**CURRICULUM**

FOR

B.Sc. ELECTRICAL (POWER) ENGINEERING

[SESSION: 2014 and Onwards]



**UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY**

The Islamia University of Bahawalpur

University College of Engineering & Technology, Baghdad-ul-Jadeed Campus

The Islamia University of Bahawalpur

Phone: +92-62-9255474, Fax +92-62-9255537

[www.iub.edu.pk](http://www.iub.edu.pk)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Curriculum for BSc Electrical (Power) Engineering, Session 2014 & Onwards** | | | | | | | | | |
| **1st Year Semester-I** | | | | | **1st Year Semester-II** | | | | |
| **Course Code** | | **Course Name** | **Cr. Hr.** | | **Course Code** | | **Course Name** | **Cr. Hr.** | |
| **Th** | **Lab** | **Th** | **Lab** |
| GS | 171 | Calculus and Analytical Geometry (Math-I) | 3 | 0 | GS | 172 | Linear Algebra (Math-II) | 3 | 0 |
| EE | 111 | Circuit Analysis (EF) | 3 | 1 | EE | 113 | Network Analysis (EF) | 3 | 1 |
| CS | 141 | Introduction to Computing | 2 | 1 | CS | 142 | Computer Programming | 2 | 1 |
| HS | 163 | Functional English (Eng-I) | 2 | 0 | EE | 112 | Engineering Drawing (EF) | 0 | 1 |
| HS | 161 | Islamic Studies/Ethics | 2 | 0 | HS | 162 | Pakistan Studies | 2 | 0 |
| ME | 151 | Basic Mechanical Engineering (IDE-I) | 3 | 0 | HS | 164 | Communication Skills (Eng-II) | 2 | 0 |
| **Total** | | | **15** | **2** | **Total** | | | **12** | **3** |
| **17** | | **15** | |
| **2nd Year Semester-III** | | | | | **2nd Year Semester-IV** | | | | |
| **Course Code** | | **Course Name** | **Cr. Hr.** | | **Course Code** | | **Course Name** | **Cr. Hr.** | |
| **Th** | **Lab** | **Th** | **Lab** |
| GS | 271 | Differential Equations (Math-III) | 3 | 0 | GS | 272 | Complex Variables and Transforms (Math-IV) | 3 | 0 |
| HS | 261 | Technical Report Writing (Eng-III) | 3 | 0 | EE | 216 | Instrumentation and Measurements (EB) | 3 | 1 |
| EE | 211 | Electronic Devices and Circuits (EF) | 3 | 1 | EE | 217 | AC Machines (EB) | 3 | 1 |
| EE | 213 | Electrical Machine Fundamentals (EF) | 3 | 1 | EE | 215 | Electromagnetic Field Theory (EB) | 3 | 0 |
| EE | 212 | Digital Logic Design (EF) | 3 | 1 | ME | 251 | Applied Thermodynamics (IBE-II) | 3 | 1 |
|  |  |  |  |  |  |  |  |  |  |
| **Total** | | | **15** | **3** | **Total** | | | **15** | **3** |
| **18** | | **18** | |
| **3rd Year Semester-V** | | | | | **3rd Year Semester-VI** | | | | |
| **Course Code** | | **Course Name** | **Cr. Hr.** | | **Course Code** | | **Course Name** | **Cr. Hr.** | |
| **Th** | **Lab** | **Th** | **Lab** |
| GS | 371 | Numerical Methods (Math-V) | 3 | 0 | CS | 341 | Microprocessor Based Systems (EB) | 3 | 1 |
| EE | 311 | Signals and Systems (EF) | 3 | 1 | MS | 382 | Power Economics and Management | 3 | 0 |
| EE | 312 | Linear Control Systems (EB) | 3 | 1 | EE | 315 | Power Transmission (ED) | 3 | 1 |
| ES | 323 | Communication Systems (EB) | 3 | 1 | EE | 313 | Digital Signal Processing (EB) | 3 | 1 |
| EE | 314 | Electrical Power Generation (ED) | 3 | 0 | ES | 321 | Power Electronics (EB) | 3 | 1 |
|  |  |  |  |  |  |  |  |  |  |
| **Total** | | | **15** | **3** | **Total** | | | **15** | **4** |
| **18** | | **19** | |
| **4th Year Semester-VII** | | | | | **4th Year Semester-VIII** | | | | |
| **Course Code** | | **Course Name** | **Cr. Hr.** | | **Course Code** | | **Course Name** | **Cr. Hr.** | |
| **Th** | **Lab** | **Th** | **Lab** |
| EE | 411 | Power Distributation and Utilization (EB) | 3 | 1 | EE | 414 | Power System Stability and Control (ED) | 3 | 1 |
| EE | 417 | Advanced Electrical Machine Design (ED) | 3 | 1 | EE | 415 | Power System Protection (ED) | 3 | 1 |
| EE | 413 | Power System Analysis (ED) | 3 | 0 | EE | 416 | High Voltage Engineering (ED) | 3 | 1 |
| MS | 481 | Enterpreneurship and Leadership | 2 | 0 | HS | 361 | Professional and Social Ethics | 2 | 0 |
| EE | 499A | Project-I | 0 | 3 | EE | 499B | Project-II | 0 | 3 |
| **Total** | | | **11** | **5** | **Total** | | | **11** | **6** |
| **16** | | **17** | |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Total Credit Hours** | **138** |  |

|  |  |  |
| --- | --- | --- |
| **GS-171** | **Calculus and Analytical Geometry** | **3+0** |
| **Prerequisite:** None | | |
| **Objective:** Teach the concepts of calculus and analytic geometry and the applications of these concepts to the solution of engineering problems. | | |
| **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. | | |
| **Recommended Books:**   * George B. Thomas and Ross L. Finney, “Calculus and Analytic Geometry,” Latest Edition, Addison-Wesley, ISBN: 0201531747. * George F. Simmons, “Calculus with Analytic Geometry,” Latest Edition, McGraw-Hill, ISBN: 0070576424. * Gerald B. Folland, “Advanced Calculus,” Latest Edition, Prentice Hall, ISBN: 0130652652. * Monty J. Strauss, Gerald L. Bradley and Karl J. Smith, “Calculus”, Latest Edition, Prentice Hall, ISBN: 0130918717. | | |

