

Bachelor of Electronic Engineering (Microelectronic)

YEAR 1

YEAR 1
SEMESTER I

**UWS 10103 NATIONHOOD AND CURRENT DEVELOPMENT IN
MALAYSIA**

SYNOPSIS:

This course will provide students a fundamental concept, the processes of formation and development of Malaysia. The topics covered include the concept of state, Malacca Kingdom, implication of imperialism and colonisation, spirit of patriotism and nationalism, independence and formation of Malaysia. Besides, students will also be exposed to the constitution of Malaysia, Malaysian Government System, Economic and Social Development Policy as the main policy in the national development. At the end of the course students will able to appreciate the roles and responsibilities of a good citizen to the country.

REFERENCES:

1. Abdul Halim Nasir. (2004). *Mosque Architecture in the Malay World*. Bangi: Penerbit Universiti Kebangsaan Malaysia.
2. *Ensiklopedia Sejarah Kebudayaan Melayu*. (1998). Kuala Lumpur: Dewan Bahasa dan Pustaka.
3. Khoo Kay Kim. (2001). *Malay Society: Tranformation and Democratisation*. Kelana Jaya: Pelanduk Publications
4. Nazaruddin Mohd. Jali. (2003). *Malaysian Studies: Nationhood and Citizenship*. Petaling Jaya: Pearson Prentice Hall.
5. Yahaya Ismail. (1989). *The Cultural Heritage of Malaysia*. Kuala Lumpur : Dinamika Kreatif Sdn. Bhd.

UWB 11002 MALAY LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic of Malay language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Malay language.

REFERENCES:

1. Asmah Hj. Omar. (2005). *Susur Galur Bahasa Melayu*. KL: DBP..
2. Asmah Hj. Omar. (2003). *Nahu Melayu Mutakhir*. KL: DBP.
3. Abdul Hamid Mahmood. (1992). *Menguasai Ejaan Bahasa Malaysia Dengan Cepat*. KL: DBP
4. Abdul Hamid Mahmood. (1998). *Menguasai Ejaan Bahasa Melayu*. KL: DBP.
5. Edward S. King. (1998). *Speak In Malay*. KL: Times Publication..
6. Edward S. King. (1998). *Write In Malay*. Times Publication : KL

UWB 10101 ENGLISH FOR ACADEMIC PURPOSES

SYNOPSIS:

English for Academic Purposes focuses on fulfilling students' academic requirements, such as the acquisition of reading, writing, speaking and listening skills in English. The course also provides opportunities for students to acquire note taking and study skills. Students will be reinforced on aspects of English language oral and written skills that are most relevant to them in their academic work. By the end of the course, students should be able to use English for a wide range of academic activities.

REFERENCES:

1. Koh Soo Ling (2007). *Effective Text for MUET*. Ilmu Bakti Sdn. Bhd.
2. Azian Abd. Aziz (2006) *English for Academic Communication*. Mc Graw Hill Malaysia
3. Noreha Taib (2003). *Basic English, 2nd Ed*. Mc Graw Hill Malaysia
4. Harbans Kaur (2005). *Explore MUET*. Fajar Bakti Sdn. Bhd

UQ*101 CO-CURRICULUM I**

SYNOPSIS:

Kursus ini ditawarkan dalam pelbagai bentuk aktiviti pilihan untuk pelajar peringkat Sarjana Muda dan Diploma. Lapan bidang aktiviti yang ditawarkan adalah Pengucapan Awam, Keusahawanan, Sukan, Khidmat Komuniti, Kesukarelawanan, Kepimpinan, Kebudayaan dan Daya Usaha dan Inovasi.

UWA 10102 ISLAMIC STUDIES

SYNOPSIS:

This course explains about Islamic concept as ad deen. It discusses the study of al-Quran and al-Hadith, Aqidah ahl al-Sunnah wa al Jamaah, trends of aqidah's doctrine, the growth of fiqh's mazhab, the principles of muamalah, Islamic criminal law, the ethics of work in Islam, issues in Islamic Family law, and current issues

REFERENCES:

1. Harun Din. (2001). *Manusia Dan Islam*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
2. Ismail Hj. Ali. (1995). *Pengertian dan Pegangan Iktikad yang benar: Ahli Sunnah Wal Jamaah*. Kuala Lumpur: Penerbitan al-Hidayah
3. Mustafa Abd. Rahman. (1998), *Hadith Empat Puluh*. Kuala Lumpur: Dewan Pustaka Fajar.
4. Mustafa Hj. Daud. (1995). *Konsep Ibadah Menurut Islam*. Kuala Lumpur: Dewan Pustaka dan Bahasa.
5. Paizah Hj. Ismail. (1991). *Undang-undang Jenayah Islam*. Kuala Lumpur: Dewan Pustaka Islam, Angkatan Belia Islam Malaysia.

UWA 10202 MORAL STUDIES

SYNOPSIS:

This course explores the introduction to moral concepts, some aspects related to the morality and its importance in our daily lives, some western moral theories, moral values in great religions of the world, morality and ethics in professional careers and contemporary moral issues.

REFERENCES:

1. Eow Boon Hin. (2002). *Moral Education*. Longman.
2. Ahmad Khamis. (1999). *Etika Untuk Institusi Pengajian Tinggi*. Kuala Lumpur: Kumpulan Budiman.
3. Mohd Nasir Omar. (1986). *Falsafah Etika; Perbandingan Islam dan Barat*. Kuala Lumpur: JPM.
4. Hussain Othman. (2009). *Wacana Asasi Agama dan Sains*. Batu Pahat: Penerbit UTHM..
5. Hussain Othman, S.M. Dawilah Al-Edrus, Berhannudin M. Salleh, Abdullah Sulaiman, (2009). *PBL Untuk Pembangunan Komuniti Lestari*. Batu Pahat: Penerbit UTHM.

BWM 10103 ENGINEERING MATHEMATICS I

SYNOPSIS:

Limits and Continuity: Techniques of finding limits. Continuity.
Differentiation and Applications: Techniques of differentiation: product rule, quotient rule. Chain rule. Implicit differentiation. Higher derivatives. Differentiation of implicit functions, parametric equations and inverse functions. Applications: rates of change, maximum and minimum problems, sketching rational functions. **L'Hopital's Rule:** Indeterminate form of type $0/0$, ∞/∞ , $0 \cdot \infty$, 0^0 , ∞^0 , 1^∞ , $\infty - \infty$. **Integration:** Techniques of integration: integration by substitution, integration by parts, integrating rational functions, integrating power of trigonometric functions, rational functions of sine and cosine, integrating hyperbolic functions and integration by trigonometric and hyperbolic substitution. **Further Differentiation and Integration and Applications:** Derivatives and integrals involving inverse trigonometric and hyperbolic functions. Applications: arc length, surface area of revolution, curvature. **Power Series:** Convergence test. Conditional and absolute convergence. Power series: Taylor and Maclaurin series. Differentiation and integration of power series.

REFERENCES:

1. Anton, H., Bivens, I., Davis, S. (2005) *Calculus*. 8th Ed. USA: John Wiley & Sons, Inc.
2. Smith, R. T., Minton, R. B. (2006) *Calculus Concept & Connection*. New York: McGraw-Hill.
3. Abd. Wahid Md. Raji, Hamisan Rahmat, Ismail Kamis, Mohd Nor Mohamad, Ong, C.T. (2003) *Calculus* Malaysia: UTM Publication.
4. Larson, R. E., Hostetler, R. P., Edward, B. H. (1998) *Calculus with Analytic Geometry*. 6th Ed. USA: Houghton Mifflin Company.
5. Thomas, G. B., Finney, R. L. (1996) *Calculus and Analytic Geometry*. 9th Ed. USA: Addison- Wesley Publishing Company.
6. Edward, C. H., Penney, D. E. (1998) *Calculus*. 5th Ed. USA: Prentice-Hall, Inc.
7. Stroud, K. A., Booth, D.J. (2007) *Engineering Mathematics*. 6th Ed. US: Palgrave Macmillan.

BEC 10102 COMPUTER PROGRAMMING

SYNOPSIS:

Introduce the concept of Software Development Environment with an emphasis on programming skills; design, develop, test, and evaluate software systems which can be apply to the solution of problem solving using C++ Programming Language.

REFERENCES:

1. Delores M. Etter, Jeanine A. Ingber. Engineering Problem Solving with C++, 2nd. Edition. Prentice-Hall, 2007.
2. Jeri R. Hanly, Elliot B. Koffman. Problem Solving and Program Design in C, 4th. Edition. Addison-Wesley, 2004.
3. Katupitiya, Jayantha, Bentley, Kim. Interfacing with C++, Springer, 2006.
4. Jeri R. Hanly, Elliot B. Koffman. C Programming for Engineers, 2nd Edition, Addison-Wesley, 2004.
5. H. M. Deitel and P. J. Deitel, C: How to Program, 4th Edition, Prentice-Hall, 2004.
6. James L. Antonakos and Kenneth C. Mansfield, Structured C for Engineering and Technology, 4th Edition, Prentice-Hall, 2001.
7. Hutchings et al, Interfacing with C, 1st Edition, Butterworth-Heinemann, 2000.

