    **Exclusion:** nil

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### Objectives:

This subject provides students with thorough understanding of multimedia technologies. After the completion of the subject, the student should be able to appreciate a wide range of techniques and standards adopted in the multimedia industry.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the requirements of a multimedia system and the formats of different multimedia signals.
2. Understand the different multimedia standards and the technologies.
3. Design simple systems for multimedia retrieval and management.
4. Perform multimedia authoring, and to process and integrate different types of signals to form multimedia presentations.
5. Understand, describe, the technologies for streaming multimedia content over the Internet.
6. Appreciate the architectures and technologies of various multimedia systems, such as Video-on-Demand (VoD), multimedia conferencing, etc.

#### Category B: Attributes for all-roundedness

7. Communicate effectively.
  8. Think critically and creatively.
  9. Assimilate new technological and development in related fields.
- 

### Syllabus:

1. Introduction to Multimedia Systems  
Perspective of multimedia computing and communications, review of the key enabling technologies, overview of multimedia system requirements and multimedia software tools.
2. Multimedia Signal Representations  
Basics of audio/image/video file formats, introduction to MIDI (Musical Instrument Digital Interface), basics of digital video and color processing.
3. Multimedia Standards  
Image and video compression standards: JPEG, H.261/263/264, MPEG-1 and -2, MPEG-4 Facial animation.
4. Multimedia Information Indexing and Retrieval  
MPEG-7, Content-based retrieval (CBR) in image database, some existing CBR systems/applications. Digital libraries.
5. Optical Storage Media  
CD-Audio, CD-ROM, and Digital Video Disc (DVD).
6. Multimedia Authoring and Integration  
Multimedia authoring: authoring metaphors, multimedia production and presentation, SMIL: concept, structure, timelines, synchronization, implementation.
7. Multimedia Communications  
Quality of Service (QoS) requirements for multimedia communications, traffic modelling of multimedia sources, multiplexing, loss concealment, transport protocol support for multimedia communications. Multimedia on Internet: resource reservation protocol (RSVP), MBone.

8. Case Studies

Multimedia conferencing, video-on-demand (VOD), set-top box and interactive TV, digital TV and high definition TV (HDTV).

**Laboratory Experiments:**

1. Analysis of MPEG video coding
  2. Audio signal processing
  3. Developing simple multimedia applications using SMIL
  4. Multimedia production
  5. Multimedia integration
- 

**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments, laboratory reports, and two tests.

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**Reference Books:**

1. M. Mandal, *Multimedia Signals and Systems*, Kluwer Academic Publishers, 2003.
2. F. Halsall, *Multimedia Communications: Applications, Networks, Protocols and Standards*, Addison-Wesley, 2001.
3. Z.N. Li and Mark S. Drew, *Fundamentals of Multimedia*, Prentice-Hall, 2004.
4. C.H. Wu and J.D. Irwin, *Emerging Multimedia Computer Communication Technologies*, Prentice-Hall, 1998.
5. B. Furht, S.W. Smoliar and H.J. Zhang, *Video and Image Processing in Multimedia Systems*, Kluwer Academic Publishers, 1995.

## SUBJECT DESCRIPTION FORM

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**Subject Title:** Distributed Systems and Network Programming

**Subject Code:** EIE424

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 36 hours  
Laboratory 6 hours  
(Equivalent to 18 laboratory hours)

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**Pre-requisite:** Object Oriented Design and Programming (EIE320)

**Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

This subject will provide students with the principles and practical programming skills of developing distributed systems. It enables students to master the development skill for providing distributed services on the Web. Through a series of lab exercises, students will have the chance of developing interoperable and distributed Web applications.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the enabling technologies for building distributed systems.
2. Understand the different components for developing Web Services.
3. Set up and configure a standard Web Service system and develop simple Web Service applications.