|  |  |  |
| --- | --- | --- |
| **EE-111** | **Circuit Analysis** | **3+1** |
| **Prerequisite:** None | | |
| **Objective:** Teach the methods used in the analysis of electrical circuits. | | |
| **Course Outline:** Physical foundation of electric circuits; electric current; electromotive force; resistance; conventional current; Ohm’s law; work, energy, and power; conductance; efficiency; real and ideal sources; resistive networks; Kirchoff’s voltage and current laws; voltage divider rule; current divider rule; series- and parallel-connected sources; voltage and current source conversions; mesh analysis; nodal analysis; network theorems (Superposition, Thevenin’s, Norton’s, and Maximum Power Transfer) with independent and dependent sources; capacitance and capacitors; inductance and inductors; electromagnetic induction; alternating current fundamentals; phasor representation of alternating current; AC voltage and current relationships for pure resistance; inductive and capacitive circuits; wye-delta transformations. | | |
| **Lab Outline:** Study of DC series circuits, parallel circuits, Kirchhoff’s current and voltage laws, current divider theorem, voltage divider theorem, network theorems, simple RLC circuits, transformer operation, and simulation of basic electrical circuits using PSPICE. | | |
| **Recommended Books:**   * William H. Hayt, Jack  Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis,” Seventh Edition, 2006, McGraw-Hill, ISBN: 0073263184. * J. David Irwin and Robert M. Nelson, “Basic Engineering Circuit Analysis,” Eighth Edition, 2006, John Wiley & Sons, ISBN: 0470083093. * Robert L. Boylestad, “Introductory Circuit Analysis,” Eleventh Edition, 2004, Prentice Hall, ISBN: 0131730444 | | |

|  |  |  |
| --- | --- | --- |
| **CS-141** | **Introduction to Computing** | **2+1** |
| **Prerequisite:** None | | |
| **Objective:** To introduce the computer components and programming principle | | |
| **Course Outline:** History, classification, basic components, CPU, memory, peripheral devices, storage media and devices, physical and logical storage, 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, basic programming techniques, data types and declaration, header file and linkage, variables and constants, arrays, input/output, termination, remark, control structures, branching, conditional structures, repetition and loops, basic library functions | | |
| **Lab Outline:** Basic machines organization including motherboard, memory, I/O cards, Networking devices, Use of flow charts, Introduction to office tools , Introduction to various operating systems, Coding, executing and debugging simple programs, Implementation of simple control structures, Implementation of simple functions, Implementation of different function styles, input/output, loops, conditional Branching, mouse control, graphics. | | |
| **Recommended Books:**   * Brian Williams and Stacey Sawyer, *Using Information Technology*, Latest Edition, McGraw-Hill, ISBN: 0072260718 * William Stallings, *Computer Organization and Architecture: Designing for Performance*, Latest Edition , Prentice Hall, ISBN: 0131856448, ISBN-13: 9780131856448 * Robert Lafore *“Thinking in C”* Latest Edition | | |

|  |  |  |
| --- | --- | --- |
| **HS-163** | **Functional English** | **2+0** |
| **Prerequisite:** Functional English | | |
| **Objective:** To enhance language skills and develop critical thinking | | |
| **Course Outline:**  Basics of grammar. Parts of speech and used of articles. Sentences structure, active voice and passive voice. Practice in unified sentence. Analysis of phrase, clause and sentence structure. Transitive and in transitive verbs. Punctuation and spelling.  Comprehension: answers to questions on a given text. Discussion: general topics and every day conversation (topics of 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 teacher. Translation skill: Urdu to English. Paragraph writing: topics to be chosen at the discretion of the teacher. Presentation skills. | | |
| **Recommended Books:**   * Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492 * Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506   **Writing**   * Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19435405 7 Pages 20-27 and 35-41.   **Reading/Comprehension**   * Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford * Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2. | | |

|  |  |  |
| --- | --- | --- |
| **HS-161** | **Islamic Studies/Ethics** | **2+0** |
| **Prerequisite:** None | | |
| **Course Outline:** Introduction to Holy Quran, Quran as first source of Islamic law, Urdu Translation of Sura Furqan (63-77), Introduction of Hadith and Sunnah. Hadith and Sunnah Second source of Islamic Law, Ten Hadiths of Holy Prophet. Command Interdiction, Islam and Health. True earning and bribery. The after effects of Ibadat on our human life. The rights of parents and neighbors. The Etiquette concerning eating and walking. Decency in talking. The manner concerning our social life. Islam and Environment. The relation of teacher and student. Nobility of character. Duties and rights of a citizen. The cure of patient and his/her consolation. Islam, the best religion. Islam and human rights. | | |
| **Recommended Books:**   * HAMEED ULLAH MUHAMMAD, “EMERGENCE OF ISLAM” , IRI, ISLAMABAD * HAMEED ULLAH MUHAMMAD, “MUSLIM CONDUCT OF STATE” * MULANA MUHAMMAD YOUSAF ISLAHI,” * Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law” leaf Publication Islamabad, Pakistan. * Ahmad Hasan, “Principles of Islamic Jurisprudence”Islamic Research  Institute, international Islamic University, Islamabad (1993) * Mir Waliullah, “Muslim Jrisprudence and the Quranic Law of Crimes”Islamic Book Service (1982) * H.S. Bhatia, U“Studies in Islamic Law, Religion and Society” Deep & Deep Publications New Delhi (1989) * Dr. Muhammad Zia-ul-Haq, U“Introduction to Al Sharia Al Islamia” Allama Iqbal Open University, Islamabad (2001) | | |

|  |  |  |
| --- | --- | --- |
| **ME-151** | **Basic Mechanical Engineering** | **3+0** |
| **Prerequisite:** None | | |
| **Objective:**  The course is intended to give a through understanding of basic mechanical engineering concepts | | |
| **Course Outline:**  Fundamental concepts and principles of mechanics, fundamental units, moments and couples, law of equilibrium, free body diagrams: structures, frames and machines.  Fundamentals of dynamics: applications of newton’s 2nd law of motions, analysis of motion and two dimensional and three dimensional spaces, methods of energy and momentum, applications of dynamics to the engineering concepts, pulleys, chains, design of flywheel, bearings, mechanical power transmission, heat transfer**.** | | |
| **Recommended Books:**   * Engineering mechanics dynamics,vol.2J.L.merriam and L.G.karaige,john and wile sons latest edition. | | |

|  |  |  |
| --- | --- | --- |
| **GS-172** | **Linear Algebra** | **3+0** |
| **Prerequisite:** None | | |
| **Objective:**  Introduce the matrix theory and the use of matrices in the solution of engineering  problems. | | |
| **Course Outline:**  Vectors, Vector Spaces, Matrices & Determinants, Cofactor and Inverse, Rank,  Linear Independence, Solution of system of Linear systems, Positive Definite  matrix, Linear Transformations, Operations on matrices, Inner products,  orthgonality and least squares, Eigenvalue & Eigenvectors. Applications to  Systems of Equations and to Geometry, Singular Value Decomposition. | | |
| **Recommended Books:**   * Gilbert Strang, "Linear Algebra and Its Applications", 4th Edition, Thomson Brooks/ Cole, 2007. * James M Ortega, "Matrix Theory – A Second Course", Plenum, 1991. * Otto Bretscher, "Linear Algebra with Applications", 3rd Edition, Prentice Hall, 2005. * David Poole, "Linear Algebra – A Modern Introduction", Brooks/Cole, 2003 | | |