BEE 10202 ENGINEERS AND SOCIETY

SYNOPSIS:

This course concerns with the profession of engineers, engineers' role and professional bodies governing the profession. Relationship of engineering and organization, and society at large are covered in this course. Ethics and professionalism cover the code of ethics and moral reasoning. Emphasis is given to the ethical issues in engineering practice; also intellectual property and anti-corruption concept. Next are the responsibilities of engineers and their rights at workplace and team work. Commitment in providing service is taught which involves safety, environmental and global issues. Last are the engineering acts, regulations and standard.

REFERENCES:

1. Mike W. Martin, Ethics in Engineering, 4th. Ed. McGraw Hill, 2005.
2. Roland Schinzinger and Mike W. Martin, Introduction to Engineering Ethics, McGraw Hill, 2000.
3. Charles B. Fleddermann, Engineering Ethics, 2nd Edition, Prentice Hall 2004.
4. John D. Kemper and Billy R. Sanders, Engineers and Their Profession, 5th Ed. Oxford University Press, 2001.
5. Daniel A. Vallero, P. Aarne Vesilind, Socially Responsible Engineering : Justice in Risk Management, John Wiley, 2006.
6. Stephen F. Johnston, J. Paul Gostelow and W. Joseph King, Engineering and Society : Challenges of Professional Practice, Prentice Hall, 2000.
7. B. S. Dhillon, Engineering Safety : Fundamentals, Techniques and Applications, World Scientific, 2003.

8. Morton E. Winston and Ralph D. Edelbach, *Society, Ethics and Technology*, Thomson, 2006 .
9. Mohd Janib Johari, *Etika Profesional*, Penerbit UTM, 2001.
10. Abdul Rahim Abdul Manaf, *Alam Jurutera*, Penerbit Universiti Malaya, 2005.
11. *Registration of Engineers Act 1967 (Act 138) and Regulations*, Lembaga Penyelidikan Undang-Undang, International Law Books Services, 2001.
12. *Electricity Supply Act 1990 and Subsidiary Legislations*.
13. *Contract Act 1950 (Revised 1974)*.
14. *Occupational Safety and Health Act 1994*.

BEL10103 ELECTRIC CIRCUITS

SYNOPSIS

The first course covers the basic theory of circuit analysis. Topics include basic electrical circuit theory and laws, electrical circuit analysis techniques and concepts, energy storage elements, network theorems, review of techniques to solve simultaneous equations, nodal and mesh circuit analysis, dependent sources, Thevenin's and Norton's equivalent circuits, maximum power transfer, solution of first and second order networks to switched DC inputs, natural responses, AC circuit steady-state response analysis, steady state power calculations in circuit analysis. Computer assisted analysis of electrical circuits. This course has an integrated laboratory.

REFERENCES:

1. J. David Irwin; *Basic Engineering Circuit Analysis*, 8th Ed.; John Wiley & sons ; 2005.
2. Alexander, C. K. & Sadiku, M.N.O.; *Fundamentals of Electric Circuits*; McGraw-Hill International Editions; 2007.
3. James W. Nilsson & Susan A. Riedel; *Electric Circuits*; Prentice-Hall; 2008.
4. William H Hayt & Jack E Kemmerly, *Engineering Circuit Analysis*, McGraw Hill, 2002.
5. Richard C. Dorf & James A. Svoboda; *Introduction to Electric Circuits*, John Wiley & Sons; 2004.
6. Marc E Herniter, *Schematic's Capture with PSpice*, 2nd Edition, Prentice-Hall International, Inc ; 2000.
7. James W. Nilsson & Susan A. Riedel; *Introductory circuits for electrical and computer engineering*; Prentice-Hall 2008.

YEAR 1
SEMESTER II

UWS 10303 MALAYSIAN STUDIES AND CULTURE

SYNOPSIS:

This course will provide students in depth the understanding of Malaysia from various perspectives. Topics to be discussed include Malaysia in relation to its history, achievement and international affairs. In addition, students will also be exposed to the ethnic composition of the country, culture and heritage. Teaching and learning process enables student to acquire knowledge and appreciates the reality of life in Malaysia through experiential learning.

REFERENCES:

1. Abdul Halim Nasir. (2004). *Mosque Architecture in the Malay World*. Bangi: Penerbit Universiti Kebangsaan Malaysia.
2. *Ensiklopedia Sejarah Kebudayaan Melayu*. (1998). Kuala Lumpur: Dewan Bahasa dan Pustaka.
3. Khoo Kay Kim. (2001). *Malay Society: Transformation and Democratisation*. Kelana Jaya: Pelanduk Publications
4. Nazaruddin Mohd. Jali. (2003). *Malaysian Studies: Nationhood and Citizenship*. Petaling Jaya: Pearson Prentice Hall.
5. Yahaya Ismail. (1989). *The Cultural Heritage of Malaysia*. Kuala Lumpur : Dinamika Kreatif Sdn. Bhd.

UWB 10202 EFFECTIVE COMMUNICATION

SYNOPSIS:

This course emphasizes on task- based learning approach and focuses on developing students' delivery of speech in oral interactions and presentations. Importance is given on mastery of self-directed learning, team-work, research, oral presentations, reasoning and creativity. This course also enables students to acquire knowledge and skills necessary for conducting and participating in meetings, including writing of meeting documents. Students will also be exposed to the techniques of conducting interview.

REFERENCES:

1. Cheesebro, T, O'Connor, L. & Rios, F. (2007). *Communication Skills : Preparing for Career Success* (3rd ed.) Upper Saddle River, NJ: Pearson.
2. Davies, W.J. (2001) *Communication Skills : A Guide for Engineering and Applied Science Student* (2nd ed.) . London: Prentice Hall.
3. Joan van Emden, L. (2004). *Presentation Skills for Students*. New York: Palgrave Macmillan.
4. Richard Johnson-Sheehan. (2005). *Technical Communication Today*. New York: Pearson.
5. Salbiah Seliman et. al. (2004). *English Communication for Learners in Engineering*. Malaysia: Prentice Hall.

UWS 10202 ETHNIC RELATIONS

SYNOPSIS:

This course focuses on the concept of ethnic relations and its practices in the Malaysian society. Class discussions cover the fundamental of ethnic relations and the history of the construction of a plural society. The Malaysia Constitution will be covered as a core of living in the society. Discussions will be further conducted into detail on the linkages between ethnicity and development in social, political and economic aspects based on top-down and bottom-up approaches by the government and society.

REFERENCES:

1. Shamsul Amri Baharuddin (2007). *Modul Hubungan Etnik*. Shah Alam: Universiti Teknologi MARA.
2. Zaid Ahmad, Ho Hui Ling, Sarjit Sing Gill, Ahmad Tarmizi Talib, Ku Halim Ku Arifin, Lee Yok Fee, Nazri Muslim dan Ruslan Zainuddin (2006). *Hubungan Etnik di Malaysia*. Shah Alam: Oxford Fajar Sdn. Bhd.
3. Lembaga Penyelidikan Undang-undang (2003). *Perlembagaan Persekutuan: (hingga 15hb Ogos 2003)*. Petaling Jaya: International Law Book Services.
4. Nazaruddin Mohd Jali, Ma'rof Redzuan, Asnarulkhadi Abu Samah dan Ismail Mohd Rashid (2005). *Pengajian Malaysia*. Petaling Jaya: Prentice

UQ*1**01

CO-CURRICULUM II

SYNOPSIS:

Kursus ini ditawarkan dalam pelbagai bentuk aktiviti pilihan untuk pelajar peringkat Sarjana Muda dan Diploma. Lapan bidang aktiviti yang ditawarkan adalah Pengucapan Awam, Keusahawanan, Sukan, Khidmat Komuniti, Kesukarelawanan, Kepimpinan, Kebudayaan dan Daya Usaha dan Inovasi.

BWM 10303

ENGINEERING MATHEMATICS IIE

SYNOPSIS:

First Order Differential Equations: Formation and methods of solution (Separating the variables, homogeneous, linear and exact) , initial value problem, application (electric circuit). **Second Order Linear Differential Equations with Constant Coefficients:** Methods of solution : Method of undetermined coefficient and method of variation of parameter. Application of second order linear differential equation with constant coefficients in electric circuit. **System of First and Second Order Differential Equations:** Eigen value and eigen function. **Laplace Transform:** Definition. Linearity, first shift theorem, Multiplying by t . Unit step function and Delta function, second shift theorem. Inverse Laplace transform : Definition and properties. Convolution theorem. Solve initial and boundary value problems for linear differential equation with constant coefficients which involve unit step function, Dirac Delta function and periodic function. **Fourier Series:** Fourier series in interval period 2π . Odd and even function. Fourier series in interval $(-l, l)$. Half range series. **Series Solution for Differential Equations:** Power series method, Legendre polynomial, Bessel equation. **Introduction of Fourier Transform.**

REFERENCES:

1. Phang, C. , Phang, P. (2007) Engineering Mathematics II BSM1933 (Learning Module). UTHM Publication.
2. Abd. Wahid Md. Raji, Mohd Nor Mohamad (2008) *Differential Equations for Engineering Students*.
3. Stroud, K. A., Booth, D.J. (2007) *Engineering Mathematics*. 6th Ed. US: Palgrave Macmillan.
4. Stroud, K. A., Booth, D.J. (2007) *Advanced Engineering Mathematics*. 4th Ed. US: Palgrave Macmillan
5. Kuldeep Singh (2003) *Engineering Mathematics through Applications*. Industrial Press, Inc.
6. Robert J. Lopez (2001) *Advanced Engineering Mathematics*. Addison Wesley.
7. Peter V. O'Neil (2003) *Advanced Engineering Mathematics*. Thomson Brooks/ Cole.

