Curriculum

For

BS Electronics (4 Years)

Department of Electronics

Bacha Khan University Charsadda, Pakistan
Website: www.bkuc.edu.pk

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Layout for BS Electronics

Compulsory Requirements (the student has no choice)		General Courses to be chosen from other departments		Discipline Specific Foundation Courses	
7-8 Courses		7-8 Courses		9-10 courses	
18-24 Credit hours		21-24 Cr. hours		30-36 Credit hours	
Subject	**Cr hr**	**Subject**	**Cr hr**	**Subject**	**Cr hr**
1. English-I (English Comprehension)	3+0	1. Project Management	3+0	1. Circuit Analysis	3+1
2. English-II(Communication Skills)	3+0	2. Physics-I	2+1	2. Basic Electronics	3+1
3. Pakistan Studies	2+0	3. Physics-II	2+1	3. Digital Logic Design-I	3+1
4. Islamic Studies	2+0	4. Probability & Statistics	3+0	4. Amplifiers and Oscillators	3+1
5. Maths-I (Calculus & Analytical Geometry)	3+0	5. Semiconductor Material & Device Fabrication	2+1	5. Programming Languages	2+1
6. Maths-II(Linear Algebra & Differential Equations)	3+0	6. Complex Variables & Transforms	3+0	6. Solid State Electronics	3+0
7. Introduction To Computer and Programming	2+1	7. Numerical Methods	3+0	7. Digital Logic Design-II	3+1
		8. Mobile & Wireless Communication	3+0	8. Computer-Aided Electronics Design	1+2
				9. Electromagnetic Field Theory	3+0
				10. Analog and Digital Communication	3+1
	19		24		36

Major courses including research project/internship		Elective Courses within the major	
11-13 courses		4 courses	
36-42 Credit hours		12 Credit Hours	
Subject	**Cr hr**	**Subject**	**Cr hr**
1. Signal and Systems	**3+1**		
2. Microprocessor and Interfacing	**3+1**	1. Digital Instrumentation Systems	**3+1**
3. Instrumentation & Measurements	**3+1**	2. Industrial Electronics	**3+1**
4. Integrated Circuit Design & Applications	**3+1**	3. VLSI and ASIC Design	**3+1**
5. Power Electronics	**3+1**	4. Final Year Project	**2+4**
6. Control System	**3+1**		
7. Optoelectronics	**3+0**		
8. Microcontroller & Embedded Systems	**3+1**		
9. Digital Signal Processing	**3+1**		
10. Data Communication & Networks	**2+1**		
11. Microwave Communication	**3+0**		
	41		**18**

Total Credit Hours 133 - 136

Semester wise Layout for BS Electronics

1st and 2nd Semester

Semester I		**Cr.Hrs**
ELE111	Islamic Studies	2(2+0)
ELE112	English Comprehension	3(3+0)
ELE113	Calculus and Analytical Geometry	3(3+0)
ELE114	Physics-1	3(2+1)
ELE115	Introduction to Computer and Programming language	3(2+1)
ELE116	Circuit Analysis	4(3+1)
Credit Hours (1st Semester)		**18**

Semester II		**Cr.Hrs**
ELE121	Pakistan Studies	2(2+0)
ELE122	Communication Skills	3(3+0)
ELE123	Linear Algebra and Differential Equations	3(3+0)
ELE124	Physics-2	3(2+1)
ELE125	Basic Electronics	4(3+1)
Credit Hours (2nd Semester)		**15**

3rd and 4th semester

Semester III		Cr.Hrs
ELE231	Complex Variables and Transforms	3(3+0)
ELE232	Digital Logic Design-1	4(3+1)
ELE233	Amplifiers and Oscillators	4(3+1)
ELE234	Programming Language	3(2+1)
ELE235	Solid State Electronics	3(3+0)
Total Credit Hours		**17**

Semester III		Cr.Hrs
ELE231	Complex Variables and Transforms	3(3+0)
ELE232	Digital Logic Design-1	4(3+1)
ELE233	Amplifiers and Oscillators	4(3+1)
ELE234	Programming Language	3(2+1)
ELE235	Solid State Electronics	3(3+0)
Credit Hours (4th Semester)		**17**

5th and 6th semester

Semester V		Cr.Hrs
ELE351	Semiconductor Materials and Device Fabrication	3(2+1)
ELE352	Numerical Methods	3(3+0)
ELE353	Signals and Systems	4(3+1)
ELE354	Microprocessor and Interfacing	4(3+1)
ELE355	Instrumentation and Measurements	4(3+1)
Credit Hours (5th Semester)		**18**

Semester VI		Cr.Hrs
ELE361	Integrated Circuit Design and Applications	4(3+1)
ELE362	Power Electronics	4(3+1)
ELE363	Project Management	3(3+0)
ELE364	Optoelectronics	3(3+0)
ELE365	Microcontroller and Embedded Systems	4(3+1)
Credit Hours (6th Semester)		**18**

7th and 8th semester

Semester VII		Cr.Hrs
ELE471	Control Systems	4(3+1)
ELE472	Digital Signal Processing	4(3+1)
ELE473	Digital Instrumentation Systems	4(3+1)
ELE474	Analog and Digital Communication	4(3+1)
ELE475	Final Project-1	2(0+2)
Credit Hours (7th Semester)		**18**

Semester VIII		Cr.Hrs
ELE481	Industrial Eelctronics	4(3+1)
ELE482	VLSI and ASIC Design	4(3+1)
ELE483	Microwave Communication	3(3+0)
ELE484	Final Project-2	4(0+4)
Credit Hours (8th Semester)		**15**

Summary of semester wise Scheme
For 4 Years BS in Electronics

Semester I		**Cr.Hrs**
ELE111	Islamic Studies	2(2+0)
ELE112	English Comprehension	3(3+0)
ELE113	Calculus and Analytical Geometry	3(3+0)
ELE114	Physics-1	3(2+1)
ELE115	Introduction to Computer and Programming language	3(2+1)
ELE116	Circuit Analysis	4(3+1)
Total Credit Hours		**18**

Semester II		**Cr.Hrs**
ELE121	Pakistan Studies	2(2+0)
ELE122	Communication Skills	3(3+0)
ELE123	Linear Algebra and Differential Equations	3(3+0)
ELE124	Physics-2	3(2+1)
ELE125	Basic Electronics	4(3+1)
Total Credit Hours		**15**

Semester III		**Cr.Hrs**
ELE231	Complex Variables and Transforms	3(3+0)
ELE232	Digital Logic Design-1	4(3+1)
ELE233	Amplifiers and Oscillators	4(3+1)
ELE234	Programming Language	3(2+1)
ELE235	Solid State Electronics	3(3+0)
Total Credit Hours		**17**

Semester IV		**Cr.Hrs**
ELE241	Probability and Statistics	3(3+0)
ELE242	Digital Logic Design- 2	4(3+1)
ELE243	Computer-Aided Electronic Design	3(1+2)
ELE244	Electromagnetic Field Theory	3(3+0)
ELE245	Data Communication and Networks	3(2+1)
Total Credit Hours		**16**

Semester V		**Cr.Hrs**
ELE351	Semiconductor Materials and Device Fabrication	3(2+1)
ELE352	Numerical Methods	3(3+0)
ELE353	Signals and Systems	4(3+ 1)
ELE354	Microprocessor and Interfacing	4(3+1)
ELE355	Instrumentation and Measurements	4(3+1)
Total Credit Hours		**18**

Semester VI		**Cr.Hrs**
ELE361	Integrated Circuit Design and Applications	4(3+1)
ELE362	Power Electronics	4(3+1)
ELE363	Project Management	3(3+0)
ELE364	Optoelectronics	3(3+0)
ELE365	Microcontroller and Embedded Systems	4(3+1)
Total Credit Hours		**18**

Semester VII		**Cr.Hrs**
ELE471	Control Systems	4(3+1)
ELE472	Digital Signal Processing	4(3+1)
ELE473	Digital Instrumentation Systems	4(3+1)
ELE474	Analog and Digital Communication	4(3+1)
ELE475	Final Project-1	2(0+2)
Total Credit Hours		**18**

Semester VIII		**Cr.Hrs**
ELE481	Industrial Eelectronics	4(3+1)
ELE482	VLSI and ASIC Design	4(3+1)
ELE483	Microwave Communication	3(3+0)
ELE484	Final Project-2	4(0+4)
Total Credit Hours		**15**