|  |  |  |
| --- | --- | --- |
| **EE-113** | **Network Analysis** | **3+1** |
| **Prerequisite:** Circuit Analysis-I | | |
| **Objective:** Teach the methods used in the analysis of electrical circuits. | | |
| **Course Outline:** Integro-differential equations of circuits; transient analysis; source-free series and parallel LC circuits; complete response of *RLC* circuit; resonance; lossless *LC* circuit; complex forcing functions; phase relationships for *R*, *L* and *C*; impedance and admittance; sinusoidal steady-state response; quality factor; power factor and power factor improvement; complex frequency; three-phase balanced and unbalanced circuits; three-phase source-load connections; power relationships; magnetically-coupled circuits (mutual inductance, energy considerations, ideal transformers); variable frequency network performance; variable frequency response analysis; sinusoidal frequency analysis; resonant circuits and filter circuits; general two-port networks; impedance and admittance parameters; transmission parameters; hybrid parameters; and interconnection of two port networks. | | |
| **Lab Outline:** Basic *RL* and *RC* circuits, *RLC* circuit, sinusoidal steady-state analysis, AC power circuit analysis, polyphase circuits, frequency-domain analysis and Bode plots, network analysis in the s-domain, mutual inductance and transformers, two-port networks, circuit analysis techniques using software packages such as PSPICE, Electronic Workbench, Multi-Sim, and Lab View . | | |
| **Recommended Books:**   * + William H. Hayt, Jack Kemmerly and Steven M. Durbin, “Engineering Circuit Analysis,” Seventh Edition, 2006, McGraw-Hill, ISBN: 0073263184.   + Muhammad H. Rashid, “Introduction to PSpice Using OrCAD for Circuits and Electronics,” Third Edition, 2004, Prentice Hall, ISBN: 0131019880.. | | |

|  |  |  |
| --- | --- | --- |
| **CS-142** | **Computer Programming** | **2+1** |
| **Prerequisite:** Introduction to Computing | | |
| **Objective:** To acquaint the students with the fundamental concepts of  structured and object oriented computer programming language such as C++  OR Java. | | |
| **Course Outline:** Fundamental data types, abstract data types, arrays and matrices, records and  pointers, linked lists, Introduction to Object oriented programming and software  development, defining classes, selection statements, repetition statements,  exceptions and assertions, arrays and collections, file I/O, inheritance and  polymorphism, GUI and Event-driven programming. | | |
| **Lab Outline:** Programming in C++ OR Java using simple programs for basic file I/O, single dimensional arrays, two-dimensional arrays, sorting algorithm, problem solving in  object-oriented paradigm, object oriented programme design process and tools,  implementation of classes and derived classes, objects and encapsulation,  operator and functions overloading, inheritance and polymorphism, GUI  development. | | |
| **Recommended Books:**   * + - Robert Lafore, "Object-Oriented Programming in C++", Prentice Hall, 0672323087, (Latest Edition).     - C. Thomas Wu, "An Introduction to Object-Oriented Programming with Java", Mc-Graw Hill | | |

|  |  |  |
| --- | --- | --- |
| **EE-112** | **Engineering Drawing** | **0+1** |
| **Prerequisite:** Non | | |
| **Objective:** To equip the students with the basic knowledge and skills of engineering drawing  and its application in practical scenarios. The students will also be introduced to some  popular commercial CAD packages. | | |
| **Course Outline:**  Types of lines and usage, dimensioning, lettering, orthographic 1st angle  projection, sheet planning, orthographic 3rd angle projection, introduction of  computer aided drawing, isometric projection, sectional drawing and assembly  drawing.  The course consists of scale drawing only. Drawing sheets will be prepared on  drawing board and using computer software.  Electrical circuit drawing, Electrical and Electronics CAD’s, Industrial  wiring/drawing.  Introduction to computer-aided design tools such as AutoCAD, OrCAD and PCAD;  computer-aided drafting principles and practices; engineering drawing  fundamentals using AutoCAD; drawing of electrical machinery and layouts of  electronic assemblies; design and layout of circuit boards using software (PCAD or OrCAD). | | |
| **Recommended Books:**   * Shawna Lockhart, “Tutorial Guide to AutoCAD”, Prentice Hall, ISBN:   9780131713833, Latest Edition.   * Muhammad H. Rashid, “Introduction to PSpice Using OrCAD for Circuits and Electronics”, Prentice Hall, ISBN: 0131019880, Latest Edition. * First Year Engineering Drawing, A.C Parkinson, Latest Edition. * Illustrated AutoCAD, Release 10, T.W. Berghauser and P. L. Sclive,   BPB, Latest Edition.   * George Amura, Mastering Autocad 2000 Publishers, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **HS-162** | **Pakistan Studies** | **2+0** |
| **Prerequisite:** None | | |
| **Objective:** The course framework is issue-oriented. It has many dimensions, the historical and ideological background of Pakistan the process of governance and national development as well as the issues arising in the modern, age and posing challenges to Pakistan. The course has been designed with a vision that Pakistan Studies should open a window to future. | | |
| **Course Outline:**  **1. Historical Perspective**  a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah. b. Factors leading to Muslim separatism  c. People and Land i. Indus Civilization             ii. Muslim advent            iii. Location and Geo-Physical features.  **2. Government and Politics in Pakistan**  Political and constitutional phases:  a. 1947-58   b. 1958-71   c. 1971-77   d. 1977-88   e. 1988-99   f. 1999 onward.  **3. Contemporary Pakistan**  a. Economic institutions and issues b. Society and social structure    c. Ethnicity d. Foreign policy of Pakistan and challenges e. Futuristic outlook of Pakistan | | |
| **Recommended Books:**   * Burki, Shahid Javed. *State & Society in Pakistan,* The Macmillan Press Ltd 1980. * Akbar, S. Zaidi. *Issue in Pakistan’s Economy.* Karachi: Oxford University Press, 2000. * Mehmood, Safdar. *Pakistan Political Roots & Development.*Lahore, 1994. * Wilcox, Wayne.*The Emergence of Banglades.,* Washington: American Enterprise, Institute of Public Policy Research, 1972. * Amin, Tahir. *Ethno - National Movement in Pakistan,* Islamabad: Institute of Policy Studies, Islamabad. * Ziring, Lawrence. *Enigma of Political Development.* Kent England: WmDawson & sons Ltd, 1980. * Zahid, Ansar. *History & Culture of Sindh.* Karachi: Royal BookCompany, 1980. * Afzal, M. Rafique. *Political Parties in Pakistan,* Vol. I, II & III.Islamabad: NIH and cultural Research,1998. | | |