BEL10203 ANALOG ELECTRONICS

SYNOPSIS:

This course provides the student with the basic knowledge necessary to understand the operation and application of semiconductor devices in discrete electronic circuits. The course covers an introduction to the semiconductor theory. Emphasis is on the basic electronic semiconductor devices such as the diode, the bipolar junction transistor (BJT), the field-effect transistor (FET). Biasing, small-signal and large signal analysis and the principles employed in the design of electronic circuits are included. Analytical, graphical, and computer tools are used to explain the basic building blocks of analog circuits. Topics also include Frequency Response of BJT and JFET, multistage amplifiers, cascade and cascode configurations, Darlington pair, Differential amplifier, Power amplifiers: class A, B and AB.

REFERENCES:

1. R.Boylestad, L. Nashelsky; Electronic Devices and Circuit Theory, 9th Edition; Prentice Hall; 2006.
2. Donald A. Neamen; Microelectronics Circuit Analysis and Design, 3rd Ed.; McGraw Hill, 2007.
3. Albert Paul Malvino, Electronic Principles, 7th Ed., McGraw Hill, 2007.
4. Robert T.Paynter; Introductory Electronics Devices and Circuits, Conventional Flow Version, 7th Edition; Prentice Hall; 2006.
5. Theodore F. Bogart, Jeffrey S. Beasley and Guillermo Rico, Electronic Devices and Circuits; 5th Edition, Prentice Hall; 2004.
6. Thomas L. Floyd, Electronics Fundamentals: Circuits, Devices and Applications, 5th Ed., Prentice Hall, 2001.
7. Adel S. Sedra and Kenneth C. Smith; Microelectronics Circuits, 5th Ed.; Oxford University Press, 2004.

BEE 10403 ELECTRICAL TECHNOLOGY

SYNOPSIS:

Electrical principles are an important aspect of an electrical engineering study that involves the basic operations and the characteristic of the various dc and ac electrical circuitry and electrical machines. In general when a study of the electrical technology, the student will be able to tackle problems in examination or in the actual electrical industrial environment with regard to various areas such as the single phase and three phase electrical circuits, electromagnetism, magnetic circuits, the resistor, inductor and capacitor as an electrical devices or component, and the dc and ac electrical machines.

REFERENCES:

1. Edward Hughes, Electrical Technology; Longman, 1977.
2. Theodore Wildi, Electrical Machines, Drives and Power Systems; Prentice Hall, 2006.
3. Chapman Stephen J., Electric Machinery and Power System Fundamentals; McGraw-Hill, 2002.
4. Edward Hughes, Hughes Electrical and Electronic Technology, 9th Ed., Prentice Hall, 2005.
5. J. B. Gupta, Electrical Technology, S. K. Kataria, 2004.

BEE10501

ENGINEERING PRACTICES

SYNOPSIS:

The course is developed to give the required knowledge regarding electrical wiring and installation. It will develop the capability of carrying out electrical wiring activities up to a certain level of competency. The topics covered are the domestic wiring and installation, industrial wiring and installation. In the designing of electronic circuits' aspects, OrCAD will be used as it will help in making the schematic entry, doing FPGA synthesis, digital, analog, mixed-signal simulation and printed circuit board layout. PLC will be used to provide the programming knowledge for the controlling of the basic and advance automation system.

YEAR 2

YEAR 2
SEMESTER I

UWB 20302 TECHNICAL WRITING

SYNOPSIS:

This course introduces students to report writing skills needed at tertiary level. Students will learn basic report writing skills such as proposals, progress report, informational and analytical reports. In order to do this, they will learn how to collect data using questionnaires. The data collected will be analyzed, transferred into graphic forms and presented orally and in writing. Based on the analysis of data, students will be able to draw conclusions and make recommendations.

REFERENCES:

1. Finkelstein, J. (2008). *Pocket Book of Technical Writing*. 3rd ed. Singapore: McGraw Hill.
2. Kolin, P. C. (2006). *Successful Writing at Work*. Concise ed. USA: Houghton Mufflin Company.
3. Salbiah Seliman et. al. (2004). *English Communication for Learners in Engineering*. Malaysia: Prentice Hall.
4. Lakshmy Anantha Krishnan et. al. (2003). *Engineering Your Report: From Start to Finish*. Singapore: Prentice Hall.
5. Gerson, S. J. & Gerson, S. M. (2003). *Technical Writing: Process and Product*. 3rd ed. New Jersey: Prentice Hall.

BWM20403 ENGINEERING MATHEMATICS III

SYNOPSIS:

Functions of Several Variables: Domains, ranges, contour line, level curves and 3D-graphs. Partial derivatives and chain rules. Mixed derivatives. Total differentials and exact differentials. Local and absolute extreme values of functions of two variables. **Multiple Integrations:** Double integrals: Areas and volumes. Double integrals in polar coordinates. Surface areas. Triple integrals: Volumes. Triple integrals in cylindrical and spherical coordinates. Center of mass, center of gravity and inertial moments. **Vector-valued Functions:** Definition and graphs. Differentiations and integrations. Tangent vectors, normal vectors, arc length and curvature. Motion in a plane curve. Directional derivatives and gradients of functions of two variables. **Vector Calculus:** Line integrals of scalar and vector field. Independence of path and conservative vector field. Green's Theorem. Surface integrals of scalar and vector field. Gauss's Theorem and Stokes' Theorem

REFERENCES:

1. Anton, H., Bivens, I., Davis, S. (2005) *Calculus*. 8th Ed. USA: John Wiley & Sons, Inc.
2. Stroud, K. A., Booth, D.J. (2007) *Advanced Engineering Mathematics*. 4th Ed. US: Palgrave Macmillan
3. Bradley, G.L. , Smith, K.J (1999) *Calculus*. 2nd Ed. New Jersey: Prentice Hall.
4. Abd. Wahid Md. Raji, Phang, C. , Phang, P. (2007) *Engineering Mathematics III BSM2913*. (Learning Module). UTHM Publication.
5. Yusof Yaacob, Maslan Osman (2000) *Matematik Kejuruteraan*. UTM.
6. Thomas , Finey (1996) *Calculus*. 9th Ed. New York: Addison Wesley.
7. Smith, R.T. , Minton, R.B. (2006) *Calculus: Concepts & Connections*. New York: McGraw-Hill.
8. Stewart, J. (2003) *Calculus*. USA. Thomson Learning Inc.

BPK20802 KEUSAHAWANAN

SYNOPSIS:

Kursus ini memberi pendedahan kepada pelajar tentang aspek asas keusahawanan. Kursus ini meliputi empat modul utama iaitu pemupukan budaya keusahawan, peluang dan rancangan perniagaan, praktikum keusahawanan dan pembentangan laporan aktiviti keusahawanan.

RUJUKAN:

1. Kementerian Pengajian Tinggi (2007) 'Asas Pembudayaan Keusahawanan'. Penerbit UUM.
2. Marc J. Dollinger. – 3rd ed. (2003), 'Entrepreneurship; Strategic and Resources'. Prentice Hall Pearson Malaysia Sdn. Bhd.
3. UiTM Entrepreneurship Study Group (2004), 'Fundamentals of Entrepreneurship' Prentice Hall Pearson Malaysia Sdn. Bhd.
4. Carol Yip (2007) 'Smart Money-User' Kanyin Publication.
5. Agensi Kaunseling and Pengurusan Kredit (2009) 'Money Sense- Getting Smart with Your Money. 2nd Edition.
6. Agensi Kaunseling and Pengurusan Kredit (2009) 'Celik Wang- Pengurusan Wang secara Bijak.
7. Ministry of Domestic Trade & Consumer Affairs, www.kpdnhep.gov.my.
8. Personal Money (the Edge Magazine), www.theedgemalaysia.com.
9. Agensi Kaunseling and Pengurusan Kredit (AKPK), www.akpk.org.my.

BEL20303 DIGITAL ELECTRONICS

SYNOPSIS:

This course is the first course in digital electronics. Beginning with representing physical values in digital form using binary, octal and hexadecimal numbering system, conversion between these numbering systems, also representation of values in codes such as BCD and Gray. This is followed by representing negative values in binary, binary arithmetic and BCD addition. Basic logic gates and symbols are introduced as well as Boolean expressions, truth tables and timing diagrams. Combining basic gates to implement certain function, and analyzing circuits to obtain its Boolean expression, simplify using Boolean theorem and Karnaugh-map approach. In digital arithmetic, adder circuits are introduced, starting from half adder, full adder and the design of the carry look ahead adder and BCD adder. Then, on to MSI logic circuits such as encoder, decoder, multiplexer and demultiplexer. Memory elements such as latches and flip-flops are introduced followed by flip-flop applications in counters and registers. ADCs and DACs are also included. The final topic is on integrated circuit family characteristic and technology.