Total Credit Hours = 135

Details of the Courses for 4 Years BS in Electronics

SEMESTER I

ELE111 Islamic Studies 2(2+0)

Course Outline

Basic Concepts of Quran, History of Quran, Uloom- ul-Quran, Verses of Surah Al-Bqra related to Faith (Verse No-284-286), Verses of Surah Al-Hujrat related to Adab Ali- Nabi (Verse No-1-18), Verses of Surah Al-Mumanoon related to Characteristics of faithful (Verse No-1-11), Verses of Surah Al-Furqan related to Social Ethics (Verse No.63-77), Verses of Surah Al- Inam related to Ihkam (Verse No-152-154)
Verses of Surah Al-Ihzab related to Adab al-Nabi (Verse No.6, 21, 40, 57, 58.), Verses of Surah Al-Hashar (18,19,20) related to thinking, Day of Judgment.
Verses of Surah Al-Saf related to Tafakar, Tadabar(Verse No-1,14), Life of Muhammad Bin Abdullah (Before Prephet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons derived from the life of Holy Prephet in Makkah, Life of Holy Prophet (S.A. W) I Madina, Important Events of Life Holy Prophet in Madina, Important Lessons Derived from the life of Holy Prophet in Madina.
Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom-ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah 45
Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and contemporary issues.
Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce
Period of Khlaft-E-Rashida, Period of Ummayyads, Period of Abbasids
Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam

Recommended Books

1. Ahmad Hasan, “Principles of Islamic Jurisprudence”, Islamic Research Institute Islamabad, 1993, International Islamic University.
2. Bhatia, H.S, “Studies in Islamic Law, Religion and Society”, Deep & Deep Publications. New Delhi, 1989.
3. Muhammad Zia ul Haq, “Introduction to Al Sharia Al Islamia”, Allama Iqbal Open University, Islamabad, Pakistan, 2001.
4. Hameed Ullah Muhammad, “Introduction to Islam Mulana Muhammad Yousaf Islahi”.
5. Hameed Ullah Muhammad, “Emergence of Islam”, Islamabad, IRL.
6. Hameed Ullah Muhammad, “Muslim Conduct of State”, Islamabad, Pakistan, Hussain Hamid Hassan, ULeaf Publication.
7. Mir Waliullah, “Muslim Jurisprudence and the Quranic Law of Crimes”, Islamic Book Service, 1982.

ELE112 English-1 3(3+0)

Course Outline

Basics of Grammar, Parts of speech and use of articles, Sentence structure, active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure, Punctuation and spelling.
Comprehension, Answers to questions on a given text.
Discussion, General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students), Listening: To be improved by showing documentaries/films carefully selected by subject teachers. Translation skills: Urdu to English. Paragraph writing: Topics to be chosen at the discretion of the teacher. Presentation skills: Introduction

Note: Extensive reading is required for vocabulary building

Recommended Books

1. A.J Thomson and A.V. Martinet. , "A Practical English Grammar Exercises 1", 3rd edition, Oxford University Press. ISBN 01943134922.
2. A.J Thomson and A.V. Martinet. , "A Practical English Grammar Exercise 2", 3rd edition, Oxford University Press. ISBN 094313506.
3. Marie-Christine Boutin, Suzanne Brinand, Françoise Grellet, "Writing: Intermediate (Oxford Supplementary Skills", 4th Impression, Oxford University Press.
4. Brain Tomlinson and Rod Ellis, ". Reading. Upper Intermediate (Oxford Supplementary Skills), 3rd Impression, 1992, ISBN 0914534022

ELE113 Calculus and Analytical Geometry 3(3+0)

Course Outline:
Introduction to functions, introduction to limit, derivatives and their applications, integral calculus with applications, vector algebra, vector calculus, introduction to analytical geometry, straight line in R3, planes, cylindrical and spherical coordinates, surfaces, cylinders and cones, spheres, spherical trigonometry.

Lab Outline:

Recommended Books:

1. George B. Thomas and Ross L. Finney, "Calculus and Analytic Geometry," Ninth Edition, 1995, Addison-Wesley, ISBN: 0201531747.
2. George F. Simmons, "Calculus with Analytic Geometry," Second Edition, 1996, McGraw-Hill, ISBN: 0070576424.
3. Gerald B. Folland, "Advanced Calculus," First Edition, First Edition, 2002, Prentice Hall, ISBN: 0130652652.
4. Monty J. Strauss, Gerald L. Bradley and Karl J. Smith, "Calculus," 2002, Prentice Hall, ISBN: 0130918717.

ELE114 Physics-1 3(2+1)

Course Outline:

Measurements and Physical quantities. International system of units. Scalars and vectors. Newton's Laws of motion. Work and Energy. Centre of mass and traditional motion. Rotational Kinematics and Dynamics. Simple harmonic motion. Waves and particles. Waves in a stretched strings. Wave and frequency. Speed of traveling waves. Principal of superposition. Energy and power in traveling waves. Interference of waves. Beats. Doppler effect, Heat, Laws of thermodynamics, Reversible and irreversible processes. The Control cycle and entropy.

Lab Outline:

Recommended Books:

1. David Halliday, Robert Resnick, and Jearl Walker, "WIE Fundamentals of Physics," Seventh Edition, 2005, John Wiley & Sons, ISBN:.
2. Arthur Beiser, "Schaum's Outline of Applied Physics," Fourth Edition, 2004,McGraw-Hill, ISBN: 0071426116.

ELE115 Introduction to Computers and Programming Language 3(2+1)

Course Outline:

History of computer, basic components, CPU, memory, peripheral devices, storage media and devices, introduction to Von-Neumann and Harvard Architecture, data organization, file storage, programs and software, system software, application software, operating systems, programming languages, compilation and interpretation, problem specification, algorithms, flow chart, pseudo code, computers in office, industry and education, number systems, Boolean algebra, introduction to programming, concept of program execution.

Lab Outline:

Computation of number system, implementation of Boolean functions, basic machines organization including motherboard, memory, I/O cards, networking devices, use of flow charts, introduction to office tools, overview of different browsers including open-source browsers, introduction to various operating systems.

Recommended Books:

1. Brian Williams and Stacey Sawyer, "Using Information Technology," Seventh Edition, 2007, McGraw-Hill, ISBN: 0072260718.
2. William Stallings, "Computer Organization and Architecture: Designing for Performance," Seventh Edition, 2006, Prentice Hall, ISBN: 0131856448.

ELE116 Circuit Analysis 4(3+1)

Course Outline:

Electric current, electromotive force (voltage), resistance, conventional current, Ohm's law, work, energy, power, conductance, efficiency, real and ideal sources, Kirchoff's voltage and current laws, voltage-divider rule, current-divider rule, series and parallel connected sources, series and parallel connected resistor capacitor and inductor networks, bridges, voltage and current source conversions, mesh analysis, nodal analysis, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, capacitance and capacitors, inductance and inductors, alternating current fundamentals, principle and operation of transformers, Resonant circuits, filter networks.

Lab Outline:

Study of Kirchoff's current and voltage laws, current divider rule, voltage divider rule, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, simulation of basic electronic circuits using PSPICE. Frequency domain analysis and Bode plots, network analysis in s-domain, circuit analysis techniques using PSPICE or other software.

Recommended Books:

1. Thomas L.Floyd, Latest Edition, "Principles of electronic circuits" Prentice Hall. • Edward Hughes, "Electrical and Electronic Technology," Ninth Revised Edition, 2005, Prentice Hall, ISBN: 0131143972.
2. William H. Hayt, Jack Kemmerly, and Steven M. Durbin, "Engineering Circuit Analysis", Seventh Edition, 2006, McGraw-Hill, ISBN: 0073263184.
3. Muhammad H. Rashid, "Introduction to PSpice Using OrCAD for Circuits and Electronics," Third Edition, 2003, Prentice Hall, ISBN: 0131019880.

SEMESTER II

ELE121 Pakistan Studies 2(2+0)

Course Outline

Ideological rationale with special reference to Sir Syed Ahmad Khan. Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah. Factors leading to Muslim separatism, People and Land, Indus Civilization, Muslim advent, Location and geo-physical features.