|  |  |  |
| --- | --- | --- |
| **HS-164** | **Communication Skills** | **2+0** |
| **Prerequisite:** Functional English | | |
| **Objective:** To enhance language skills and develop critical thinking | | |
| **Course Outline:**  **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 and minutes of the meeting, use of library and internet recourses.  **Presentation skills:** Personality development (emphasis on content, style and pronunciation).  **Note: documentaries to be shown for discussion and review** | | |
| **Recommended Books:**  **Grammar**   * Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492 * Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506   **Writing**   * Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19435405 7 Pages 20-27 and 35-41.   **Reading/Comprehension**   * Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford * Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2. | | |

|  |  |  |
| --- | --- | --- |
| **GS-271** | **Differential Equations** | **3+0** |
| **Prerequisite:** Calculus and Analytical Geometry | | |
| **Objective:** Develop fundamental skills of solving ordinary differential equations, and  developing differential equations for real-world problems | | |
| **Course Outline:**  Ordinary Differential Equations of the First Order: Geometrical Considerations,  Isoclines, Separable Equations, Equations Reducible to Separable Form, Exact  Differential Equations, Integrating Factors, Linear First-Order Differential  Equations, Variation of Parameters. Ordinary Linear Differential Equations;  Homogeneous Linear Equations of the Second Order, Homogeneous SecondOrder Equations with Constant Coefficients, General Solution, Real Roots,  Complex Roots, Double Root of the Characteristic Equation, Differential  Operators, Cauchy Equation, Homogeneous Linear Equations of Arbitrary Order,  Homogeneous Linear Equations of Arbitrary Order with Constant Coefficients,  Non-homogeneous Linear Equations. Modeling of Electrical Circuits. Systems of  Differential Equations. Series Solutions of Differential Equations. Partial  Differential Equations: Method of Separation of variables, wave, Heat & Laplace  equations and their solutions by Fourier series method | | |
| **Recommended Books:**   * Michael Greenberg, "Advanced Engineering Mathematics", 1996, Prentice   Hall publishers.   * Erwin Kreyzig, "Advanced Engineering Mathematics", 7th edition, 1993, John Wiley   & Sons Inc.   * Zill, Prindle, Weber and Schmidt, "A First Course in Differential Equations",   1996, Brooks/Cole Publishing,   * Dennis G. Zill, Michael R. Cullen. "Differential Equations with BoundaryValue Problems", 1996, Brooks/Cole Publishing, * C. H .Edwards, David E. Penney, "Elementary Differential Equations with   Applications", 1993, Prentice Hall. | | |

|  |  |  |
| --- | --- | --- |
| **HS-261** | **Technical Report Writing** | **3+0** |
| **Prerequisite:** Functional English | | |
| **Objective:** Enhance language skills and develop critical thinking | | |
| **Course Outline:**  Presentation skills. Essay writing:Descriptive, narrative, discursive,  argumentative. Academic writing: How to write a proposal for research  paper/term paper. How to write a research paper/term paper (emphasis on  style, content, language, form, clarity, consistency). Technical Report writing.  Progress report writing. | | |
| **Recommended Books:**   * Writing. Advanced by Ron White. Oxford Supplementary Skills. Third   Impression 1992. ISBN 0 19 435407 3.   * College Writing Skills by John Langan. McGraw-Hill Higher Education.   2004.   * Patterns of College Writing (4th Edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin’s Press. * The Mercury Reader. A Custom Publication. Compiled by norther Illinois   University. General Editiors: Janice Neulib; Kathleen Shine Cain; Stephen  Ruffus and Maurice Scharton. (A reader which will give students exposure  to the best of twentieth century literature, without taxing the taste of  engineering students). | | |

|  |  |  |
| --- | --- | --- |
| **EE-211** | **Electronic Devices and Circuits** | **3+1** |
| **Prerequisite:** Circuit Analysis, H.S.S.C Physics | | |
| **Objective:** To provide the foundation of electronic devices & circuits | | |
| **Course Outline:** Introduction to Electronics, Semiconductor Diodes, Forward & Reverse Characteristics of Diode, Special Purpose Diodes, Equivalent Circuit of a Diode, Diode as a Switch, Diode Applications,  Half Wave & Full wave rectifiers, Clipper & Clamper circuits, Bipolar Junction Transistor, Transistor Operation, Types of Transistor, Unbiased Transistor, Transistor Biasing Configurations, Common Emitter, Common Base, Common Collector, DC & AC analysis of BJT, Field Effect Transistors, FET Biasing Techniques, Common drain, common source, common gate, fixed Bias and Self Bias Configuration, Voltage Divider Biasing, Universal JFET Bias Curve. DC & AC analysis of FET. | | |
| **Lab Outline:** The emphasis is first on understanding the characteristics of basic circuits including resistors, capacitors, diodes, and bipolar and field effect transistors. The students then use this understanding to construct more complex circuits such as rectifier circuits and power supplies. | | |
| **Recommended Books:**   * Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Latest Edition, Prentice Hall, ISBN: 0131189050, ISBN-13: 9780131189058 * *Introductory Electronic Devices and Circuits: Electron Flow Version*, Latest Edition, Robert Paynter, Prentice Hall, ISBN10: 0131716395, ISBN-13: 9780131716391 * Qurban A. Memon, Irfan A. Halepoto, *A Practical Book on Basic Electronics*, Latest Edition , Naseem Book Depot, ISBN: 969-8680-14-4 * B.S.Chowdhry and Ahsan Ursani, *The First Practical Book on Electronic Workshop*, Latest Edition, Mehran Infotech Consultants, ISBN: 969-8680-03-9 | | |