REFERENCES:

1. J. Floyd, Digital Fundamental, Merill MacMillan, 2006.
2. J. Tocci, Digital System, Principles and Application, Prentice Hall, 2006.
3. M. Morris Mano, Charles R. Kime, Logic and Computer Design Fundamentals, 2nd Ed., Prentice Hall, 2001.
4. Milos D. Ercegovic, Thomas Lang and Jaume H. Moreno, Introduction to Digital System, John Wiley, 1999.
5. Floyd, Digital Fundamentals with VHDL, Prentice Hall, 2003.

BEK 25503 POWER SYSTEMS

SYNOPSIS:

This course is arranged to provide students understanding of electrical power systems. The course is divided into three major parts: fundamental of single-phase and three-phase power distributions, utility power system structures, and industrial power systems. The essential basic knowledge of single-phase and three-phase power systems will be covered at the beginning of the course. Subsequently, electric utility system comprises all the apparatus used in the generation, transmission, and distribution of electric energy will be provided. Finally, introduction to the industrial power system will be made together with a range of technical issues that might arise during the design and utilisation of electrical energy.

REFERENCES:

1. J Theodore Wildi. Electrical Machines, Drives, and Power Systems, 6th Edition, Pearson Education International, 2006.
2. King Alexander C & Knight William. Uninterruptible Power Supplies and Standby Power Systems, McGraw-Hill, 2003.
3. Dugan Roger C, McGranaghan M F, Santoso S and Beaty H Wayne. Electrical Power Systems Quality, 2nd Edition, McGraw-Hill, 2003.
4. R.B. Theodore. Electrical Systems Design, Prentice Hall, 2003.
5. T. A. Short. Electric Power Distribution Equipment and Systems, Taylor & Francis Group, 2006.
6. A. Emadi, A. Nasiri, and S.B. Bekiarov. Uninterruptible Power Supplies and Active Filters, CRC Press, 2005.
7. K. Pethebridge and I. Neeson. Electrical Wiring Practice (Volume 2), 6th Edition, McGraw-Hill, 2002.
8. IEE Wiring Regulations 17th Edition, BS 7671: 2008, BSI, 2008.
9. Hadi Saadat. Power System Analysis, 2nd Edition, Prentice Hall, 2004.

BEE20801

ELECTRONIC ENGINEERING LABORATORY I

SYNOPSIS:

To give students hands-on experience in understanding the material presented in the following courses:

- BEL 10203 Analog Electronics
- BEL 10303 Digital Electronics

REFERENCES:

1. R.Boylestad, L. Nashelsky; Electronic Devices and Circuit Theory, 9th Edition; Prentice Hall; 2006.
2. Donald A. Neamen; Microelectronics Circuit Analysis and Design, 3nd Ed.; McGraw Hill, 2007.
3. Thomas L. Floyd, Electronic Devices, 7th Ed., Prentice Hall, 2005.
4. J. Tocci, Digital System, Principles and Application, Prentice Hall, 2006.
5. M. Morris Mano, Charles R. Kime, Logic and Computer Design Fundamentals, 2nd Ed., PrenticeHall, 2001.

BEN 20103 Semiconductor Electronics and Devices

SYNOPSIS:

This course deals with the analysis and fundamentals of semiconductor physics involving the applications and devices. It starts with the energy bands and carrier concentration of semiconductor materials. It is followed by the carrier transport phenomena in the semiconductor. Next, p-n junction is introduced as the basic building block of semiconductor devices. The last two chapters explain the basic semiconductor devices; bipolar transistors and MOSFET.

REFERENCE:

1. S.M.Sze, Semiconductor Devices Physics and Technology, 2nd Edition, John Wiley and Sons Inc., 2002.
2. D. A. Neamen, Semiconductor Physics and Devices, 3rd Ed., McGraw-Hill, 2005.
3. D. A. Neamen, An Introduction to Semiconductor Devices, McGraw-Hill, 2006
4. S. M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, 3rd Ed., John Wiley and Sons Inc., 2006.
5. Betty Lise Anderson and Richard L. Anderson, Fundamentals of Semiconductor Devices, McGraw-Hill, 2005
6. Safa O. Kasap, Principles of Electronic Materials and Devices, 3rd d Ed., McGraw-Hill, 2006.
7. Robert F. Pierret, Advanced Semiconductor Fundamentals, 2nd Ed., Prentice Hall, 2003.
8. Kevin F. Brennan, April S. Brown, Theory of Modern Electronic Semiconductor Devices, John Wiley and Sons Inc., 2002.

YEAR 2
SEMESTER II

UWA 10302 ISLAMIC AND ASIAN CIVILISATION

SYNOPSIS:

The course discusses the introduction of civilization, its development, the interaction between civilizations; the Islamic civilization, Islam in the Malay civilization; Indian and Chinese civilizations as well as contemporary civilization issues and also the principles of Islam Hadhari.

REFERENCES:

1. Ahmad Hakimi Khairuddin dan Faridah Che Husain. (2006). *Isu-isu Kontemporari Dalam Tamadun Islam dan Tamadun Melayu, dalam Tamadun Islam dan Tamadun Melayu. Siri Teks Pengajian Tinggi*. Kuala Lumpur: Penerbit Universiti Malaya2.
2. Ibnu Khaldun, Muqaddimah Ibnu Khaldun.
3. Huntington, S. *The Clash of Civilizations and the Remaking of the World Order*. Mahyuddin
4. Hj. Yahaya. (1998) *Tamadun Islam*, Shah Alam: Penerbit Fajar Bakti Sdn. Bhd.
5. Bei Ye. (2001). *Zhongguo Wenming Lun – Zhongguo Gudai Wenming De Benzhi Yu Yuanli* (Bicara Tamadun Cina – Teori dan Asas Tamadun Kuno Cina), Penerbit: Zhongguo Shehui Kexue Chubanshe Beijing.

BWM30602 ENGINEERING MATHEMATICS IV

SYNOPSIS:

Solution of Nonlinear Equations: Bisection, secant, and Newton Raphson method. **Solution of Linear Systems of Equations:** Gaussian elimination, LU decomposition, Thomas, and Gauss-Seidel method. **Interpolation and Polynomial Approximation:** Newton's divided-difference, Lagrange and Cubic Spline. **Numerical Differentiation:** Taylor series expansion. **Numerical Integration:** Simpson and Gauss quadrature method. **Eigen Values:** Power method. **Ordinary Differentiation Equations:** Solution of Initial-Value Problems with Taylor Series, Euler, Huen, Runge-Kutta methods. Solution of Boundary-Value Problems with finite difference method. **Partial Differentiation Equations:** Explicit and implicit method using finite difference method. **Finite-element Method:** Introduction to Finite Element Method. General approach. Finite-element application in one dimension.

REFERENCES:

1. Nafisah Md Kamaruddin, Phang, C., Phang, P., Tay, K.G. (2007) *Numerical Method* (Learning Module). UTHM Publication.
2. Chapra, S.C. Canale R.P. (1989) *Numerical Methods for Engineers*. Mc Graw-Hill.
3. Jain, M.K. Iyengar, S.R.K. Jain, R.K. (1987) *Numerical Methods for Scientific and Engineering Computation*. 2nd Ed. Wiley Eastern Ltd.
4. Mathew, J.H. (1992) *Numerical Methods for Mathematics, Science & Engineering*. 2nd Ed. Prentice Hall.
5. Buchanan, J.L. & Turner, P.R. (1992) *Numerical Methods and Analysis*. McGraw Hill.
6. Burden, L.R. Faires, J.D. (1997) *Numerical Analysis*. 6th Ed. Brooks/Cole Publishing Company.

BPK30902

EKONOMI KEJURUTERAAN

SYNOPSIS:

Ekonomi kejuruteraan merupakan satu bidang kajian yang mengaitkan beberapa aspek ekonomi semasa membuat keputusan kejuruteraan. Aspek tersebut melibatkan penilaian kos dan faedah bagi projek teknikal yang dicadangkan. Konsep asas yang digunakan ialah nilai wang-masa, dan teknik yang berkaitan dengan pengkompaunan, pendiskaunan, dan konsep kesetaraan. Beberapa kaedah digunakan untuk menentukan sama ada sesuatu pelaburan itu menguntungkan atau tidak iaitu kaedah PW, FW, AW, IRR dan kaedah faedah-kos.

RUJUKAN:

1. Blank, L.T., A. Tarquin (2008): *Basics of Engineering Economy*, International ed., McGraw-Hill, New York,
2. Mohamad Sirin, R. (2007): *Teori Asas Ekonomi Kejuruteraan*, Cetakan Awal, Fakulti Pengurusan Teknologi, KUiTTHO. Malaysia.
3. Sullivan W.G, Wicks E.M. & Luxhoj J.T, (2006). *Engineering Economy*, 13th Edition, Prentice Hall Inc.
4. Chan S. Park, (2007). *Contemporary Engineering Economics*, 4th Edition, Pearson International Edition.

BEP20303 ELECTROMAGNETIC FIELDS AND WAVES

SYNOPSIS:

Explanation on electromagnet; Explanation on vector analysis, Electromagnetism, Electrostatic; Charge, Charge density, Coulomb's Law, Flux density, Potential difference, Gauss's law, Electrical energy, Capacitance, Magnetostatic, Biot-Savart's law, Ampere's Circuit law, Magnetic force, Magnetic material, Magnetic circuit, Induction, Transformer, Time-Varying fields; Faraday's law, Lenz's law, Maxwell equations, Electromagnetic wave equations: Polarization, Acceleration, Frequency, Power, Wave reflection at normal incidence plane and oblique plane.