Political and Constitutional phases: 1947-58, 1958-71, 1971-77, 1977-88, 1988-99, 1999 onward

Economic institutions and issues, Society and social structure, Ethnicity, Foreign Policy of Pakistan and challenges, Futuristic outlook of Pakistan

Recommended Books

1. Burki, Shahid Javed, "State & Society in Pakistan", The Macmillan Press Ltd. 1980
2. Akbar, S. Zaidi, "Issue in Pakistan's Economy", Karachi: Oxford University Press.2000.
3. S.M. Burke and Lawrence Ziring, "Pakistan's Foreign policy: An Historical analysis", Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar, "Pakistan Political Rots & Development" , Lahore, 1994
5. Wilcox, Wayne, "The Emergence of Bangladesh", Washington: American Enterprise, Institute of Pubic Research, 1972.
6. Mehmood, Safdar, "Pakistan Kayyun Toota", Lahore: Idara-e- aqafat-e-Islamia. Club Road.
7. Amin, Tahir, "Ethno- National Movement in Pakistan", Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence, "Enigma of Political Development", Kent England: W m Dawson & Sons Ltd, 1980.
9. Zahid, Ansar, "History & Culture of Sindh", Karachi: Royal Book Company. 1980.
10. Afzal, M. Rafique, "Polotical parties in Pakistan", Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin, "The Political System of Pakistan", Bostan: Houghton Miflin, 1967.
12. Aziz, K.K.Party, "Politics in Pakistan, Islamabad", National Commission on Historical and Cultural Research, 1976.
13. Muhamad Waseem, "Pakistan under Martial Law", Lahore: Vanguard. 1987
14. Haq, Noor Ul, "Making of Pakistan: The Military Perspective", Islamabad; National Commission on Historical and Cultural Research, 1993.

Course Outline

Enable the students to meet their real life communication needs. Paragraph Writing: Practice in writing a good, unified and coherent paragraph, Essay Writing, Introduction, CV and job application, Translation skills, Urdu to English, Study Skills, Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension, Academic skills, Letter/memo writing, minutes of meetings, use of library and internet, Presentation skills, Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Recommended Books

1. A.J Thomson and A.V. Martinet. , "A Practical English Grammar Exercise 2", 3rd edition, Oxford University Press. ISBN 094313506.
2. Marie-Christine Boutin, Suzanne Brinand, Françoise Grellet, "Writing: Intermediate (Oxford Supplementary Skills", 4th Impression, Oxford University Press. ISBN 019435405 (Pages 45-53, Notes Taking).
3. Rob Nolasco, "Writing: Upper-Intermediate (Oxford Supplementary Skills)", 4th 1992. ISBN 0194354065, (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
4. Brain Tomlinson and Rod Ellis, ". Reading. Advanced (Oxford Supplementary Skills), 3rd Impression, 1992, ISBN 0914534031
5. John Langan, " Reading and Study Skills" , 10th Edition, McGraw-Hill, 2012, ISBN: 0073533319
6. Riachard Yorky, "Study Skills", McGraw-Hill 2002. ISBN: 0071213716

ELE123 Linear Algebra and Differential Equations 3(3+0)

Prerequisite: ELE113 Calculus and Analytical Geometry

Course Outline:

Algebra of matrices; inverse of a matrix; Gauss-Jordan method for solution of a system of linear algebraic equations; vectors in the plane and in three dimensions; vector spaces; subspaces; span and linear independence; basis and dimension; homogeneous systems; coordinates and isomorphism; rank of a matrix, determinant; inverse of a matrix; applications of determinants; determinants from a computational point of view; properties of determinants; formulation, order, degree and linearity of differential equation; complementary and particular solutions; initial- and boundary-value problems; solution of ordinary linear differential equations of first order; Bernoulli's differential equation; solution of ordinary differential equations of second order; origin and formulation of partial differential equations; solutions of first-, second- and higher-order partial differential equations; homogeneous partial differential equations of order one; Lagrange's method of solution.

Recommended Books:

1. Bernard Kolman and David Hill, "Elementary Linear Algebra," Eighth Edition, 2004, Prentice Hall, ISBN: 0130457876.
2. Kenneth Hardy, "Linear Algebra for Engineers and Scientists Using Matlab," First Edition, 2005, Prentice Hall, ISBN: 0139067280.
3. Stephen Goode, "Differential Equations and Linear Algebra," Second Edition, 2000, Prentice Hall, ISBN: 013263757X.

Prerequisite: ELE 114 Physics 1

Course Outline:

Electric charge and Coulomb law, Electric field, Gauss's Law, Capacitors. Current, Resistance, Resistively and Conductivity, Ohm's Law, Microscopic models of resistance. Combination of resistances. Voltage and EMF. Magnetic field, Lorentz force, Biot-Savart Law, Ampere's Law, Gauss law for Magnetism, Magnetic materials, Inductance, Reactance and impedance, Transformer. Galvanometer, Ammeter, Voltmeter, Cathode ray Oscilloscope.

Lab Outline:

Electric fields, Gauss' law, electric potential, capacitance and dielectrics, current and resistance, magnetic fields, sources of magnetic field, Faraday's law, inductance, direct current circuits, alternating current circuits, nature of light, geometric optics, laws of geometric optics, interference of light waves, diffraction, polarization.

Recommended Books:

- David Halliday, Robert Resnick, and Jearl Walker, "WIE Fundamentals of Physics," Seventh Edition, 2005, John Wiley & Sons, ISBN: 0471465097.
- Arthur Beiser, "Schaum's Outline of Applied Physics," Fourth Edition, 2004, McGraw-Hill, ISBN: 0071426116.

Prerequisite: ELE 116 Circuit Analysis

Course Outline:

Introduction to electronics, diodes: *pn* junction diode, forward and reverse characteristics of a diode, ideal diode, practical diode, equivalent circuit of a diode, current equation of a diode, diode as a switch. Types of diodes: Schottky diode, zener diode, tunnel diode, varactor diode, LED, laser diode. Applications of diodes: Half- and full-wave rectifiers, clipper and clamper circuits, voltage multipliers. Bipolar junction transistor: Operation, *npn* and *pnp* transistors, unbiased transistor, DC biasing of a transistor, static characteristics, DC circuit analysis, load line, operating point and bias stabilization. Transistor as an amplifier. Transistor biasing configurations: Common emitter, common base, common collector. Field-effect transistor. FET biasing techniques: Common drain, common source and common gate, fixed bias and self bias configurations, voltage divider biasing. Universal JFET bias curve. Darlington pair.

Lab Outline:

The emphasis is first on understanding the characteristics of basic circuits that use resistors, capacitors, diodes, bipolar junction transistors and field-effect transistors. The students then use this understanding to design and construct more complex circuits such as rectifiers, amplifiers and power supplies.

Recommended Books:

1. Robert Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory,” Ninth Edition, 2006, Prentice Hall, ISBN: 0131189050.
2. Robert Painter, “Introductory Electronic Devices and Circuits: Electron Flow Version,” Seventh Edition, 2006, Prentice Hall, ISBN: 0131716395.

SEMESTER III

ELE231 Complex Variables and Transforms 3(3+0)

Prerequisite: ELE123 Linear Algebra & Differential Equations

Course Outline:
Introduction to complex number systems, Argand's diagram, modulus and argument of a complex number, polar form of a complex number, De Moivre's theorem and its applications, complex functions, analytical functions, harmonic and conjugate, harmonic functions, Cauchy-Riemann equations, line integrals, Green's theorem, Cauchy's theorem, Cauchy's integral formula, singularities, poles, residues, contour integration and applications; Laplace transform definition, Laplace transforms of elementary functions, properties of Laplace transform, periodic functions and their Laplace transforms, inverse Laplace transform and its properties, solutions of ordinary differential equations by Laplace transform, applications of Laplace transforms, Fourier transform definition, Fourier transforms of simple functions, magnitude and phase spectra, Fourier transform theorems, inverse Fourier transform, solutions of differential equations using Fourier transform.

Recommended Books:
1. Erwin Kreyszig, "WIE Advanced Engineering Mathematics," Ninth Edition, 2005, International Edition, John Wiley & Sons, ISBN: 0471728977.

ELE232 Digital Logic Design-1 4(3+1)

Course Outline:
Basic concepts and tools to design digital hardware consisting of both combinational and sequential logic circuits, logic gates, combinational logic design, Encoders, Decoders, Multiplexers, Demultiplexers, code converters, Ripple Carry Adder, Carry Lookahead Adder , sequential circuits and logic design, Different types of Flip Flops and its applications, D Flip Flop, J-K Flip Flop, RS Flip Flop, Concept of State Machine, Designing of synchronous and asynchronous counters, up-down counters, ring counters, random counters, Shift registers and its types. Serial in-parallel out, serial in-serial out, parallel in-serial out, parallel in parallel out.
Introduction to Microcomputers : Microprocessor and its operation (Concept of Serialization), I/Os, Buses, Memories and Storage Devices.