#### Category B: Attributes for all-roundedness

4. Think critically.
  5. Learn independently.
  6. Work in a team and collaborate effectively with others.
  7. Present ideas and findings effectively.
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### Syllabus:

1. Introduction to Distributed Systems
  - 1.1 Characteristics. Design goals. Architecture examples.
2. Enabling Tools and Techniques for Building Distributed Systems
  - 2.1 Networked Computing  
TCP/IP protocol suite. Socket programming.
  - 2.2 Component-based Software Development  
Component models. JavaBeans; CORBA; Remote Method Invocation (RMI); OM/DCOM; Enterprise JavaBeans (EJB).
  - 2.3 Extensible Markup Language (XML)  
XML Markup; parser; CDATA sections; XML namespaces. Document Type Definition (DTD); well-formed XML documents; document type declaration; element of type declarations; attribute declarations.
3. Distributed Services on the Web: Web Services
  - 3.1 Introduction to Web Services.
  - 3.2 Simple Object Access Protocol (SOAP): SOAP specification; message processing; use of namespaces.
  - 3.3 Web Services Description Language (WSDL): Role of WSDL in Web services, WSDL documents, remote web-services invocation using WSDL.
  - 3.4 Universal Description, Discovery and Integration (UDDI): role of UDDI in Web services; UDDI registries; discovery technologies.

**Laboratory Experiment:**

## Practical Works

1. Remote Method Invocation (RMI)
  2. Extensible Markup Language (XML)
  3. XML-RPC
  4. SOAP
  5. WSDL
  6. UDDI
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**Method of Assessment:**

Coursework: 40%

Examination: 60%

**Textbooks:**

1. M.L. Liu, *Distributed Computing: Principles and Applications*, Addison-Wesley, 2003.
2. C. Ethans, *Web Services Essential*, O. Reilly, 2002.

**Reference Books:**

1. R. Nagappan, *Developing Java Web services : Architecting and Developing Secure Web services using Java*, Wiley Pub., 2003.
2. U. Wahli, G.G. Ochoa, S.Cocasse, and M.Muetschard, *Websphere Version 5.1 Application Developer 5.1.1 Web Services Handbook*, IBM, 2<sup>nd</sup> ed., 2004.
3. P. Pacheco, *Parallel Programming with MPI*, Morgan Kaufmann, 1998.
4. <http://java.sum.com>.
5. G. Coulouris, *Distributed Systems: Concepts and Design*, Addison-Wesley, 2001.

## SUBJECT DESCRIPTION FORM

**Subject Title:** Video, Image, and Audio Processing

**Subject Code:** EIE425

**Number of Credits:** 3

**Hours Assigned:** Lecture/tutorial 39 hours  
Laboratory 3 hours  
(Equivalent to 9 laboratory hours)

**Pre-requisite:** Linear Systems (EIE312)

**Co-requisite:** nil      **Exclusion:** nil

### Objectives:

To provide a broad treatment of the fundamentals of speech, image, audio and video processing.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand the fundamentals of speech, image, audio and video signal processing and associated techniques.
2. Solve practical problems with some basic speech, image, audio and video signal processing techniques.
3. Design simple systems for realizing some multimedia applications with some basic speech, image, audio and video signal processing techniques.

#### Category B: Attributes for all-roundedness

4. Present ideas and findings effectively.
5. Think critically.
6. Learn independently.
7. Work in a team and collaborate effectively with others.