REFERENCES:

1. Matthew M.O.Sadiku, Element of Electromagnetic, 4th Edition, Oxford University Press, 2001 (Repr. 2003).
2. Fawwaz T. Ulaby, Fundamentals of Applied Electromagnetics, Prentice Hall, 2004.
3. Fawwaz T. Ulaby, Electromagnetics for Engineers, Pearson Education, 2005.
4. William H. H, Engineering Electromagnetics, McGraw-Hill, NY, 2005.
5. Edward J. Rothwell and Michael J. Cloud, Electromagnetics, CRC Press, 2001.
6. Zoya Popovic and Branko D. Popovic, Introductory Electromagnetics, Prentice Hall, New Jersey, 1999.

BEC 20202 MULTIMEDIA TECHNOLOGY AND APPLICATION

SYNOPSIS:

This course is intended to provide a study of multimedia technology and application theory, practice and issues through the use of a multimedia application development and authoring tools. Topic covered; Introduction to Multimedia, Multimedia Application Development and Authoring, Multimedia Elements, Multimedia I/O Technology, Multimedia Storage and Retrieval Technology.

REFERENCES:

1. Syed Mahbubur Rahman, "Multimedia technologies: concepts, methodologies, tools and applications", London: Information Science Reference, 2008.
2. Ze-Nian Li, Mark S. Drew, "Fundamentals of Multimedia", Int. Edition. Pearson Prentice-Hall, 2004.
3. Nigel Chapman and Jenny Chapman, Digital Multimedia, Wiley, 2000.
4. Prabhat K. Andleigh, Multimedia Systems Design, Prentice hall 1995.
5. Jeffcoate, Multimedia in Practice – Technology and Applications, Prentice Hall, 1994

BEE20901 ELECTRONIC ENGINEERING LABORATORY II

SYNOPSIS:

This course comprises of practical implementation for the subject of Power System, and Instrumentation and Control System. Various experiments are covered such as generator and transformer, overhead line, short circuits asymmetrical analysis, protection system, power factor correction, error in measurement, basic usage of oscilloscope, sinusoidal waveform, measuring phase and frequency using oscilloscope, application of digital oscilloscope, signal generator and frequency counter three-phase inverter, position control system, speed control system and servo system.

BEM22003 INSTRUMENTATION AND CONTROL SYSTEMS

SYNOPSIS:

This course is about the analysis, design and application of instrumentation and process control system. It is organized in 7 (seven) chapters. The outline is as follows: Chapter 1 presents an introduction to electrical instrumentation. Chapter 2 deals with digital oscilloscope and function generator. Chapter 3 gives introduction to control system. Chapter 4 discuss the mathematical modelling of dynamic system. Chapter 5 presents time domain analysis. Chapter 6 explains the controllers in process control including parameters tuning and controller setting. Chapter 7 discusses control system instrumentations. Finally, Chapter 8 presents measurement system application.

REFERENCES:

1. C.A. Smith and A. Corripio, Principles and Practice of Automatic Process Control; John Wiley, 2006.
2. J.P. Bentley, Principles of Measurement System, 4th Ed.; Pearson Prentice Hall, 2005.
3. C.D. Johnson, Process Control Instrumentation Technology, 7th Ed.; Prentice Hall, 2003.
4. K. Ogata, Modern Control Engineering, 4th Ed.; Prentice Hall, 2002.
5. R.G. Gupta, Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting; McGraw Hill, 2001.
6. T.E. Marlin, Process Control, Designing Processes and Control System for Dynamic Performance, 2nd Ed.; McGraw-Hill, 2000.
7. G.K. McMillan, Process/Industrial Instruments and Control Handbook; McGraw-Hill, 1999.
8. A. Parr, Industrial Control Handbook, 3rd Ed.; Newnes, 1998.
9. B. Cornell, Process Instrumentation Applications Manual; McGraw-Hill, 1996.

YEAR 3

YEAR 3
SEMESTER I

UWB 10602 FRENCH LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic French language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using French language.

REFERENCES:

1. Girardet, Jacky et Cridlig, Jean-Marie, (1996) *Méthod de français: PANORAMA 1*. Paris: CLE International.
2. Hatier, (1995). *Le Nouveau Bescherelle Complete Guide 12 000 French Verbs*. Paris: LIBRAIRIE HATIER
3. Kaneman-Pougatch, Massia et al, (1997). *Méthod de français: Café Crème 1*. Paris: HACHETTE F.L.E..
4. Grégoir, Maïa et al, (1995). *Grammaire Progressive du Français avec 500 exercices*. Paris: CLE International.
5. Miquel, Claire Leroy et al, (1995). *Vocabulaire Progressive du Français avec 250 exercices*. Paris: CLE International.
6. Peter V. O'Neil (2003) *Advanced Engineering Mathematics*. Thomson Brooks/ Cole.

UWB 10902 MANDARIN LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic Mandarin language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Mandarin language.

REFERENCES:

1. Liang An Xiang. (2002). KL: EPH Publishing (M) Sdn. Bhd.
2. Shi Yun. (2002). KL: EPH Publishing (M) Sdn. Bhd.
3. Claudia Ross & Jing-heng Sheng Ma. 2006. Routledge. London.

4. Dr.Lim Choon Bee. (2005). Serdang: Universiti Putra Malaysia Press.
5. Hui Jin Chang. (2002). KL: United Publishing House (M) Sdn.Bhd.
6. Claudia Ross. (2002) .USA: Press of Ohio.
- 7 Duan Duan Li & Yanping Xie. (2002). USA: Press of Ohio.

UWB 11002 MALAY LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic of Malay language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Malay language.

REFERENCES:

1. Asmah Hj. Omar. (2005). *Susur Galur Bahasa Melayu*. KL: DBP..
2. Asmah Hj. Omar. (2003). *Nahu Melayu Mutakhir*. KL: DBP.
3. Abdul Hamid Mahmood. (1992). *Menguasai Ejaan Bahasa Malaysia Dengan Cepat*. KL: DBP
4. Abdul Hamid Mahmood. (1998). *Menguasai Ejaan Bahasa Melayu*. KL: DBP.
5. Edward S. King. (1998). *Speak In Malay*. KL: Times Publication..
- 6 Edward S. King. (1998). *Write In Malay*. Times Publication : KL

UWB 11202 ARABIC LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic Arabic language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Arabic language.

REFERENCES:

1. Mohd Hisyam Abdul Rahim; Ahmad Sharifuddin Mustapha; Mohd Zain Mubarak. (2008). *Bahasa Arab UMR 1312*. Batu Pahat: Penerbit UTHM..
2. Mohd Hisyam bin Abdul Rahim. (2005). *Senang Berbahasa Arab*.

Batu Pahat: Penerbit KUITTHO.

3. Ab. Halim Mohammed; Rabiyyah Hajimaming; Wan Muhammad Wan Sulong. (2007). *Bahasa Arab Permulaan*. Serdang: Penerbit UPM.
4. Mohd Khairudin Khudri. (2006). *Akar Umbi Pembelajaran Bahasa Arab*. Kajang: One Touch Creative.
5. Sini, Mahmud Ismail; Abd Aziz, Nasif Mustapha; Husayn, Mukhtar. T.th. *al-'Arabiyyah Lil Nashiin, Kitab al-Tilmiz*. al-Mamlakah al-Saudiyah: Idarah al-Kutub al-Madrasiyah, Wizarah al-Taalim

UWB 10802 JAPANESE LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic Japanese language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Japanese language.

REFERENCES:

1. *Kodansya's Furigana Japanese Dictionary*. (2005).
2. Minna no Nihongo Listening. (2006). 2nd Ed. Tokyo: 3A Corporation
3. Minna no Nihongo Jap-English (2006). 2nd Ed. Tokyo: 3A Corporation.
4. Japanese Conversation for Beginners (2006) Bonjinsha, Tokyo Japan
5. Japanese Language Center for International Students, Tokyo University of foreign Studies.

UWB 10702 GERMAN LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic German language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using German language.

REFERENCES:

1. Nur Zakiah binti Amir Hamzah, *Guten Tag !*, Batu Pahat: Pejabat Penerbit UTHM.

2. Angela Wilkes. (2006). *German For Beginners*, London: Usborne Publishing Ltd.
3. Hartmurt Aufderstrasse. (1998). *Themen Neu 1*, Lehrwerk fuer Deutsch als Fremdsprache.
4. Dr. Albert H. Small. (1991). *German á la Cartoon*. German Grammar through Cartoons.

UWB 11102 SPANISH LANGUAGE

SYNOPSIS:

This course is designed for students to learn the basic Spanish language. Students are exposed to the skills of listening, reading, speaking, and writing with basic vocabulary, grammar and structure. Students are also exposed to the real daily situations which will help them to communicate using Spanish language.