Lab Outline:
Basic logic gates; circuits such as MUX/DEMUX, encoder/decoder, arithmetic logic unit (ALU); Counters and shift registers.

Recommended Books:
1. Thomas L. Floyd, Digital Fundamentals, 6th edition, ISBN 0-13-398488-5 Malvino Brown, "Digital Computer Electronics," Third Edition, McGraw-Hill, ISBN: 0021127135.
2. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals," Third Edition, 2003, Prentice Hall, ISBN: 013140539X.
3. Roger L Tokheim, "Digital Electronics: Principles and Applications," Student Text with MultiSIM CD-ROM, Sixth Edition, 2002, McGraw-Hill, ISBN: 0078309816.

ELE233 Amplifiers and Oscillators 4(3+1)

Prerequisite: ELE125 Basic Electronics

Course Outline:

Amplifier analysis: Transistor as an amplifier, hybrid model of a transistor, small-signal analysis, large-signal analysis, gain calculation of single-stage amplifier, cascading, multistage gain calculations. Classification of amplifiers on the basis of biasing: Class A amplifier, class B amplifier, class AB amplifier, class C amplifier, push-pull amplifier, complementary symmetry amplifier. Classification of amplifiers on the basis of coupling: RC-coupled amplifier, transformer-coupled amplifier, direct-coupled amplifier. Classification of amplifiers on the basis of frequency: Audio-frequency amplifier, radio-frequency amplifier, tuned amplifiers. Feedback: Feedback concept, feedback amplifiers, voltage feedback amplifier, current feedback amplifier. Effect of feedback on frequency response. Practical amplifier considerations: Input and output impedance, amplifier loading, impedance matching. Oscillators: Basic theory, tank circuit, damped and undamped oscillations, phase-shift oscillator, Colpitts oscillator, Hartley oscillator, Wein Bridge oscillator.

Lab Outline:

Transistor curve tracer, introduction to PSPICE and AC voltage dividers, characterization and design of emitter and source followers, characterization and design of AC variable-gain amplifier, design of test circuits for BJTs and FETs, design of FET ring oscillators, design and characterization of emitter-coupled transistor pairs, tuned amplifier and oscillator, design of oscillators.

Recommended Books:

1. Thomas L. Floyd, "Electronics Fundamentals: Circuits, Devices, and Applications," Sixth Edition, 2004, Prentice Hall, ISBN: 0131111388.
2. Thomas L. Floyd and David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits," Second Edition, 1999, Prentice Hall, ISBN: 0130829870.
3. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory," Ninth Edition, 2006, Prentice Hall, ISBN: 0131189050.

ELE234 Programming Language C/C++ 3(2+1)

Prerequisite: ELE115 Introduction to Computers

Course Outline:

Concept of Machine language, Low Level language, Introduction to Intel Assembly Language, Migration from low level to High level language, High Level Languages, Concept of Sequential Flow of programs, Problem Analysis and Algorithm Development, Flow charting, Conditional Flow, Repetitive Flow, and Algorithm Logic, Program structure, pre processor declaration, Looping and flow control in C, Functions and Structure Programming, standard data type, Branching and Nested flow of control, Array and string, Multi-dimensional Array, pointers and Structure data types, Input/output Instructions, Machine Hardware access through C/C++, File handling.

Lab Outline:

1. To write different Programs, e. g. Quadratic equation, Temp Conversion etc.
2. Project etc.

Recommended Books:

1. Robert Lafore, "Object-Oriented Programming in C++," Fourth Edition, 2002, Prentice Hall, ISBN: 0672323087.

ELE235 Solid State Electronics 3(3+0)

Course Outline:

Introduction to Basic Quantum Mechanics, Particle in a Box, Kronning_ Penning Model and Energy Bands in Solids, Semiconductors Statistics, Intrinsic and Extrinsic Semiconductor, Shallow and Deep Impurities, Non _Degenerate and degenerate Semiconductors, Calculation of Doping Densities and the Fermi Level, Mobility, Conductivity and life Time of Carriers. The PN Junction: Homo and Hetro- unction Devices, Abrupt and Linearly Graded PN Junctions, Current Transport in the PN Junction PIN Diodes, SCR, DIAC & TRIAC.

Transistors: Bi-Polar Junction Transistors, Modes of Operations, Injunctions Efficiency, Gain etc, Transistor Modeling, Frequency Performance, HF Transistors, Metal Semiconductor Contacts, Field Effect Transistors, JFET, MESFET, MOS DIODE, MOSFETS Structures, Frequency Performance of Devices. Introduction to Fabrication of Semiconductor Devices and Integrated Circuits.

Recommended Books

1. Solid State Electronic Devices, 4th Edition by Beng G. Streetman Prentice Hall International, inc, l995.
2. Physics & Technology of Semiconductor Devices by A .S. Grove Wiley, New York.
3. Solid State Electronics by A Barlieve Prentice Hall, 1985.
4. Introduction Semiconductor Materials and Devices by MS Tyagi Wiley New York, 1991.

SEMESTER IV

ELE241 Probability and Statistics 3(3+0)

Course Outline:

Set theory, basic concepts of probability, conditional probability, independent events, Baye's formula, discrete and continuous random variables, distributions and density functions, probability distributions (binomial, Poisson, hyper geometric, normal, uniform and exponential), mean, variance, standard deviations, moments and moment generating functions, linear regression and curve fitting, limits theorems, stochastic processes, first and second order characteristics, applications.

Recommended Books:

1. Susan Milton and Jesse C Arnold, "Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences," Fourth Edition, 2003, McGraw-Hill, ISBN: 007246836.
2. William Mendenhall and Terry Sincich, "Statistics for Engineers and the Sciences," Fifth Edition, 2007, Prentice Hall, ISBN10: 0131877062.

ELE242 Digital Logic Design-2 4(3+1)

Prerequisite: ELE232 Digital Logic Design-1

Course Outline:

Memories and Memory Organization, SAP-1, CPU design, Instruction execution cycle, I/O operations, Micro-Operations, pipelining, Controlling and Sequencing, instruction set architecture, Cache memory, introduction to CISC and RISC architecture. Introduction to Programmable logic devices (PAL, GAL, PLD, FPGA), Verilog HDL coding for programmable logic devices.

Lab Outline:

Programming practice in Verilog HDL using OrCad/MATLAB or ModelSim simulators to design different types of combinational and sequential logic circuits to be implemented on Programmable logic devices.

Recommended Books:

1. M. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals", First Edition, 2012, Pearson, ISBN: 978-81-317-2881-9.
2. Malvino Brown, "Digital Computer Electronics," Third Edition, McGraw-Hill, ISBN: 0021127135.
3. William Stallings, "Computer Organization and Architecture: Designing for Performance," Seventh Edition, 2006, Prentice Hall, ISBN: 0131856448.
4. Samir Palnitkar, "Verilog HDL," Second Edition, 2003, Prentice Hall, ISBN: 0130449113.
5. Thomas L. Floyd, Digital Fundamentals, 6th edition, ISBN 0-13-398488-5
6. M. Morris Mano, "Digital Design & XILINX 6.3 XSE PKG," First Edition, 2005, Prentice Hall, ISBN: 0131678485.

ELE243 Computer-Aided Electronic Design 3(1+2)

Prerequisite: ELE234 Programming Language C/C++

Lab Outline:
Introduction to computer-aided design tools, Schematic design of electronic circuits, PSpice Simulation and layout design of Printed Circuit Boards, physical manufacturing of PCB, soldering and testing the newly designed PCB.
Introduction to MATLAB, Programming in MATLAB and Plotting.
Introduction Verilog HDL, coding for Logic Gates and Logic Functions in Verilog HDL.

Recommended Books:

1. Kraig Mitzner, "Complete PCB Design Using OrCad Capture and Layout", 2007, Newnes,
2. Muhammad H. Rashid, "Introduction to PSpice Using OrCAD for Circuits and Electronics," Third Edition, 2004, Prentice Hall, ISBN: 0131019880.
3. Samir Palnitkar, "Verilog HDL," Second Edition, 2003, Prentice Hall, ISBN: 0130449113.
4. Stven T. Karris, "Digital Circuit Analysis and Design with Simulink Modeling and Introduction to CPLDs and FPGAs", 2nd Ed, 2007, ISBN: 9871934404055

ELE244 Electromagnetic Field Theory 3(3+0)

Prerequisite: ELE231 Complex Variables and Transform

Course Outline:
Vector analysis, Coulombs law and electric field intensity, Gauss's law, flux density and divergence, energy and potential, conductor dielectric and capacitance, Poisson's and Laplace's equations, steady-state magnetic field, magnetic forces, materials and inductance, time-varying fields and Maxwell's equations, uniform plane waves.