|  |  |  |
| --- | --- | --- |
| **EE-213** | **DC Machines** | **3+1** |
| **Prerequisite:** Circuit Analysis-II | | |
| **Objective:** Teach the Basic operation and working of various DC Machines. . | | |
| **Course Outlines:**  ***Electromechanical Energy Conversion:*** Forces and torques in magnetic field systems. Energy balance, Singly excited system, Co-energy, Multiply excited system. Dynamic equations.  ***D.C. Machines Fundamentals****:* Simple linear machine. A loop rotating between pole faces. Communication. Armature construction. Armature reaction. Induced voltage and torque equation. Construction. Power flow and losses  D.C. Generators: Equivalent circuit Magnetization curve. Separately existed; shunt, series and compounded generators. Parallel operation.  ***D.C. Motors:*** Equivalent circuit. Separately excited; Shunt, permanent magnet, series and compounded motors.  ***Speed control of DC motors***: Starters, speed control methods for series,  hunt and compound motors, series parallel control for traction motor, multi-voltage control, plugging, Dynamic braking, testing efficiency and temperature rise, determination of losses, divert and indirect test, estimation of temperature rise of armature, commutator and field winding, Efficiency.  ***Electro-mechanics and Machines:*** Transducers Unified Machine Theory, | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Electric Machinery Fundamentals 2nd ed. 1991 by Stephen J. Chapman, McGraw-Hill. * Electric Machinery, 5th ed. 1991. Fitzgerald, Kingsley and Umans, McGraw Hill. * Electrical Machines. Hindmarsh, McGraw Hill. | | |

|  |  |  |
| --- | --- | --- |
| **EE-212** | **Digital Logic Design** | **3+1** |
| **Prerequisite:** None | | |
| **Objective:** Introduce the concepts and tools for the design of digital electronic circuits. | | |
| **Course Outline:** Basic concepts and tools to design digital hardware consisting of both combinational and sequential logic circuits, number systems, Boolean algebra, logic gates, combinational logic design, sequential circuits and logic design, memory and simple programmable logic devices (SPLDs), introduction to field programmable logic devices (FPLDs)/field programmable gate arrays (FPGAs), introduction to Verilog HDL (VHDL), gate-level and dataflow modeling, use of simulation software such as Veriwell Verilog Simulator. | | |
| **Lab Outline:** Basic logic gates, Verilog simulation and hardware implementation of combinational circuits such as MUX/DEMUX, encoder/decoder, arithmetic logic unit (ALU), Verilog simulation and hardware implementation of sequential circuits such as flip-flops, registers, shift registers, counters, implementation of logic circuits using SPLDs; project solving a real-life problem. | | |
| **Recommended Books:**   * Morris Mano and Charles R. Kime, “Logic and Computer Design Fundamentals,” Third Edition, 2003, Prentice Hall, ISBN: 013140539X. * M. Morris Mano, “Digital Design & XILINX 6.3 XSE PKG,” First Edition, 2005, Prentice Hall, ISBN: 0131678485. * Roger L Tokheim, “Digital Electronics: Principles and Applications,” Student Text with MultiSIM CD-ROM, Sixth Edition, 2002, McGraw-Hill, ISBN: 0078309816. * • Samir Palnitkar, “Verilog HDL,” Second Edition, 2003, Prentice Hall, ISBN:0130449113. | | |

|  |  |  |
| --- | --- | --- |
| **GS-272** | **Complex Variables and Transforms** | **3+0** |
| **Prerequisite:** Linear Algebra, Differential Equations | | |
| **Objective:** Introduce the concepts of complex variables, Laplace transform, and Fourier transform, and the use of transforms in the solution of engineering problems. | | |
| **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, convolution theorem, inverse Laplace transform by integral and partial fraction methods, Heaviside expansion formula, solutions of ordinary differential equations by Laplace transform, applications of Laplace transforms; series solution of differential equations, validity of series solution, ordinary point, singular point, Forbenius method, indicial equation, Bessel’s differential equation, its solution of first kind and recurrence formulae, Legendre differential equation and its solution, Rodrigues formula; 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:**   * Erwin Kreyszig, “Advanced Engineering Mathematics, Latest International Edition, John Wiley & Sons, ISBN: 0471728977. | | |

|  |  |  |
| --- | --- | --- |
| **EE-216** | **Instrumentation and Measurement** | **3+1** |
| **Prerequisite:** Circuit Analysis – II | | |
| **Objective:** Acquaint the students with the concepts, methods and instruments for measuring electrical and non-electrical quantities. | | |
| **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:**   * Klaas B. Klaassen and Steve Gee, “Electronic Measurement and Instrumentation”, Cambridge University Press, ISBN: 0521477298, Latest Edition.T * Kevin James, “PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control”, Newness, ISBN: 0750646241, Latest Edition. * Electronic Instrumentation and Measurement Techniques, W.D. Cooper & A.D. Helfrical. * Fundamentals of Electrical Measurements, B.S. Gragory. Electronic Measurement and Instrumentation, Oliver, Latest edition. * Sensors and Transducers, Usher M J, 1996, MacMillan, Latest Edition. * Transducers in Digital Systems, Woolvet G, Peter Peregrinus, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **EE-217** | **AC Machines** | **3+1** |
| **Prerequisite:** Electrical Machine Fundamentals | | |
| **Course Outline:**  ***Transformers*:** Transformer Fundamentals, Importance of transformers. Types and construction. Ideal transformer. Theory and operation of real Single-phase transformers phasor diagrams. Leakage reactance. Losses. Equivalent circuit parameters. No load and short circuit test per Unit systems. Voltage regulation and efficiency. Autotransformers. Tapping. Parallel operation and load division. Inrush current. Exciting current. Three phase transformer. Per unit system. Three phase connections and harmonic Suppression. Vector groups. Three phase transformation using two transformers  ***Three Phase Induction Motor:*** Production of rotating field and torque. Reversal of rotation. Construction. Synchronous speed. Slip and its effect on rotor frequency and voltage. Equivalent circuit. Power and torque. Losses, efficiency and power factor. Torque-speed characteristics. Starting and speed control. Induction generator  ***Single-Phase Induction Motors:*** Types and performance Analysis. Heating and cooling of motors  ***Synchronous Generator:*** Construction. Excitation system. Equivalent circuit. Phasor diagram. Power and torque. Measurement of parameters. Generator operating alone. Capability chart. Synchronization Parallel operation with infinite bus and power sharing. Parallel operation of same size generators generating, Loss of field excitation. Cooling systems. Shut down procedure.  ***Synchronous Motors:*** Principle of operation starting, Shaft load, power angle and developed torque. Counter voltage (CEMF) and armature reaction voltage, equivalent circuit and phasor diagram. Power Equation. Effects of changes in shaft load and field excitation. V-curves. Losses and efficiency. Power factor improvement. Speed control. Ratings. Design aspects of transformers, Indication motors and synchronous motors | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Electric Machines, 1st Ed. 1991 (chapters 3,4,5,8,9). Charles I. Hubert, Maxwell Macmillan. * Electric machinery Fundamental, 2nd ed. 1991 (chapter:2,8.9 and 10), Stephen J. Chapman, McGraw Hill | | |