### Syllabus:

1. Speech processing
  - 1.1 Physiology of speech generation: characteristic of speech sounds; glottal excitation; speech production models: discrete-time speech production model; discrete-time filter model for speech production; source excitation model.
  - 1.2 Linear prediction analysis: All-pole models; least-squares estimation; spectral matching; spectral envelopes; applications of LP analysis.
  - 1.3 Speech coding: Coder's attributes; waveform coding; vocoders; analysis-by-synthesis coding; code-excited linear predictive vocoder; regular pulse-excited LPC.
2. Image processing
  - 2.1 Fundamentals of digital image: Digital image representation and visual perception, image sampling and quantization.
  - 2.2 Image enhancement Histogram processing; Median filtering; Low-pass filtering; High-pass filtering; Spatial filtering; Linear interpolation, zooming.
  - 2.3 Image coding and compression techniques: Scalar and vector quantizations; Codeword assignment; Entropy coding; Transform image coding; Wavelet coding; Codec examples.
  - 2.4 Image analysis and segmentation: Feature extraction; Histogram; Edge detection; Thresholding.
  - 2.5 Image representation and description: Boundary descriptor; Chaincode; Fourier descriptor; Skeletonizing; Texture descriptor; Moments.
3. Audio processing
  - 3.1 Fundamentals of digital audio: Sampling; Dithering; Quantization; psychoacoustic model.
  - 3.2 Basic digital audio processing techniques: Anti-aliasing filtering; Oversampling; Analog-to-digital conversion; Dithering; Noise shaping; Digital-to-analog Conversion; Equalisation.
  - 3.3 Digital Audio compression: Critical bands; threshold of hearing; Amplitude masking; Temporal masking; Waveform coding; Perceptual coding; Coding techniques: Subband coding and Transform coding; Codec examples.

#### 4. Video processing

4.1 Fundamentals of digital video: Basics of digital video; digital video formats.

4.2 Basic digital video processing techniques: Motion estimation; Interframe filtering; Motion-compensated filtering; Error concealment.

4.3 Video coding techniques: Temporal redundancy; Spatial redundancy; Block-based motion estimation and compensation; Coding techniques: Model-based coding, Motion-compensated waveform coding; Codec examples.

#### **Laboratory Experiments:**

1. Audio compression
  2. Speech signal analysis
  3. Psychoacoustic behavior
  4. Motion estimation and its application in video coding
  5. Image processing techniques
  6. Image compression
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#### **Method of Assessment:**

Continuous Assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments, laboratory reports, and two tests.

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#### **Textbooks:**

1. R.C. Gonzalez and R.E. Woods, *Digital image processing*, 2<sup>nd</sup> ed., Prentice-Hall, 2002.
2. J.R. Deller, J.G. Proakis, and J.H.L. Hansen, *Discrete-Time Processing of Speech Signal*, Macmillan Pub. Company, 2000.

#### **Reference Books:**

1. Yao Wang, Joern Ostermann, and Ya-Qin Zhang, *Video Processing and Communications*, Prentice-Hall, 2002.
2. Ken C. Pohlmann, *Principles of digital audio*, 3<sup>rd</sup> ed., McGraw-Hill, 1995.
3. L.R. Rabiner and B.H. Juang, *Fundamentals of Speech Recognition*, Prentice-Hall, 1993.
4. T.P. Barnwell III, K. Nayebi, and C.H. Richardson, *Speech Coding: A Laboratory Textbook*, John Wiley & Sons, Inc., 1996.

## SUSUBJECT DESCRIPTION FORM

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**Subject Title:** Honours Project

**Subject Code:** EIE433

**Number of Credits:** 6

**Hours Assigned:** Structured Study 84 hours  
Self-work/Guided Study 168 hours  
Total 252 hours

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**Pre-requisite:** nil

**Co-requisite:** nil    **Exclusion:** nil

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### Objectives:

Engineering is the science of the applying scientific principles and technology to improve human life. This may take the form of invention, design, implementation, so on and so forth. The objective is to come up with solutions to existing problems while considering various constraints. Hence the students studying in a curriculum will be most benefited from doing a project in order to have the chance to practise hands-on application of the knowledge the student has learned throughout the curriculum, while producing something useful or valuable. Against this background, there is a final year project (FYP) component in the curriculum with the objectives:

1. To provide the opportunity to the student so that he/she can apply what he/she has learnt in previous stages in a real-life engineering context.
2. To enable the student to acquire and practise project management skills and discipline while pursuing the FYP.
3. To enable the student to apply engineering knowledge in analysis of problems and synthesis of solution while considering various constraints.