Recommended Books:

1. William Hayt and John A. Buck, "Engineering Electromagnetics," Seventh Edition, 2006, McGraw-Hill, ISBN: 0073104639.
2. Sadiku, Matthew N, "Elements of Electromagnetics," Second Edition, 1994, Oxford University Press, ISBN: 0195103688.

ELE245 Data Communication and Networks 3(2+1)

Course Outline:
Introduction to Networks, Data Communications principles, Data Signaling Formats Channel Bandwidth and Capacity. The Physical Layer, Noise and Error Detection Methods Queuing Systems. The Continuous Time Discrete Event Process. Time Division Multiplexing, Frequency Division Multiplexing, Synchronous Time Division Multiplexing, The Data Link Layer and X .25, Routing in Packet Switched Network, Flow and Congestion Control, Multiple Access Communication Protocols, Random Access Techniques, Centralized Demand Assignment Schemes, Distributed Demand Assignment schemes. Local Area Network Protocols and Standards. Token Bus, Distributed Queue Dual Bus, Fiber Distributed Data Interface, Network Interconnection through Bridges and Routers. Transport Protocols, Users Datagram protocol, Transport Protocols. Datagrarm protocol, Transport Protocols. Integrated Services Digital Networks (ISDN) Switching Techniques and Fast Packet Switching. Digital Circuit Switching, Advances in Switching Techniques, Photonic Switching.

Lab Outline:

Configuration of different operating systems i.e. windows2000 Professional and windows XP, for a network environment, Hands on experience of different Network devices, i.e. Hubs, Bridges, Switches, Routers, making network cables, cross cables and direct cables, Establishishing a local area network (LAN), using different software tools regarding LAN

Recommended Books:

1. Behrouze A. Forouzan, "Data Communications and Networking", 3rd Ed, Tata McGraw Hill.
2. MCSE Networking Essentials by J.cusad & Dan New Land.
3. Data and Computer Communication by W. Stallings, Macmillan, New York, 1994.

SEMESTER V

ELE351 Semiconductor Materials and Device Fabrication 3(2+1)

Prerequisite: ELE125 Basic Electronics / ELE235 Solid State Electronics

Course Outline:
Overview of fabrication of solid-state devices and integrated circuits, introduction to basic electronic components and devices, layouts, unit processes common to all IC technologies such as substrate preparation, oxidation, diffusion and ion implantation, basic silicon processing, process modeling.

Lab Outline:
The students will be taught process modeling using a simulation tool such as SUPREM or equivalent. The fundamental silicon-based processing such as oxide growth, annealing, diffusion mechanisms, ion implantation and rapid thermal processing, physical vapor deposition and other processes will be modeled using SUPREM or equivalent. The students will model the device structures, for example, pMOS, and predict their electrical characteristics. In case device processing facilities are available, then the students will conduct the processes to fabricate and test the desired structures.

Recommended Books:

1. Charles A. Harper, "Electronic Materials and Processes Handbook," Third Edition, T2004, McGraw-Hill, ISBN: 0071402144.
2. C. Y.Chang and S.M. Sze, "ULSI Technology", Mc Graw Hill, 1996, ISBN: 0-07-063062-3
3. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits," Fifth Edition, 2003, Oxford University Press, ISBN: 0195142519.

ELE352 Numerical Methods 3(3+0)

Prerequisite: ELE231 Complex Variables and Transforms

Course Outline:
Introduction, Solution of equations by Iteration, Interpolation, Splines, Numerical Integration and differentiation, Numerical methods in linear algebra, Gauss elimination, LU-Factorization, Matrix Inversion, Method of least squares, Matrix eigen value problems, Inclusion of matrix eigen values, Roots of polynomials, solutions of linear algebraic equations, solution of ordinary differential equations, modified Euler method, Runge Kutta method, error analysis and stability. Floating point number system, error analysis, solution of ordinary and partial differential equations.

Recommended Books:
1. Erwin Kreyszig, "WIE Advanced Engineering Mathematics," Ninth Edition, 2005, International Edition, John Wiley & Sons, ISBN: 0471728977.
2. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers," Fifth Edition, 2006, McGraw-Hill, ISBN: 0073101567.
3. Curtis F. Gerald, "Applied Numerical Analysis," Seventh Edition, 2003, Addison, Wesley, ISBN: 0321133048.

ELE353 Signals and Systems 4(3+1)

Prerequisite: ELE116 Circuit Analysis

Course Outline:
Types of signals, signal representation and models, system characterization, time domain analysis, frequency domain representation and analysis, continuous-time filters, sampled continuous-time signals, frequency domain representation and analysis of signals and systems.

Lab Outline:
Study of various types of signals, analysis of signals, filter design, analog-to-digital converters, signal sampling using different parameters.

Recommended Books:
1. Gordon. E. Carlson, "Signals and Linear System Analysis," Second Edition, 1998, John Wiley & Sons, ISBN: 0471124656.
2. Simon Haykin, "Signals and Systems," Second Edition, 2003, John Wiley & Sons, ISBN: 0471378518.
3. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems," Second Edition, 1996, Prentice Hall, ISBN: 0138147574.

ELE354 Microprocessor and Interfacing 4(3+1)

Prerequisite: ELE242 Digital Logic Design-2

Course Outline:
Study of Intel series of Microprocessors, 8088 to Pentium-4, and their comparative study. The 8088/8086 Microprocessors: Pin outs and the Pin Functions, Clock Circuitry, Bus Buffering and Latching, Bus Timing, Ready and the Wait State, Minimum Mode Versus Maximum Mode. Memory Devices, Address Decoding, 8088/8086 Memory Interface, Dynamic RAM Controllers, Memory Testing. Basic I/O Port Address Decoding, The 8255A Programmable Peripheral Interface, The 8279 Programmable keyboard/Disp1ay Interface, 8254 Programmable Interval Timer. Basic Interrupt Processing, Hardware Interrupts, Expanding the Interrupt Structure, 8259A Programmable Interrupt Controller. Introduction to DMA, The 8257_5 DMA Controller, and DMA Processed Printer Interface. Introduction, Analog to Digital Conversion Basics, Major Considerations for Data Acquisitions systems. Analog to Digital Converters, ADC Performance Parameters, ADC Code Sample & Hold Circuits, Analog Multiplexes, Analog Signal Isolation, Designing of a Data Acquisition system. Introduction to Digital Communications, Serial Communications Interface Adapters, The825 IA Communications Interface Adapter, The RS_232C Interface Standard, Current Loops, Data Transmission Methods, Modems, IEEE 488, General Purpose Instrumentation Bus (GPIB), NEC 7210 GPIB Communication Interface.

Lab Outline:
Study of 80386 Intel microprocessor ISA using its training boards, implementation of interfacing techniques (using gates, decoders, and SPLDs) to memory system and different I/O devices, learning and implementation of interrupt-driven I/O, learning and implementation of simple microcontroller based circuits, and a mini project.

Recommended Books:
1. Barry B. Brey, "The Intel Microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4," Seventh Edition, 2006, Prentice Hall, ISBN: 0131195069.
2. Douglas V. Hall, "Microprocessor and Interfacing", Revised Second Edition, 2005, Tata McGraw-Hill, ISBN: 0070601674.

ELE355 Instrumentation and Measurements 4(3+1)

Prerequisite: ELE125 Basic Electronics / ELE233 Amplifiers & Oscillators

Course Outline:

Precision measurements terminologies including resolution, sensitivity, accuracy, and uncertainty; engineering units and standards; principles of different measurement techniques; instruments for measurement of electrical properties, pressure, temperature, position, velocity, flow rates (mass and volume) and concentration; systems for signal processing and signal transmission; modern instrumentation techniques; static and dynamic responses of instrumentation and signal conditioning; basic data manipulation skills using personal computers and graphs; data acquisition systems; principles of operation, construction and working of different analog and digital meters, oscilloscope, recording instruments, signal generators, transducers, and other electrical and non-electrical instruments; types of bridges for measurement of resistance, inductance, and capacitance; power and energy meters; high-voltage measurements.