|  |  |  |
| --- | --- | --- |
| **EE-215** | **Electromagnetic Field Theory** | **3+0** |
| **Prerequisite:** Calculus and Analytical Geometry | | |
| **Objective:** Introduce the concepts and mathematical methods to understand and analyze electromagnetic fields and waves. | | |
| **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. | | |
| **Lab Outline:** Simulations using Matlab | | |
| **Recommended Books:**   * William Hayt and John A. Buck, “Engineering Electromagnetics,” Seventh Edition, 2006, McGraw-Hill, ISBN: 0073104639. * Sadiku, Matthew N, “Elements of Electromagnetics,” Second Edition, 1994, Oxford University Press, ISBN: 0195103688. | | |

|  |  |  |
| --- | --- | --- |
| **ME-251** | **Applied Thermodynamics** | **3+1** |
| **Prerequisite:** Basic Mechanical Engineering | | |
| **Objective:** To give basic understanding of the subject to the undergraduate students of  Electrical Discipline, and to satisfy requirements for an Engineering Degree. | | |
| **Course Outline:** Basic concepts and definitions, Processes & Cycles, concept of Thermodynamic  Property and definition of State; First Law of Thermodynamics, Work & Heat as  energies in transition, Interchange-ability of Energy States, Working Fluids and  Steady / Unsteady Flow Energy Equations, Perfect and Real Gases; Second Law  of Thermodynamics,  Reversible and Irreversible Processes, Entropy & Carnot Efficiency, concept of  Available Energy. | | |
| **Recommended Books:**   * Applied Thermodynamics for Engineers & Technologists, T. D. Eastop &   McConkey, Longman, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **GS-371** | **Numerical Methods** | **3+0** |
|  | | |
| **Course Objective(s):**  To introduce commonly used numerical techniques in computer engineering. | | |
| **Course Description:**  Floating Point number system. Error analysis. Solutions of equations. Interpolation. Splines. Numerical differentiation and integration. Numerical methods in linear algebra, system of linear equations, method of least squares, eigen values, eigenvectors. Solution of ordinary and partial differential equations. This subject is to be supplemented with extensive computer exercises. | | |
| **Recommended Text(s):**   * *Erwin Kreyszig, WIE Advanced Engineering Mathematics, Ninth Edition, International Edition, John Wiley & Sons, ISBN-10: 0-471-72897-7, Latest Edition.* * *Curtis F.Gerald Patrick O. Wheatley: Applied Numerical Analysis, Addison-Wesley, Latest Edition.* * *Donald Greenspan & Vincenzo Casulli: Numerical Analysis For Applied Mathematics, Science, and Engineering, Addison-Wesley, Latest Edition.* * *David Kahaner: Numerical Methods and Software, Prentice Hall, Latest Edition.* | | |

|  |  |  |
| --- | --- | --- |
| **EE-311** | **Signals and Systems** | **3+1** |
| **Prerequisite:** Complex Variables and Transforms | | |
| **Objective:** This is a basic course that is intended to provide the fundamentals of signals, systems and transforms to the electrical engineering students. The course is aimed to build a comprehensive foundation for later higher level courses in communication systems, control systems and digital signal processing. Both discrete-time and continuous-time signals, systems and transforms are covered in this course. | | |
| **Course Outline** Continuous time and discrete time signals, periodic signals, even and odd signals, exponential and sinusoidal signals, the unit impulse and unit step functions, continues time and discrete time systems, linear time invariant (LTI) systems, difference equation, causality, BIBO stability, convolution and correlation, discrete time Fourier transforms, DFT and FFT algorithms, time and frequency characterization of signals and systems, the sampling theorem, aliasing, sampling the discrete time signals, z-transform, analysis and characterization of LTI systems using z-transform, case studies: communication systems and linear feedback systems. | | |
| **Lab Outline:** Study of various types of signals; analysis of signals; filter design; analogue-to-digital converters; signal sampling using different parameters; 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. Implementation of digital circuits/systems on DSP kits. | | |
| **Recommended Books:**   * Simon Haykin, “Signals and Systems,” Second Edition, 2003, John Wiley & Sons, ISBN: 0471378518. * John G. Proakis and Dimitris K. Manolakis, “Digital Signal Processing,” Fourth Edition, 2006, Prentice Hall, ISBN: 0131873741. * Sen M. Kuo and Woon-Seng S. Gan, “Digital Signal Processors: Architecture, Implementation and Applications,” First Edition, 2005, Prentice Hall, ISBN:0130352144. * Gordon. E. Carlson, “Signals and Linear System Analysis,” Second Edition, 1998, John Wiley & Sons, ISBN: 0471124656. | | |

|  |  |  |
| --- | --- | --- |
| **EE-312** | **Linear Control Systems** | **3+1** |
| **Prerequisite:** Signals and Systems | | |
| **Objective:** This course is aimed to build a comprehensive foundation in the  analysis and design of control systems using classical and modern techniques. | | |
| **Course Outline:** Modeling of electrical, mechanical and biological control systems, Open and closed-loop systems, Block diagrams. Second order systems. Step and impulse  Response. Performance criteria. Steady state error. Sensitivity, s-plane system  Stability. Analysis and design with the root loci method. Frequency domain  analysis, Bode plots, Nyquist criterion, gain and phase margins, Nichols charts.  The State-space method, state equations, flow graphs, stability, compensation  techniques. Simulation and Controller design using MATLAB | | |
| **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:**   * Steffani, Savant, Shahian and Hostetter, "Design of Feedback Control * Systems" 4th Edition, Saunders College Publications. * Katsushiko, Ogata, “Modern Control Engineering,” McGraw-Hill, `5th Edition * R. C. Dorf and R. H. Bishop, “Modern Control Systems,” 12th Edition * B. C. Kuo, “Automatic Control Systems” 7th Edition | | |

|  |  |  |
| --- | --- | --- |
| **EE-314** | **Electrical Power Generation** | **3+0** |
| **Prerequisite:** Applied Thermodynamics | | |
| **Objective:** The students learn different power plant and modes of energy conversion to generate electrical energy in this course and the concepts of fuel cells are introduced. | | |
| **Course Outline:**  Thermal Power Plants**:** Sources of conventional energy and method of harnessing, special features and cycles used in steam, gas and diesel power plants, combine cycle systems and cogeneration. Location of the above plants and selection of units, prime movers and associated equipment  Hydroelectric Power Plants: The plants and their equipment, layouts, run of the river and accumulation type station, types of hydroelectric turbines and their stations  Nuclear Power Plants: Nuclear reaction, fission and fusion reaction, critical mass chain reaction, moderators, reactor control and cooling, classification of reactors, different types of reactors, radiation damages, shielding of grays neutrons, materials for construction  Thermoelectric Generators: Thermoelectric effect, solid state description of thermoelectric effect, analysis and design of thermoelectric generators, figure of merit, device configuration, solar and radioisotope powered generators, applications  MHD Generators: Gaseous conductors, analysis and design of MHD generator, problems associated with MHD generation, possible configuration. Photovoltaic Generators: Radiation principles, optical effects in semiconductors and PN junction, analysis and design of converter, fabrication of cells, solar cells in Space  Fuel Cells: Thermodynamic principles, efficiency of fuel cell factors limiting the performance, design, new development in fuel cells, possibility of future use in electric vehicles  Wind power generation. | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Principles of Energy Conversion by Arche W. Culp, Latest Edition. * Power Plant Technology by M.M. Wakel, McGraw Hill, Latest Edition | | |