### Student Learning Outcomes:

On successful completion of the final year project, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Understand, take up, and master the basic knowledge and skills related to the specific project.
2. Understand the background, the requirements, objectives, and deliverables to be produced.
3. Integrate and apply knowledge learnt in present and previous stages (vertical integration) and across different subjects (horizontal integration).
4. Apply various professional skills in electronic and information engineering to achieve the objectives of the project.
5. Learn to use new tools and facilities, and to gather new information, for the conduction of the project.

#### Category B: Attributes for all-roundedness

6. Work under the guidance of a supervisor while exercising self-discipline to manage the project.
  7. Review critically the student's own achievement and other related works.
  8. Communicate effectively with related parties (supervisor, peers, vendors).
  9. Work with others (team partners, outsource company, technical support staff) collaboratively.
  10. Realize different constraints, and to make appropriate compromise, when designing a solution to an engineering problem.
  11. Disseminate effectively the results and knowledge learnt in the project.
  12. Transfer the knowledge and skills learnt in the project.
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### Syllabus:

The progression of the project will be guided by a framework, which consists of the following indicative stages. The specific details will vary from project to project.

### Project Specification

In this stage, the student will work in conjunction with the project supervisor to draw up a concrete project plan specifying at least the following:

1. Background of the project
2. Aims and objectives
3. Deliverables

4. Methodology to be adopted
5. Schedule

### **Project Execution**

This is the major part of the project. After the specification is done, the project will be pursued so that the objectives are to be met; the deliverables are to be produced in accordance with the schedule. The student and the project supervisor will meet constantly to discuss the progress. In particular the following should be demonstrated:

1. Adherence to the schedule
2. Achievement of objectives by the student's work
3. Initiatives of the students to work, design, and to solve problems
4. Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches)
5. Diligence of the students to spend sufficient effort on the project
6. Systematic documentation of data, design, results, ...etc. during the process of working out the project

### **Project Report**

After the project is finished, it is important that the student can be able to disseminate the results so that the results can be reviewed by others. Through this dissemination process, project achievements can be communicated, experience can be shared, knowledge and skills learnt can be retained and transferred. The following elements will be important:

1. Project log book
2. Project report (hardcopy and softcopy)
3. Presentation
4. Performance in a Question-and-Answer session

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### **Method of Assessment:**

Continuous Assessment: 100%

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### **Reference Books:**

To be specified by the project supervisor for each project.



**Laboratory Experiments:**

1. Poisson source properties and their characterization.
  2. Simulation study on queueing properties.
  3. Design of an N-trunk telephone switch.
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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments, quizzes and two tests.

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**Reference Books:**

1. R.L. Freeman, *Fundamentals of Telecommunications*, John Wiley, 1999.
2. W. Goralski, *SONET/SDH*, McGraw-Hill, 2002.
3. M. Cole, *Introduction to Telecommunications: Voice, Data and the Internet*, Prentice-Hall, 2002.
4. J. Salrand, *High-performance Communication Networks*, Morgan Kaufmann, 2000.
5. S.K. Bose, *An Introduction to Queuing Systems*, Kluwer Academic/Plenum Publishers, 2002.
6. W.C. Chan, *Performance Analysis of Telecommunications and Local Area Networks*, Kluwer Academic Publishers, 2000.
7. R.L. Freeman, *Telecommunication System Engineering*, 3<sup>rd</sup> ed., John Wiley, 1996.

## SUBJECT DESCRIPTION FORM

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<b>Subject Title:</b> Mobile Communications	<b>Subject Code:</b> EIE447
<b>Number of Credits:</b> 3	<b>Hours Assigned:</b> Lecture/tutorial 36 hours Project/presentation 6 hours (Equivalent to 18 laboratory hours)

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**Pre-requisite:** Communication Fundamentals (EIE331)      **Co-requisite:** nil      **Exclusion:** nil

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### Objectives:

To introduce the fundamental design principles and issues in mobile communications.  
To enable student to understand the basic features of mobile communication systems and digital trunked radio: GSM, CDMA (IS-95) and TETRA.