Lab Outline:

Design, construction, and analysis of measurement circuits, data acquisition circuits, instrumentation devices, and automatic testing; measurement of electrical parameters using different lab instruments; calibration of measurement instruments; use of data acquisition systems for presentation and interpretation of data; use of microcomputers to acquire and process data; use of simulation and instrumentation languages (LabView).

Recommended Books:

1. Klaas B. Klaassen and Steve Gee, "Electronic Measurement and Instrumentation," 1996, Cambridge University Press, ISBN: 0521477298.
2. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control," 2000, Newnes, ISBN: 0750646241.

SEMESTER VI

ELE361 Integrated Circuit Design and Applications 4(3+ 1)

Prerequisite: ELE351 Semiconductor Materials & Device Fabrication

Course Outline:
Analog Integrated Circuits, Basic specification and requirements; Packaging, Amplifiers and Feedback Operations, Power Supplies and Integrated Circuit Regulators, Operation Amplifiers Characteristics and Design. Wave form generators; square wave generators, Ramp generators, Sine wane generators, Function generators, Digitally Controlled Frequency Synthesizer PLL Synthesizer, Active filters; Characteristics and frequency response, Active versus Passive filters, First Order Low pass Filter, High pass Active Filters, Band pass Filters, State Variable Filters, Notch Filters.
Detailed design of pulse and switching circuits; switch; mono-stable, a-stable and bi-stable circuits;

Lab Outline:
Comparator analysis, inverting and non-inverting amplifiers, analog-to-digital and digital-to-analog converters, dual regulator, switched-capacitor voltage converter, op-amp DC characteristic measurement, op-amp speed, single-supply op-amp, function generator, phase locked-loop, frequency synthesizer.

Recommended Books:

1. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits 4th Edition 2002.
2. Robert F. Coughlin, Fredrick F. Driscoll, Operational Amplifiers with Linear Integrated Circuits, 6th Edition, 2001, Prentice Hall.
3. Thomas, Rosa, The Analysis and Design of Linear Circuits, 3rd Edition 2001.
4. J. Micheal Jacobs, Application and Design with Analog Integrated Circuits, Prentice Hall, 1996.
5. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits," Fifth Edition, 2003, Oxford University Press, ISBN: 0195142519.
6. Thomas L. Floyd and David M. Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits," Second Edition, 1999, Prentice Hall, ISBN: 0130829870.

ELE362 Power Electronics 4(3+1)

Prerequisite: ELE233 Amplifiers & Oscillators

Course Outline:
Introduction to power electronics; solid-state devices used in power electronics: power diode, power BJT, power MOSFET, SCR, GTO, IGBT, TRIAC, DIAC; semi-controlled, fully-controlled and uncontrolled rectifiers: single-phase and three-phase, six-pulse, twelve-pulse and twenty-four pulse rectifiers; single-phase and three-phase inverters; pulse-width-modulated (PWM) inverters; UPS; types of converters; switched mode power supplies, AC and DC motor drives.

Lab Outline:
Design of converters; single-phase and three-phase uncontrolled, half-controlled and fully-controlled rectifiers; buck, boost and polarity inverting converters; flyback converter.

Recommended Books:

1. Cyril W. Lander, "Power Electronics," Third Edition, 1993, McGraw-Hill UK, ISBN: 0077077148.
2. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications," Third Edition, 2004, Prentice Hall, ISBN: 0131011405.
3. Ned Mohan, William P. Robbins and Tore M. Undeland, "Power Electronics: Converters, Applications and Design," Media Enhanced, Third Edition, 2003, John Wiley & Sons, ISBN: 0471429082.

ELE363 Project Management 3(3+0)

Course Outline:

Role of projects in organization's competitive strategy, standard methodologies for managing projects, project life cycle, design implementation interface, estimating, contractual risk allocation, scheduling: PBS and WBS, integration of scope, time, resource and cost dimensions of a project; evaluation of labor, material, equipment, and subcontract resources; scheduling techniques such as CPM/PERT and GERT, critical chain, solving real-world project schedules, cost budgeting, cost baseline, cash flow analysis, earned value analysis, cost control, proposal presentation, application of software for project management.

Recommended Books:

1. Avraham Shtub, Jonathan F. Bard and Shlomo Globerson, "Project Management: Processes, Methodologies, and Economics" Second Edition, 2005, Prentice Hall, ISBN: 0130413313.

ELE364 Optoelectronics 3(3+0)

Prerequisite: ELE244 EMT / ELE353 Signals & Systems

Course Outline:

Nature of light, basic laws of light, optical fiber, types of optical fiber, fiber material, fabrication and components, laser, threshold condition, laser losses, population inversion and threshold conditions, laser modes, classes of lasers, semiconductor light sources, light emitting diodes, semiconductor laser diodes (SLDs), optical transmitter, optical receivers, wavelength division multiplexing (WDM), FDM versus WDM, WDM multiplexer, benefits of WDM, dense wavelength division multiplexing, optical networks. Introduction to fiber optics, Physics of light, Principles of Fiber optics light propagation, total internal reflection, mode propagation, skew waves, acceptance angle and numerical aperture. Fiber Characteristics: Fiber losses, Material losses, Scattering, Wave-guide and Microbend losses. Intermodal dispersion, Interamodal dispersion. Step index fiber multi mode fiber, graded index fiber, step index fiber single mode, other fibers, Principles of Fiber Optic Communication, Modulation and Multiplexing, fiber Optics Components.

Lab Outline:

Optical sources, optical detectors, optical amplifiers, optical transmitters, optical receivers, optical transreceivers, optical fibers, propagation of light through an optical fiber, losses in fiber optic elements, optical modulation, multiplexing, optical systems.

Recommended Book:

1. Harold Kolimbiris, "Fiber Optics Communications," First Edition, 2004, Prentice Hall, ISBN: 0130158836.

Prerequisite: ELE 354 Microprocessor & Interfacing

Course Outline:

Introduction to Microcontrollers, Comparison of PIC, 8051, 68HC11 Microcontrollers, 8051 Microcontroller hardware Architecture, Programming in assembly and C51, Timers/Counters, Serial Port and serial communication, Interrupts, Advanced programming techniques, interfacing different devices with Microcontroller, keypad, LCD module, real time clock DS12887, DS1307, Dot matrix display, stepper motor, temperature sensor, ADC, DAC.

Lab Outline:

Introduction to KEIL software, making hex file, debugging of programs, hardware Emulators, And interfacing different devices with Microcontroller, keypad, LCD module, real time clock DS12887, DS1307, Dot matrix display, stepper motor, temperature sensor, ADC, DAC.

Recommended Book:

1. Muhammad Ali Mazidi, Janice Mazidi and Rolin McKinlay, "8051 Microcontroller and Embedded Systems," Second Edition, 2005, Prentice Hall, ISBN: 013119402X.
2. Scott Mechenzie, "8051 Microcontroller", 3rd Edition,

SEMESTER VII

ELE471 Control Systems 4(3+1)

Prerequisite: ELE353 Signals and Systems

Course Outline:
Introduction to control systems; open-loop and closed-loop systems, and their transfer functions, block diagrams, signal flow graphs; introduction to modeling; formation of differential equations of electrical, mechanical and other systems, transfer functions; stability, Routh's stability criterion, types and analysis of feedback control systems; root locus, Bode plots, polar plots, Nyquist stability criterion, gain and phase margins, Nichol's chart; steady-state and transient response of first-order, second-order and higher-order systems; introduction to state-space concepts and design techniques, formation and solution of state equations, eigenvalues and eigenvectors, transfer function matrices; PID controllers and compensators.

Lab Outline:
Familiarization with MATLAB Control System tool box and MATLAB-SIMULINK tool box; simulation of step response and impulse response with unity feedback using MATLAB; determination of root locus, Bode plot, and Nyquist plot using MATLAB; determination of PI, PD and PID controller action of first-order simulated process.

Recommended Books:
1. Katsuhiko Ogata, "Modern Control Engineering," Fourth Edition, 2002, Prentice Hall, ISBN: 0130609072.
2. Benjamin C. Kuo, "Automatic Control Systems," Eighth Edition, 2003, John Wiley & Sons, ISBN: 0471381489.

ELE472 Digital Signal Processing 4(3+1)

Prerequisite: ELE353 Signals and Systems

Course Outline:
Discrete Fourier transform and its properties, fast Fourier transform algorithms, inverse transform techniques, implementation of discrete-time systems, analysis and design of FIR and IIR Filters, frequency transformation, design of digital filters based on least square methods, multi-rate digital signal processing, power spectrum estimation.