REFERENCES:

1. Nurul Sabrina Zan: *Hola! Hablo Español* First Edition. Batu Pahat: Penerbit UTHM.
2. Joy Renjilian - Burgay, Ana Beatriz Chiquito y Susan M. Mraz: *Caminos*.
3. Salina Husain. *Vamos a aprender español lengua extranjera*
4. Gail Stein. *The Complete IDIOT'S GUIDE to Learning Spanish on Your Own*. 2nd Ed.
5. Irwin Stern. *Ultimate SPANISH Revised and Update*.

BEE 31202 CREATIVITY AND INNOVATION

SYNOPSIS:

This course focuses on developing a creative person who will eventually think strategically, creatively and critically. The knowledge and skills acquired throughout the course will later be applied by the students in solving problems and making decisions in the future. In this course, students will be exposed to various creativity and problem solving techniques. Some of the skills to be covered throughout the course are problem solving, techniques in creativity and techniques in innovation. Students will also be participating in exhibition and competition.

REFERENCES:

1. Bernacki, E. 2002. *Wow! That's a Great Idea!*. Singapore : Prentice Hall.
2. De Bono, E. (2003). *Serious Creativity 1 : Lateral Thinking Tools, Techniques and Application*. Singapore : Allscript Books.
3. De Bono, E. (2003). *Serious Creativity 2 : Lateral Thinking Tools, Techniques and Application*. Singapore : Allscript Books.
4. Ceserani, J. & Greatwood, P. 1995. *Innovation and Creativity*. London : Kogan Page.
5. Ceserani, J. & Greatwood, P. 2001. *Innovation and Creativity*. New Delhi : Creast Publishing House.
6. Clegg, B. & Birch, P. 2002. *Crash Course in Creativity*. London : Kogan Page.
7. De Bono, E. 1998. *Edward De Bono Supermind Pack: Expand Your Thinking Power with Strategic & Mental Exercise*. DK Publishing Incorporated.
8. Lumsdaine, E., Lumsdaine, M. & Shelnut, J. W. 1999. *Creative Problem Solving and Engineering Design*. USA: McGraw-Hill.
9. Tanner, D. 1997. *Total Creativity*. APTT Publications.

BWM20502

ENGINEERING STATISTICS

SYNOPSIS:

Random Variables. Probability Distributions: Binomial, Hypergeometric, Poisson and Normal distributions. Normal approximation to Binomial and Poisson. **Sampling Distribution:** Sampling distribution for mean and difference between two means, distribution for proportion. **Estimation:** Point estimation and confidence intervals, confidence intervals for mean, variance and proportion. **Hypothesis Testing:** Mean for small/large sample, difference between two means and proportion for small/large sample. Variance and the ratio of variance. **Simple Linear Regression:** Graphical method, least square method. Coefficient of determination R^2 . Correlation.

RUJUKAN:

1. Cik Sri Mazzura, Nafisah, Kek, S.L. & Phang, P. (2007) *Engineering Statistics* (Module)
2. Ronald E. Walpole & Raymond H Myers (1998) *Probability and Statistics for Engineers and Scientists*, 6th ed. Prentice Hall.
3. William Mendenhall & Terry Sincich (1995) *Statistics for Engineering and the Science*, 4th ed. Prentice Hall.

4. Allan G. Bluman (2001) *Elementary Statistics: A Step by Step Approach*. McGraw-Hill.
5. George Woodbury (2004) *An Introduction to Statistics*. Thomson Learning.
6. Douglas C. Montgomery, George C. Runger and Norma Faris Hubele. (2004) *Engineering Statistics*. John Wiley, New York.

BEP 31803 ELECTRONIC COMMUNICATION SYSTEMS

SYNOPSIS:

This course introduces the fundamentals in analog and digital communication systems. Comprises of analysis of signals and noise, generation of analog and digital modulation schemes, transmission lines, antenna and wave propagation as a part of a complete system in communication. Finally, the topic discussed relate with current application in communication systems.

REFERENCES:

1. Wayne Tomasi, *Electronic Communication Systems: Fundamental Through Advanced 5th Ed.*, Pearson Prentice Hall, 2004.
2. Jeffrey S. Beasley, Gary M. Miller, *Modern Electronic Communication 9th Ed.*, Pearson Prentice Hall 2008.
3. Proakis, J. G., Salehi M., *Communication System Engineering 2nd Ed*, Pearson Prentice-Hall, 2002.
4. Couch, L. W., *Digital and Analog Communication Systems*, 7th Ed, Pearson Prentice-Hall, 2007.
5. Proakis, J. G. et al, *Essential of Communication System Engineering*, Pearson Prentice-Hall, 2005
6. Simon Haykin, *Communication System*, 4th Ed, John Wiley and Sons, 2001.
7. Louis Frenzel, *Communication Electronics*, McGraw-Hill, 2001.
8. Ziemer, R. E., et. al., *Principles of Communication*, 5th Ed, John Wiley, 2002

BEL30403 ELECTRONICS CIRCUIT ANALYSIS AND DESIGN

SYNOPSIS:

Fundamental concepts of analog electronics and the application of these concepts to the design of analog circuits. Among the topics covered are the fundamentals of operational amplifiers: linear and non-linear operation; feedback and oscillators; op-amp circuits: Instrumentation amplifier, active filters; regulated DC power supply. Focus is on the design, implementation, and testing of analog circuits by means of computer simulation software.

REFERENCES:

1. R.Boylestad, L. Nashelsky;Electronic Devices and Circuit Theory, 9th Edition; Prentice Hall; 2006.
2. Donald A. Neamen; Microelectronics Circuit Analysis and Design, 3rd Ed.; McGraw Hill, 2007.
3. Adel S. Sedra and Kenneth C. Smith; Microelectronics Circuits, 5th Ed.; Oxford Univ. Press, 2004.
4. Thomas L. Floyd; Electronic Devices, 7th Ed. ; Prentice Hall, 2005.
5. Albert Paul Malvino; Electronic Principles, 7th Ed.; McGraw Hill, 2007.
6. Robert T.Paynter; Introductory Electronics Devices and Circuits, Conventional Flow Version, 7th Edition; Prentice Hall; 2006.
7. Theodore F. Bogart, Jeffrey S. Beasley and Guillermo Rico, Electronic Devices and Circuits; 5th Edition, Prentice Hall; 2004.
8. Thomas L. Floyd; Electronics Fundamentals: Circuits, Devices and Applications, 5th Ed.; Prentice Hall, 2001.

BEE31002 ELECTRONIC ENGINEERING LABORATORY III

SYNOPSIS:

This laboratory give students hands-on experience in understanding the material presented in the following subjects:

- BEP30403 Communication Theory
- BEL30403 Electronic Circuit Analysis & Designs.

BEN 30203 Digital IC Design

SYNOPSIS:

This course starts with brief history of IC designer profession, physical layout and IC design flow followed by schematic fundamental such as MOS transistor, logic gates, transmission gates and schematic connectivity. Next chapter is about layout design such as transistor layout, design rules, design guidelines and design verification. The following part is on layout design flow and advance technique for specialize building block layout design. Lastly, the techniques to interconnect building block are covered.

REFERENCE:

1. Dan Clein, CMOS IC Layout: Concepts, Methodologies, and Tools, 2000.
2. J. Floyd, Digital Fundamental, Merill MacMillan, 2006.
3. Thomas L. Floyd, Digital Fundamentals with VHDL, Prentice Hall, 2003.
4. Sung-Mo Kang, Yusuf Lebleici, CMOS Digital Integrated Circuits Analysis & Design, 3rd Ed., McGraw-Hill, 2003.
5. David A. Hodges, Analysis and Design of Digital Integrated Circuit, 3rd Ed., McGraw-Hill, 2004.

YEAR 3
SEMESTER II

BEE30103 ENGINEERING MANAGEMENT

SYNOPSIS:

This course introduces engineers to the ways in which management principles are applied in engineering project and organization. Managing people and career opportunities as engineering manager. Management function: planning and forecasting, strategy formulation, decision making, organizing, leading and controlling. Quality Management. Project management and its activities. Resources Management, Financial Management, and Maintenance, Reliability and Safety Management are among the topics covered.

REFERENCES:

1. Lucy C. Morse and Daniel L Babcock, *Managing Engineering and Technology*. Prentice Hall, 2007.
2. C. M. Chang, *Engineering Management : Challenges in the New Millennium*, Prentice Hall, 2005
3. Avraham Shtub, Jonathan F. Bard, Shlomo Globerson, *Project Management : Processes, Methodologies and Economics*, Prentice Hall, 2005
4. John V. Chelsom, Andrew C. Payne, *Management for Engineers, Scientists and Technologists*, John Wiley, 2004
5. Abdul Talib Bon, *Pengurusan Kejuruteraan*, Penerbit KUITTHO, 2004.
6. David L. Goetsch, *Occupational Safety and Health for Technologists, Engineers and Managers*, 5th ed. Prentice Hall, 2005
7. *Occupational Safety and Health Act 1994*.

BEP 30503 DIGITAL SIGNAL PROCESSING

SYNOPSIS:

This course is to introduce and understand the main concepts of digital signal processing, review of discrete signal and system, characteristic and operation, discrete convolution, digital filter design, sampling and quantization, discrete Fourier transform, z-transform, IIR and FIR digital filters, the implementation of digital filters, random process, spectrum estimation and DSP processor.