|  |  |  |
| --- | --- | --- |
| **ES-323** | **Communication Systems** | **2+1** |
| **Prerequisite:** Complex Variables and Transforms, EMT | | |
| **Objective:**  Develop a fundamental understanding of communication systems with emphasis on signal modulation techniques. Teach both analog techniques (amplitude modulation, frequency modulation) and digital techniques (pulse code modulation, phase shift keying, frequency shift keying). | | |
| **Course Outline:**  Basic definitions; modulation and de-modulation techniques: amplitude, angle, pulse modulation, digital modulation techniques; information theory; error detection and correction; multiplexing techniques; noise and its effects on signal transmission; BER performance of various modulation techniques under noisy environment. | | |
| **Lab Outline:**  Study of different modulation techniques including amplitude modulation, frequency and pulse modulation, study of demodulation techniques, experimental modules for FDM, TDM and PCM; MATLAB/SIMULINK modeling and simulation of a simple transceiver, a mini project is recommended. | | |
| **Recommended Books:**   * B. P. Lathi, “Modern Digital and Analog Communication Systems,” Third Edition, 1998, Oxford University Press, ISBN: 0195110099. * Leon W. Couch, “Digital and Analog Communication Systems,” Seventh Edition, 2007, Prentice Hall, ISBN: 0131424920. * John G. Proakis and Masoud Salehi, “Communication Systems Engineering,” Second Edition, 2002, Prentice Hall, ISBN: 0130617938. | | |

|  |  |  |
| --- | --- | --- |
| **CS-341** | **Microprocessors Based Systems** | **3+1** |
| Prerequisite: Digital Logic Design | | |
| Objective: Teach the architecture, programming, interfacing, and applications of microprocessors and microcontrollers. | | |
| Course Outline: Introduction to Intel family microprocessors, instruction set architecture (ISA), assembly language programming, hardware model, read/write cycles, exception/interrupt processing, memory systems, I/O devices, DMA, interfacing to memory and I/O devices, analog-todigital and digital-to-analog converters, introduction to PIC/Atmel 8051 microcontrollers. | | |
| 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:   * 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. * Douglas V. Hall, “Microprocessor and Interfacing”, Revised Second Edition, 2005, Tata McGraw-Hill, ISBN: 0070601674. * Han-Way Huang, “PIC Microcontroller: An Introduction to Software & Hardware Interfacing,” First Edition, 2004, Thomson Delmar Learning, ISBN: 1401839673. * Muhammad Ali Mazidi, Janice Mazidi and Rolin McKinlay, “8051 Microcontroller and Embedded Systems,” Second Edition, 2005, Prentice Hall, ISBN: 013119402X. | | |

|  |  |  |
| --- | --- | --- |
| **MS-382** | **Power Economics and Management** | **3+0** |
| **Prerequisite:** None | | |
| **Objective:**  This course discusses basics of economics, load management, tariffs and reliability of power systems | | |
| **Course Outline:**  Introduction: Basic concept and principles of economics, microeconomic theory, the problems of scarcity. Concept of engineering economy  Economic Environment: Consumer and producer goods, goods and services, demand & supply concept. Equilibrium, elasticity of demand, elasticity of supply, measures of economic worth. Price-supply-demand relationship. Theory of production, factors of production, laws of returns, break-even charts and relationships. Perfect competition, monopoly, monopolistic competition and oligopoly. Fundamentals of marketing  Elementary Financial Analysis: Basic accounting equation. Development and interpretation of financial statement-income statement, balance sheet and cash flow. Working capital management  Break Even Analysis: Revenue/cost terminologies, behavior of costs, determination of costs/revenues, numerical and graphical presentations. Practical applications. BEA as a management tool for achieving financial/operation efficiency  Selection between Alternatives: Time value of money and financial internal rate of return, present value, future value and annuities. Cost-benefit analysis: selection amongst materials, techniques, design etc. Investment philosophy, investment, alternatives having identical lives, alternatives having different lives, make or buy decisions and replacement decisions  Value Analysis/Value Engineering: Value analysis procedures, value engineering procedures, value analysis versus value engineering, advantages and applications in different areas, value analysis in designing and purchasing. Linear Programming: Mathematical statement of linear programming problems, graphic solution simplex procedure, duality problem  Depreciation and Taxes: Depreciation concept, economic life, methods of depreciations, profit and returns on capital, productivity of capital gain (loss) on the disposal of an asset, depreciation as a tax shield  Business Organization: Type of ownership, single ownership, partnerships, corporation, type of stocks and joint stock companies banking and specialized credit institutions  Capital Financing & Allocation: Capital budgeting, allocation of capital among independent projects, financing with debt capital, financing with equity capital trading on equity, financial leveraging | | |
| **Recommended Books:**   * Engineering Economy by A. Tarquin, Latest Edition. * Engineering Economy by Degarmo, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **EE-315** | **Electrical Power Transmission** | **3+1** |
| **Prerequisite:** AC Machines | | |
| **Objective:**  The course presents basics of electrical power transmission along with electrical and mechanical design impacts on power transmission in detail and HVDC transmission is introduced | | |
| **Course Outline:**  One-line diagram, choice of voltage and choice of AC/DC systems, economic comparison of various transmission systems, standard voltages in Pakistan and abroad for transmission and sub-transmission. Introduction to HV, EHV and UHV system Conductor types; resistance, skin effect, line inductance based and flux considerations. Inductance of single phase and three phase lines, inductance of composite conductor line, inductance of bundled conductors, capacitance of single phase and three-phase lines, effect of earth on capacitance, capacitance of bundled conductors, parallel circuit lines, Ferranti effect  Short, medium and long transmission lines, solution of equations. Traveling waves, surge impedance loading, equivalent circuit, and power flow through the line, voltage regulation and line surges. Line supports, sag and tension calculation, total length of conductor supports at different levels, mechanical degree of safety, effect of wind pressure and ice loading, conductor vibration and use of dampers  Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators, corona effect, corona loss, radio interference due to corona  Underground cables: types, calculation of inductance and capacitance, insulation resistance, insulation breakdown of cables, thermal characteristics of cables, calculation of current rating of the cables, fault locating techniques, cable jointing techniques  Introduction and classification of HVDC transmission | | |
| **Lab Outline:**  Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Elements of Power System by Stevenson, Latest Edition. * Power System Analysis by Grainger and Stevenson, Latest Edition | | |