Lab Outline:
MATLAB-based simulation tool box for signal processing, simulation and development of basic signal processing algorithms, study of general signal processing concepts such as sampling, aliasing, quantization, and internal arithmetic operations, signal generation, spectrum estimation and fast transforms, sampling rate conversion and multi-rate processing.

Recommended Books:
1. John G. Proakis and Dimitris K. Manolakis, "Digital Signal Processing," Fourth Edition, 2006, Prentice Hall, ISBN: 0131873741.
2. Sen M. Kuo, "Digital Signal Processors: Architecture, Implementation and Applications," First Edition, 2005, Prentice Hall, ISBN: 0130352144.

ELE473 Digital Instrumentation Systems 4(3+1)

Prerequisite: ELE365 Microcontroller & Embedded Systems

Course Outline:
Advanced instrumentation techniques; microprocessor-based instrumentation; analog-to-digital and digital-to-analog converters; PC-based instrumentation systems: interfacing techniques, data acquisition software, and virtual Instruments; intelligent instrumentation systems.

Lab Outline:
Laboratory activities include the design, construction, and analysis of microprocessor-based measurement circuits, data acquisition circuits, instrumentation devices, and automatic testing. Use of data acquisition systems for presentation and interpretation of data. Use of microcomputers to acquire and process data. Use of simulation and
instrumentation languages (LabView).

Recommended Books:
1. Ronald Tocci, Neal Widmer and Greg Moss, "Digital Systems: Principles and Applications," Tenth Edition, 2007, Prentice Hall, ISBN: 0131725793.
2. William J. Dally and John W. Poulton, "Digital Systems Engineering," 1998, Cambridge University Press, ISBN: 0521592925.

ELE474 Analog and Digital Communication 4(3+1)

Prerequisite: ELE245 Data Communication & Networking / ELE353 Signals & Systems

Course Outline:
Basic definitions; modulation and de-modulation techniques: amplitude, AM Transmitters, high level modulation, low level modulation, double modulation, AM Radio Receivers, Superheterodyne Receiver, Frequency Modulation, Direct and Indirect Frequency Modulation (Phase/Angle Modulation), Carrier Phase in the Frequency-Modulated Wave, pulse modulation, digital modulation techniques; information theory; error detection and correction; multiplexing techniques; noise and its effects on signal transmission.

Lab Outline:
Design and construction of AM and FM modulation and Demodulation Circuits. Study of different signals behavior and its analysis-using computer simulated experiments and Communication Trainer. Study of different digital communication systems on Digital Communication Trainer.

Recommended Books:
1. Robert J. Schoenbeck, "Electronic Communications: Modulation and Transmission", Second Edition,
2. B. P. Lathi, "Modern Digital and Analog Communication Systems," Third Edition, 1998, Oxford University Press, ISBN: 0195110099.
3. Leon W. Couch, "Digital and Analog Communication Systems," Seventh Edition, 2007, Prentice Hall, ISBN: 0131424920.
4. John G. Proakis and Masoud Salehi, "Communication Systems Engineering," Second Edition, 2002, Prentice Hall, ISBN: 0130617938.

Course Outline:

This course enables the students to enhance their technical capabilities by implementing their theoretical and practical knowledge in the field of research and development. Students should complete background study and simulation/design of the project.

SEMESTER VIII

ELE481 Industrial Electronics 4(3+1)

Prerequisite: ELE362 Power Electronics

Course Outline:

Mechanical Devices, Sensors Switches, Operational Amplifiers and other ICs, for industrial Applications, time Delay Circuits, phase and power control circuits .DC and AC Motors, Stepper Motors, Motor Control Circuits, Transducers, Industrial Process Control, Digital Sequences Control, Speed control of DC, AC, and servo motors. Process control. Measurement of non-electrical quantities: Temperature, displacement, pressure, time, frequency; digital industrial measuring systems. Ultra-sonic generation and application. X-ray applications in industry. Photo-electric devices. Industrial control using PLC's. Data acquisition. Distributed control system in process industries.

Pulse Modulation in Industrial Telemetry and Data Communication, Segmental Power Control, Programmable Logic Controllers (PLC) and its programming, Automation and Robotics.

Lab Outline:

Experimentation with different sensors, ADC, DAC, speed control of DC, AC, stepper and servo motors, power control devices.

Recommended Books:

1. Petrozella, "Industrial Electronics", latest edition.
2. James and Laslie, "Industrial Electronics", latest edition.
3. Frank D. Petruzella, "Programmable Logic Controllers," Third Edition, 2005, McGraw-Hill, ISBN: 0078298520.
4. Frank D. Petruzella, "Industrial Electronics," First Edition, 1995, McGraw-Hill, ISBN: 0028019962

ELE482 VLSI and ASIC Design 4(3+1)

Prerequisite: ELE361 Integrated Circuit Design and Applications

Course Outline:

Introduction to integrated circuits, IC fabrication, monolithic integrated circuits, introduction to MOS technology, basic electrical properties of MOS and BiCMOS circuits, basic digital building blocks using MOS transistors basic circuit concepts, ultra-fast VLSI circuits and systems and their design.

ASIC design methodologies. Programmable ASICs. Field programmable gate Arrays: Architecture, Programming Technologies, Design Parameters and Models. FPGA Technology Mapping Techniques, Routing Techniques, Placement Techniques and Testing

Lab Outline:

Implementation of VLSI design techniques using VHDL and /or Verilog HDL.

Recommended Book:

1. Zainalabedin Navabi, "Verilog Computer-Based Training Course," First Edition, 2002, McGraw-Hill, ISBN: 0071374736.
2. S. Brown, R. Francis, J. Rose and Z. Varnesic, "Field-Programmable Gate Arrays", Kluwer Academic Publishers
3. Programmable Logic Handbook: PLDs, CPLDs & FPGAs, by Ashok K. Sharma, McGrow-Hill

ELE483 Microwave Communication 3(3+0)

Prerequisite: ELE474 Analog & Digital Communication

Course Outline:
Microwave components: waveguides, waveguide junctions, directional couplers, isolators, circulators, resonators. Microwave generators: microwave tubes, two cavity klystron, reflex klystron, TWT, magnetron. Microwave semiconductor devices. Gunn diode, Impact diode, PIN diode, Mixers, Detectors. Microwave measurements, measurement of frequency, VSWR, power, noise and impedance.

Recommended Book:
1. Kennedy, Electronic Communication Systems, 4th edition, McGraw Hill 1992.

ELE484 Final Project-2 4(0+4)

Outline:
Hardware and software implementation of project design completed in the previous semester, testing and debugging, project report submission and presentation.

Curriculum

For

B.Sc Electronics (2 Years)

Department of Electronics

Bacha Khan University Charsadda, Pakistan
Website: www.bkuc.edu.pk

COURSE OUTLINE OF ELECTRONICS AT B.Sc. LEVEL .

The syllabus shall comprise of four papers, two in each year of B.Sc and the Practical course should not be less than six hour per week. A list of proposed experiments is annexed as A. Training on computer aided circuit design and analysis should also be provided. These are as follow:

Paper–I :	Linear Circuit Analysis	30
Paper–II :	Electronic Devices	30
Paper-III:	Digital Electronics	30
Paper–IV :	Electronics in Communication	30
Practical Part–I:		15
Practical Part- II:		15
Total :	150	

Paper – I : Linear Circuit Analysis

Voltage:

Voltage sources (electromagnetic, photovoltaic, thermocouple, electrostatic, and chemical). Voltage measuring instruments, the Volt-Ohm-Millimeter, analogue and digital meters, Oscilloscope.

Current:

Definition of current. conventional current, current measurement with a multi-meter.

Resistor:

Color coding and tolerance, Measurement of resistance by multi-meter, Variable resistors. Rheostat. Potentiometer and thermistors.

Introduction to Ohm's law, Intuitive understanding by hydraulic equivalent of basic resistive circuit, Resistance in series. The concept of voltage drop, the Kerchief's voltage law, Voltage dividers. The concept of ground. Voltage division for positive and negative voltages.

Parallel resistive circuits:

Resistance in Parallel. Kerchief's current law. Definition of conductance. Unloaded Bridge circuit. Balanced Bridge. Common mode voltages. Typical Bridge applications. Use of parallel and series resistors to increase the measuring range of current and voltmeters. Loading effect on voltmeters. Ohm's per volt rating.