REFERENCES:

1. Digital Signal Processing: Principles, Algorithm and Applications, John G. Proakis, Dimitris G Manolakis, 4th Ed, Pearson Prentice Hall, 2007.
2. Analog and Digital Signal Processing, Ashok Ambardar, 2nd Edition, Thompson, 1999.

BEC 30303

COMPUTER ARCHITECTURE AND ORGANISATION

SYNOPSIS:

The course is about the fundamentals of computer organization and architecture and relates these to contemporary design issues. The application of these concepts depends on the current state of the technology and the price/performance objectives of the designer. This syllabus is organized into eight chapters. The structure and functional of computer are covered in chapter 1 and chapter 2. The performance issues are also discussed in chapter 2. Chapter 3 through chapter 6 covered the major components of the computer systems. Architectural issue such as instruction sets design and data types are covered in chapter 7. Finally, organizational issues such as pipelining also covered in chapter 8.

REFERENCES:

1. Andrew S. Tanenbaum. Structured Computer Organization, 5th Edition. Pearson Prentice Hall-New Jersey. 2006.
2. Murdocca, Miles J; Heuring, Vincent P. Principles of Computer Architecture, International Edition. Prentice Hall-New Jersey. 2000.
3. William Stallings. Computer Organization & Architecture: Designing for Performance, 7th Edition. Pearson Prentice Hall-New Jersey. 2006.
4. Hamacher, Carl; Vranesic, Zvonko; Zaky, Safwat. Computer Organization, 5th Edition. McGraw-Hill-Singapore. 2002.
5. Williams, Rob. Computer Systems Architecture: A Networking Approach, Pearson Education-England. 2001.

BEC 30403 MICROPROCESSOR AND MICROCONTROLLER

SYNOPSIS:

This course is intended to provide a study of the concept of microprocessor and microcontroller with an emphasis on programming skills; design, interfacing between microprocessor/ microcontroller and other device, CPU architecture, organize and memory interfacing, bus concept, interrupt, communication interfacing and A/D conversion.

REFERENCES:

1. Barry B. Brey, "INTEL Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium ProProcessor, Pentium II, III, 4, 7/E", Prentice Hall, 2005.
2. Mazidi, "PIC Microcontroller & Embedded Systems", Pearson, 2008.
3. A.V Deshmukh, "Microcontrollers: Theory and Applications", McGrawHill, 2006.
4. Dogan Ibrahim, "PIC Basic: Programming and Projects", Oxford: Newnes, 2001.
5. Martin Bates, "Introduction to Microelectronic Systems: The PIC16F84 Micocontroller", London: Arnold, 2000.

BEE31102 ELECTRONIC ENGINEERING LABORATORY IV

SYNOPSIS:

To give students hands-on experience in understanding the material presented in the following subjects:

- BEC 30303 Computer Architecture and Organization
- BEC 30403 Microprocessor and Microcontroller

BEN 30303 VLSI Design

SYNOPSIS:

This course is about VLSI design process using CAE tools. It starts with a brief introduction of currently available CAE design tools, physical layout and IC design flow using Tanner Tools. Then it will cover the basic interface and control of Tanner tools. Next, student will start using this design tools to draw the layout of MOS transistor and using DRC features to check the design. Then, student will construct basic CMOS and combinational logic gates

physical layout, and simulate them using T-Spice. After that, student will construct more complex MSI logic circuit layout using cell building block. Finally, student will do basic optimization for the design.

REFERENCE:

1. J. Floyd, Digital Fundamental, Merrill MacMillan, 2006.
2. J. Floyd, Digital Fundamentals with VHDL, Prentice Hall, 2003.
3. Neil Weste and David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd Ed., Addison Wesley, 2005.
4. Wayne Wolf, Modern VLSI Design: System-on-Chip Design, 3rd Ed., Prentice Hall, 2002.
5. Liming Xiu, VLSI Circuit Design Methodology Demystified: A Conceptual Taxonomy, John Wiley & Sons, 2008.

YEAR 3
SEMESTER III

BEE 30304 INDUSTRIAL TRAINING

SYNOPSIS:

Students are required to undergo industrial training in related field for 8 weeks in the organizations determined by faculty and assessed by both their external and internal supervisors.

REFERENCES:

1. Buku Log Latihan Industri UTHM. (Bahagian A), Pejabat Penerbit UTHM.

YEAR 4

YEAR 4
SEMESTER I

BEE 40602 FINAL YEAR PROJECT I

SYNOPSIS:

This course is the first part of an individual project during final year of study based on a topic selected from the subjects studied or a related engineering problem. Each student is expected to present his proposal and research plus a progress report during the first seminar of the final year project.

REFERENCES:

1. Guidelines for the Implementation of Final Year Project in the Faculty of Electrical and Electronics Engineering UTHM.
2. Guidelines for Thesis Writing.

BEN 40403 Analog IC Design

SYNOPSIS:

This course introduces design of analog integrated circuit in CMOS. The analysis and design of basic CMOS analog circuit building blocks are introduced, including current mirrors, inverting amplifiers, differential pairs, and cascode amplifiers. Noise, frequency response, stability and frequency compensation are explained, followed by design of one-stage and two-stage operational amplifiers. Applications of operational amplifiers will also be briefly discussed. The students will do design, simulation, and layout of analog integrated circuits in CAD design environment.

REFERENCE:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2001.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 4th Ed., Wiley Publishers, 2001.
3. Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, 2nd Ed., 2002.
4. Franco Maloberti, Analog Design for CMOS VLSI Systems, Kluwer Academic Publishers, 2001.
5. David A. Johns and Ken Martin, Analog Integrated Circuit Design, John Wiley and Sons Inc., 1997.
6. Roger T. Howe and Charles G. Sodini, Microelectronics: An Integrated Approach, New Jersey: Prentice Hall, 1997.

BEN 40503 MEMS and NEMS Design

SYNOPSIS:

This course explains on modeling for basic structures in designing MEMS/NEMS device. Subject content consists of introduction to MEMS/NEMS, MEMS/NEMS material and mechanical properties, silicon micromachining, MEMS/NEMS design approach, lumped modeling and dynamics, modeling for coupled system, MEMS/NEMS applications, and MEMS/NEMS simulation and design tools.

REFERENCE:

1. Pelesko, J.A. & Bernstein, D. H., Modeling MEMS/NEMS and NEMS. Boca Raton: CRC Press, 2003.
2. Senturia, S. D., Microsystem design. London: Kluwer Academic Published, 2001.
3. Korvink, J.G. & Oliver, P. (edt.), MEMS/NEMS: A Practical Guide to Design, Analysis and Applications. USA: Springer, 2006.
4. Gad-el-Hak, M. (edt.), The MEMS/NEMS handbook. Boca Raton: CRC Press, 2002.
5. Gardner, J. W., Varadan, V. K. & Awadelkarim, O. O., Microsensors, MEMS/NEMS, and Smart Devices. England: John Wiley & Son Ltd., 2001.
6. Madou, M. J., Fundamentals of Microfabrication, The Science of Minituarization, 2nd Ed.; Boca Raton: CRC Press, 2002.
7. Lyshevski, S. E., Nano- And Microelectromechanical Systems, Fundamentals of Nano- and Microengineering. Boca Raton: CRC Press, 2001.

BEN 40603 Micro Fabrication

SYNOPSIS:

This course describes the Micro Fabrication emphasizing on CMOS inverter since CMOS technology has been widely used for its low power dissipation and excellent in transferring data. It includes introduction to CMOS and cleanroom technology which is compulsory for fabrication technology. Fabrication techniques and processes for micro devices such as oxidation, photolithography, diffusion, etching and metallization will be explained clearly in each chapter.

REFERENCE:

1. Christopher Saint and Judy Saint, IC Mask Design Essential Layout Technique, McGraw-Hill, 2002.
2. C.Y. Chang and S.M. Tze, ULSI Technology, McGraw Hill, 2002.

3. Travis N. Blalock and Richard C. Jaegaer, Microelectronic Circuit Design, McGraw-Hill, 2004.
4. Professor H. Scott Hinton, CMOS Fabrication Process, Technical Report, University of Kansas, 2002.
5. Peter Van Zant, Microchip Fabrication a Practice Guide to Semiconductor Processing, McGraw Hill, 2000.

BEN403** **ELECTIVE I**
Please refer to elective course list

BEN404** **ELECTIVE II**
Please refer to elective course list

YEAR 4
SEMESTER II

BEE 40604 FINAL YEAR PROJECT II

SYNOPSIS:

This course is the second part of an individual project during final year of study based on a topic selected from the subjects studied or a related engineering problem. Each student is expected to present result of his final year project.

REFERENCES:

1. Guidelines for the Implementation of Final Year Project in the Faculty of Electrical and Electronics Engineering UTHM.
2. Guidelines for Thesis Writing.

BEN 40702 Semiconductor Material Analysis

SYNOPSIS:

This course introduces the physics of semiconductor materials including the chemical bond and electrical conductivity. It also explains the main element semiconductor materials used in the semiconductor industry. It covers the semiconductor compounds that formed by the semiconductor elements. The semiconductor compounds include the group IV-VI, III-V, II-VI and I-VII materials.