### Student Learning Outcomes:

On successful completion of this subject, the students will be able to:

#### Category A: Professional/academic knowledge and skills

1. Recognize the frequency spectra allocated for mobile communications in Hong Kong
2. Understand the basic network architecture of a mobile communication system.
3. Realize the importance of frequency-reuse concept in mobile communications and to be able to analyze its effect on interference, system capacity and grade of service.
4. Understand the different types of large-scale and small-scale fading channel models and to be able to analyze their influence on the performance of a mobile communication system.
5. Appreciate various multiple access techniques used in mobile communications and their pros and cons.
6. Recognize the relative pros and cons of various digital modulation schemes and to be able to select the appropriate modulation scheme under a given channel environment.
7. Understand the basic features of mobile communication systems and digital trunked radio: GSM, CDMA (IS-95) and TETRA.

#### Category B: Attributes for all-roundedness

8. Coordinate work among group members and to work as a team.
  9. Present ideas and results in front of an audience.
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### Syllabus:

1. Introduction to Cellular Radio Systems  
System planning. Cellular structure, concepts of frequency reuse and cells splitting. Frequency planning and spectrum allocation. Co-channel interference, adjacent channel interference. Interference and system capacity. Hand-off mechanism. Multiple access techniques: Frequency-division multiple access (FDMA), Time-division multiple access (TDMA) and Code-division multiple access (CDMA).
2. Mobile Radio Propagation  
Free space radio wave propagation. Reflection, diffraction and scattering. Ground reflection model. Classification of terrain roughness. Okumura model and Hata model. Extension of Hata model to PCS.
3. Mobile Radio Channel Characterisations  
Lognormal, Ricean and Rayleigh fading models. Doppler frequency, delay spread, coherence bandwidth, level crossing rate. Characterisation of multipath phenomena. Fading effects due to multi-path time delay spread. Fading effects due to Doppler spread. Simulation of Rayleigh fading channel.
4. Signal Transmission over Mobile Radio Channels  
FSK, BPSK, PSK, DPSK, QPSK, OQPSK, p/4 DQPSK, MSK and GMSK. Performance of FSK, PSK, and GMSK in Rayleigh fading channel.

5. Current Mobile Communication Systems and Digital Trunked Radio  
Global System for Mobile Communications (GSM). Terrestrial Trunked Radio (TETRA). IS-95 (CDMA).
6. Evolution from 2G to 3G  
Path migration from 2G to 3G mobile systems.

**Project:**

1. To study the frequency reuse patterns employed by mobile operators in Hong Kong along MTR/KCRC lines and to study the statistics properties of the received signal power in a mobile environment.
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**Method of Assessment:**

Continuous assessment: 40%                      Examination: 60%

The continuous assessment will consist of a number of assignments, two open-book tests, one project report and one presentation.

The examination will be an open-book type.

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**Reference Books:**

1. Rappaport T. S., *Wireless Communications: Principles and Practice*, Prentice-Hall PTR, 2<sup>nd</sup> ed., 2002.
2. Garg V. K. and Wilkes J., *Principles and applications of GSM*, Prentice-Hall PTR, 1999.
3. Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D), Designers' guide; Part 1: Overview, technical description and radio aspects, ETSI ETR 300 -1.
4. Radio Equipment and Systems (RES); Trans European Trunked Radio (TETRA); Voice plus Data (V+D); Part 1: General network design, ETSI ETS 300 392-1.



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**Method of Assessment:**

Continuous Assessment: 55 %

Examination: 45%

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**Reference Book:**

1. Johnston, F. Stephen, Gostelow, J.P. and King, W. Joseph (2000) *Engineering and society Challenges of Professional Practice*, Upper Saddle River, N.J.: Prentice Hall