AC Circuits:

Graphical representation of AC voltages and currents. The Sine wave. rms, peak and peak to peak value of sine wave. Validity of Ohm's law and Kerchief's laws. Analysis of Circuits with superimposed AC and DC. Equivalent electrical circuits of a transistor amplifier, the DC and AC equivalent circuits.

Power:

Definition of Power. Power dissipation in resistors, efficiency, Power equations, Power calculations in series and parallel resistive circuits. Maximum power transfer. Output efficiency, Power in Ac resistive circuits, Average power and instantaneous peak power.

Inductance:

Induction of voltages in a conductor, Factors controlling amount of induced voltage. Principle of a transformer. Self induction and inductance coil. Inductance as electrical inertia. The effect of switching power on/off to an LR circuit. The Time Constant. Effect of inductance on square wave at high frequency. Calculation of self induced and mutually induced voltages. Total inductance of a coil in series. Determination of mutual inductance and coefficient of coupling.

Capacitance:

Physical significance of capacitance. Factors that effect capacitance. Capacitors in series and parallel. Charging and discharging of a capacitor in RC circuit. Time constant. Effect of capacitance on square wave at high frequency. Differentiating circuit.

Inductors and Capacitors in AC Circuits:

Inductance in AC circuit. Inductive reactance. Frequency dependence, Capacitance in AC circuit. Capacitive reactance. Frequency dependence.
Intuitive understanding of capacitive reactance through the hydraulic equivalent of basic capacitive circuit.

Series LCR Circuit:

AC series LR circuit. Phasor, Impedance. Power dissipation. Power factor and reactive power. Series RC circuits. Calculation of voltage drops, phase angles, reactance and impedance. Power consumption. Half-Power frequency. Power factor, Series LCR circuits. Impedance and Phase angle calculation. True and apparent reactive power.

Resonance:

Resonant systems. Resonant frequency. The Q of a resonant circuit. Series resonator and bandwidth.

Parallel LCR Circuit:

Parallel RC, RL and LCR circuits. Impedance and phase angle calculations. Power. Apparent and reactive power. Parallel resonators. Resonant frequency. Impedance, Q and bandwidth of a resonator. Application of Tank circuits.

Network Theorem:

The superposition theorem and its application. Thevenin's theorem and its application. Analysis of loaded bridge circuits. Norton's theorem and its application.

Recommended Text Book:

1. Electric Circuits 7th Edition, by Thomas James W. Nilsson and Susan A. Riedel. Addison Waseley, 1996.

Reference Book:

1. Thomas L. Floyed, Latest Edition "Principles of Electronic Circuits" Printice Hall (1989)
2. Rutkowski G B. "Basic Electricity for Electronics: A text-Laboratory Manual", Glencoe Publishing Company, a division of MaCmillan Insc. 1984.

Paper – II : Electronic Devices

Electrons and holes in semiconductor, p and n type semiconductors. The p-n junction. Characteristics of p-n junction diode, Zener diode, bipolar transistor, Field effect transistor. MOS diode. MOSFET. Tunnel diode and Light emitting diodes. Characteristics and applications of thyristors and triacs.

Rectifies:

Half wave, full wave and bridge rectifier, ripple factor. Voltage regulation, construction of regulated power supplies.

Amplifiers:

Common base, common emitter and common collector amplifiers. Voltage current and power amplification. Positive and negative feed back.

Oscillators:
Hartley, Colpitt and Crystal Oscillators.

The Operational Amplifiers:

Introduction, operational amplifier characteristics, open-loop gain, bandwidth: effect of negative feedback on gain and bandwidth, Practical operational amplifier circuits. Inverting and non-inverting amplifies, the unity gain buffer, the summing amplifier. Op-amp specification (CMRR., slew rate. Input offset voltage and current,
PSRR). Selection criteira of an op-amp.

Recommended Text Book:

"Electronic Circuit Theory", by Louis Nashelsky and Rovert Boylestad , 7th Edition

Paper – III : Digital Electronics:

Switching Circuits:

Transistor as a switch

Gates:

Inverters, OR gates, AND gates, their logical function, electronic implementation and application. Introduction to Boolean algebra, construction of NOR, NAND and XOR gates using the three basic gates. De Morgan's theorems, Karnaugh mapping and digital circuit design.

Introduction to digital integrated circuit families:

Flip Flops:

RS latches. Transistor latch, NOR latch, NAND latch, clocked latch, D latches. unclocked, Clocked, edge triggered D flip flop, Edge triggered JK flip flop. The JK master – slave flip flop.

Register and Counters:

The concept of register, buffer register and shift register. Tristate buffers and switches. Ripple counter and frequency division. Asynchronous and Synchronous counter. Ring counter. The Mod N counter. Application of counters.

Memories:

ROMs. PROMS and EPROMS. The read write memory. Static RAM and Dynamic RAM. Application of memory. Generation of predetermined sequence and as a lookup table.

Introduction to Bus organized systems.

Recommended text Book:

Thomas Floyd . "Digital Fundamentals", 7^{th} (8^{th}) Edition, Prentice Hall.

Reference Book:

A. Panl Malvino and Donald Leach. Digital Principles and Application MC Graw Hill Co 5^{th} Edition 1992.

Paper – IV : Electronics in Communication

Amplitude Modulation Principles: Modulation, AM, FM, pulse Modulation. Power Relationships. Assignable Frequency Spectrum, Band Selection

AM Transmitters:

Circuits. High Level Modulation. Double Modulation. AM with Pulse Width Modulation, Low Level Modulation.

AM Radio Receivers and Transmitters: Superheterodyne Receiver, Double Conversion Receivers. Receiver Circuits. The Front End. IF Amplifiers. AM Detectors. Automatic Gain Control. Audio Amplifiers. Squelch, Receiver Schematics. Loudspeakers, AM Stereo.
Frequency Modulation Principles: Modulated Wave. FM Radio Frequency Band. Direct and Indirect Frequency Modulation (Phase Modulation). Carrier Phase in the Frequency-Modulated Wave.

FM Detectors. Stereo FM, FM Receiver

Television:

Scanning Principles. Deflection Systems. Video Camera Tubes. Video Picture Signal. Vestigial Sideband Transmission. TV Receiver Front END. Color Receivers.

Recommended Text Book:

Kennedy George. "Electronic Communication". McGraw Hill, 1992.

REFERENCE BOOKS:

Electronic Fundamentals by Thomas L Floyd, 2nd. Ed. Maxwell-Macmillan, New York, 1991. Essential of Communication Electronics by M. Slurzberg and W. Osterfield, National Book. Foundation, Islamabad, 1991.

Introduction to Linear Electrical Circuits and Electronics by M.C. Kelly and B. Nichols, John Wiley. New York , 1988.

Electonic Circuits Handbook by Michael Tooley, BPB Publications, New Delhi, 1994. Intorduction to Electonic Design by F.H. Mitchell Jr. and Mitchell Sr., Prentice Hall, London, 1988.

Digital Principles and Applications by A.P. Malvino and D.P Leach, 4th Ed, McGraw Hill. New York, 1986.

Digital Electronics By C.E. Strangio, Prentice Hall, London, Latest Edition

Digital Computer Electronics By Malvino A.P. and Brown J.A., McGraw Hill School Publishing Company, 1993.

Electronics for today by Tom Duncan. Oxford University Press.

List of Recommended Experiments for B.Sc

1. Circuit Theory (Thevinins Theorem, Superposition Theorem, KVL and KCL etc)
2. Junction diode characteristics
3. Clippers and Clampers
4. Rectifiers and power supplies
5. Bipolar junction Transistor Characteristics
6. Transistor Configurations
7. Load line Analysis and Large Signal Amplifiers
8. Coupled Amplifiers
9. Push Pull Amplifiers
10. Junction Field Effect Transistors
11. Transistor Voltage Regulators
12. Sinusoidal Oscillators
13. Multivibrators
14. Differential Amplifiers
15. Operational Amplifiers Characteristics
16. Mathematical Operations of Operational Amplifiers
17. Non-Linear Op-Amp Circuits
18. Active Filters
19. Oscillators and Function Generators.
20. Timers and VCOs
21. Amplitude Modulation and Demodulation
22. Phase Locked Loop
23. Logic Gates and Logic Inverters
24. Boolean Algebra
25. Shift Registers and Shift Counters
26. Binary Counters
27. Mux, Dmux, Decoders and Display
28. Semiconductor Memories
29. Frequency Counters
30. DAC and ADC