REFERENCE:

1. Lev I. Berger, Semiconductor Materials (Physical Sciences References); CRC Press Inc., 2000.
2. Angus Rocket; The Materials Science of Semiconductors; Springer Science, 2008.
3. Michael E. Levinstein, Sergey L. Rumyantsev and Michael S. Shur; Properties of Advanced Semiconductor Materials: GaN, AlN, InN; John Wiley and Sons, New York, 2003.
4. B. G. Yacobi; Semiconductor Materials: An Intro to Basic Principles (Microdevices); Kluwer Academic / Plenum Publishers, New York, 2003.
5. Sadao Adachi; Properties of Group IV, III-V and II-IV Semiconductors; John Wiley and Sons, New York, 2005.
6. An Ben Chen and Arden Sher; Semiconductor Alloys: Physics and Materials Engineering (Microdevices); Plenum Press, New York, 1995.
7. John C. Bean, Robert Hull, Robert K. Willardson and Erickson R. Weber; Germanium Silicon: Physics and Materials (Semiconductors and Semimetals); Academic Press. 1999.

BEN 40802 Microelectronic Engineering Laboratory

SYNOPSIS:

BLN 4323	MEMS and NEMS Design	Hands-on learning in designing MEMS/NEMS basic structure: CoventorWare® - design and simulation and CoventorWare® - design architect.
BLN 4333	Micro Fabrication	Hands-on learning in using specific equipment to fabricate basic MOSFET devices.

REFERENCES:

BEN 40902 Photonic Devices

SYNOPSIS:

This course is about the fundamental of photonic devices and consists of 5 chapters. Students will learn on semiconductor photonic properties, light emitting diodes, semiconductor lasers, photodetectors and photovoltaic devices. The course will concentrate on the physical properties of photonic material, design structure, characterization, fabrication process and application of photonic devices.

REFERENCE:

1. S. O. Kasap, Optoelectronics and Photonics, Prentice Hall, 2001.
2. Senturia, S. D., Microsystem design. London: Kluwer Academic Published, 2001.
3. W. B. Leigh, Devices for Optoelectronics, Marcel Dekker, 1996.
4. Jasprit Singh, Semiconductor Optoelectronics, McGraw-Hill, 1995.
5. Ronald W. Waynant and John K. Lowell, Electronic and Photonic Circuits and Devices, IEEE Inc., 1999.
6. Robert Hunsperger, Photonic Devices and Systems, Marcel Dekker Inc., 1994.

BEU405 ELECTIVE III**

Please refer to elective course list

LIST OF ELECTIVE COURSES

BEN 41003 Advanced Semiconductor Devices

SYNOPSIS:

This course deals with the analysis and fundamentals of compound-semiconductor devices including novel compound-semiconductor FET. It also covers microwave diodes such as varactor and p-i-n diodes. It is followed by the analysis of thyristor and power devices. Finally, the basic structure and application of quantum-effect and hot-electron devices is covered.

REFERENCE:

1. S. M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, 3rd Ed., John Wiley and Sons Inc., 2006.
2. D. A. Neamen, An Introduction to Semiconductor Devices, McGraw-Hill, 2006.
3. Charles C. Coleman, Modern Physics for Semiconductor Science, McGraw-Hill, 2008.
4. S. M. Sze, Semiconductor Devices Physics and Technology, 2nd Ed., John Wiley and Sons Inc., 2002.
5. Peter Y. Yu and Manuel Cardona, Fundamentals of Semiconductors: Physics and Materials Properties, 3rd Ed., Springer, 2006.
6. Tyagi M. S., Introduction to Semiconductor Materials and Devices, John Wiley and Sons Inc., 1991.

BEN 41103 IC Packaging

SYNOPSIS:

This course deals with the IC packaging and its testability. It covers on IC packaging that includes the types of packaging, microassembly processing, metallization techniques, the chip-package interconnection and several advanced packaging.

REFERENCE:

1. G.R. Boca Raton The Electronic Packaging Handbook Ed. Blackwell, CRC Press LLC, 2000.
2. Ed. M. Datta, T. Osaka & J.W. Schultze Microelectronic Packaging, RC Press LLC, 2005.
3. Laung-Terng Wang, Chen-Wen Wu and Xiaoqing Wen, VLSI Test Principles and Architectures: Design for Testability, Elsevier Inc., 2006.
4. Parag K. Lala, Digital Circuit Testing and Testability, Academic Press, 1997.
5. Charles A. Harper, Electronic and Interconnection Handbook, 4th Ed., McGraw-Hill, 2005.

BEN 41203 Reliability and Failure Analysis

SYNOPSIS:

This course covers the concepts of reliability and maintainability engineering. It also includes the failure distribution and failure rate, basic reliability evaluation, the analysis of failure data, reliability testing and growth and finally the reliability in integrated circuit.

REFERENCE:

1. Charles E Ebeling, An Introduction to Reliability and Maintainability Engineering, McGraw Hill, 2005.
2. David J. Smith, Reliability, Maintainability and Risk : Practical Methods for Engineers, Boston: Butterworth-Heinemann, 2001.
3. Alessandro Birolini, Reliability Engineering: Theory and Practice, 4th edition. Berlin: Springer, 2004.
4. Charles Cohn, Failure-free Integrated Circuit Packages : Systematic Elimination of Failures Through Rreliability Engineering, Failure Analysis and Material Improvements, McGraw-Hill, 2004.
5. Lawrence C. Wagner, Failure Analysis of Integrated Circuits – Tools and Techniques, Kluwer Academic Publishers, 2000.

BEN 41303 Material Characterization

SYNOPSIS:

This course introduces the emission and absorption spectroscopy; nature of electromagnetic radiation, basic concept of IC design characterization deals with the analysis and design of electronic circuits involving the applications of electronic devices.

REFERENCE:

1. Dieter K. Schroder, Semiconductor Material and Device Characterization, 3rd Edition; John Wiley, New York, 2006.
2. Gary E. Mcguire; Characterization of Semiconductor Materials, Principles and Methods, Vol.1; Noyes Publication, 1989.
3. W. R. Runyan and T.J. Shaffner; Semiconductor Measurements and Instrumentation, 2nd Ed.; McGraw-Hill, 1997.
4. H. H. Willard, L. L. Merrit, J.A Dean and F.A Seattle; Instrumental Methods of Analysis; CBS Publisher, New Delhi, 1996.
5. Tor A. Fjeldly, Trond Ytterdal, and Michael Shur; Introduction to Device Modeling and Circuit Simulation; John Wiley and Sons, New York, 1998.
6. N. Weste, K. Eshraghian; Principles of CMOS VLSI Design, 2nd Ed.; Addison Wesley, 1994.
7. J. P. Uyenmura; Introduction to VLSI Circuits and Systems; John

Wiley & Sons, 2003.

8. Richard S. Muller, Theodore I. Kamins, and Mansun Chan; Device Electronics for Integrated Circuits, 3rd ed.; John Wiley and Sons, 2003.

BEN 41403 IC Testability

SYNOPSIS:

This course covers comprehensively the failures and fault in digital circuits, fault diagnosis in digital circuits, test generation techniques in both combinational and sequential circuits including test generation synthesis, circuit design for testability for both combinational and sequential circuits, explore the test generation in BIST such as pattern generator and signature analysis, and its architecture.

REFERENCE:

1. Parag K. Lala, Digital Circuit Testing and Testability, Academic Press, 1997.
2. Laung-Terng Wang, Chen-Wen Wu and Xiaoqing Wen, VLSI Test Principles and Architectures: Design for Testability, Elsevier Inc., 2006.

BEN 41503 Nanoelectronic Devices

SYNOPSIS:

This course introduces the fundamental of nanotechnology. It covers the nanoscale processing, the fabrication of nanostructures for advanced device applications and to understand the techniques for the characterisation of device structures made on the nanoscale. The last part covers about the introduction to advanced devices and as a part of practical aspect, students will also be required to conduct a project on device modeling and simulation using any related simulation tools.

REFERENCE:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, New York: John Wiley, 2002.
2. G. S. May, S. M. Sze, Haboken, N. J., Fundamentals of Semiconductor Fabrication, John Wiley, 2004.
3. J. G. Korvink, A. Greiner, Semiconductors for Micro and Nanotechnology: An Introduction for Engineers, Weinheim : John Wiley, 2002.
4. O. Manasreh, Semiconductor Heterojunctions and Nanostructures, New York: McGraw-Hill, 2005.
5. D. K. Schroder, Haboken, N. J., Semiconductor Material and Device Characterization, [John Wiley, 2006](#).
6. K. Goser, P. Glosekotter and J. Dienstuhl, Nanoelectronics and Nanosystems : From Transistors to Molecular and Quantum Devices, Berlin: Springer, 2004.
7. W. A. Goddard, D. W. Brenner, S. E. Lyshevski and G. J. Iafrate (Editors), Handbook of Nanoscience, Engineering and Technology, Boca Raton, FL: CRC Press, 2003.
8. R. Waser (Editor), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Weinheim: John Wiley, 2003.
9. M. Ratner, D. Ratner, Nanotechnology : A Gentle Introduction to the Next Big Idea, Upper Saddle River, NJ: Prentice Hall, 2003.
10. C. P. Poole and F. J. Owens, Introduction to Nanotechnology, New Jersey: John Wiley, 2003.