|  |  |  |
| --- | --- | --- |
| **ES-313** | **Digital Signal Processing** | **3+1** |
| **Prerequisite:** Signal and Systems | | |
| **Objective:** To introduce basic digital signal processing and design of digital filters. | | |
| **Course Outline:** Introduction, Discrete-time signal and its representations, Discrete signals and systems, Time-domain analysis of discrete-time signals, Frequency-domain analysis, Discrete time Fourier series, Discrete-time Fourier transform, System response and frequency response, Z- transform and its properties, Solution of difference equations using Z-Transform, DFT and FFT algorithms, Implementation of Discrete-Time systems, Digital filter design, FIR and IIR filters. | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * John G. Proakis *et al.* “Digital Signal Processing- Principles, Algorithms and Applications” latest edition * *Alan V. Oppenheim* et al. *“Discrete-Time Signal Processing,” latest edition* | | |

|  |  |  |
| --- | --- | --- |
| **ES-321** | **Power Electronics** | **3+1** |
| Prerequisite: Electronic Devices and Circuits | | |
| Objective: Teach the semiconductor devices and circuits for the conversion of electrical power of a given form into a desired form. Introduce the applications of power electronics including rectifiers, inverters, UPS, and motor drives. | | |
| Course Outline:  Introduction to power electronics; solid-state devices used in power electronics: power diode, power BJT, power MOSFET, SCR, GTO, IGBT, TRIAC, DIAC; SITH, MCT, IGCT, MTO,ETO, semi-controlled, fully-controlled and uncontrolled rectifiers: single-phase and three-phase, six-pulse, twelve pulse and twenty-four pulse rectifiers; Cycloconverters, single-phase and three-phase inverters; pulse-width modulated (PWM) inverters; UPS; switched mode power supplies, AC and DC motor drives. | | |
| Lab Outline: Design of converters; single-phase and three-phase uncontrolled, half-controlled and fullycontrolled rectifiers; buck, boost and polarity inverting converters; flyback converter. | | |
| Recommended Books:   * Cyril W. Lander, “Power Electronics,” Third Edition, 1993, McGraw-Hill UK, ISBN: 0077077148. * Muhammad H. Rashid, “Power Electronics: Circuits, Devices and Applications,” Third Edition, 2004, Prentice Hall, ISBN: 0131011405. * 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. | | |

|  |  |  |
| --- | --- | --- |
| **EE-411** | **Power Distribution and Utilization** | **3+1** |
| Prerequisite: Power Transmission | | |
| **Objective:**  Students are introduced to the basics of power distribution systems and effective utilization of power in heating and illumination applications | | |
| **Course Outline:**  Introduction to distribution system. Urban, suburban and rural distribution systems. Primary, secondary and tertiary voltages. Radial and ring main systems, application of distribution transformers, estimation of load, load characteristics, substation switchgears and bus bar arrangements, calculation of voltage drop and regulation in distribution feeders  Grounding and earthing, distribution transformer neutral, earthing resistance, earthing practice in L.V. networks  Power Factor: Disadvantages and causes of low power factor, methods for improvement, application of shunt capacitors in distribution network  Batteries & Electrochemical Processes: Main types of batteries and their working, battery charging, electroplating, electrolysis and electrometallurgical process.  Cathodic protection of poles, gas pipes, oil pipes and water structures  Heating and Welding: Electric heating, resistance, induction and dielectric heating, electric furnaces, microwave heating, electric welding, resistance welding and its types  Fundamentals of Illumination Engineering: Laws, units and terms used, requirements for good lighting, illumination schemes for various situations (street lighting, commercial/industrial lighting, stadium/flood/stage/spot lighting etc.), types of lamps, their working and relative merit. | | |
| **Lab Outline:**  Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * A Text Book of Electrical Power by M.L. Anand, Latest Edition. * Electrical Power Distribution System by Turan Gonen, Latest Edition | | |

|  |  |  |
| --- | --- | --- |
| **EE-417** | **Advanced Electrical Machine Design** | **3+1** |
| **Prerequisite:** AC & DC Machines | | |
| **Objective:**  Discussion of design and loading of Power Transformers and Induction motors is introduced and electrical equipment installation; commissioning, testing and troubleshooting practices are discussed. | | |
| **Course Outline:**  **Part-A Machine Design:**  Industrial standardization, national and international standards, codes and testing laboratories, manufacturing and operating systems, design considerations for electrical machines, properties and applications of materials for magnetic machine insulation system and its design considerations, thermal time constant, cooling systems of transformers and rotating machines, duty cycles, ratings and temperature-rise, mechanical design considerations, specific loading and output equations of power transformer and induction motor, design of transformer or induction motor, introduction to computer aided design (CAD) and computer aided manufacturing (CAM)  **Part-B Installation, Maintenance and Troubleshooting of Machines:**  Safety precautions, troubleshooting and emergency repairs. Installation, commissioning, testing, maintenance, and troubleshooting of (i) power transformers and (ii) induction motors. (iii) AC generators  **Part-C Equipments Training (Practical):**  Measurement of magnetic flux, inductance and reluctance of a part of electrical machines, study of transformer and rotating-machine parts. Understanding operating principles, ratings and application of the following equipment: power supplies, magnetic contactors, thermal overloads, miniature circuit breakers, metallic-clad circuit breakers, earth leakage circuit breaker, clip-on meters, cable fault locators, Megger earth tester, relay testers, motor controllers, tachometers, phase tester (L.V. and H.V.). The students will have to submit a hand written report consisting of class work, design and laboratory work for evaluation and viva-voce examination. Theory paper will be from Part-A only. | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Commissioning, Operation and Maintenance of Electrical Equipment by S. Rao, Khanna Publisher, India, Latest Edition. * Alternating Current Machines by M.G. Say, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **EE-413** | **Power System Analysis** | **3+0** |
| **Prerequisite:** Circuit Analysis-II | | |
| **Objective:**  This course has been designed to introduce the importance of analyzing various aspects of power system. It covers power flow studies and fault analysis of both symmetrical and unsymmetrical faults in power networks. This forms the basis for power system operation, control and protection. | | |
| **Course Outline:**  Branch and Node admittances; Mutually coupled Branches in Y-bus; Equivalent Admittance Network; Modification of Y-bus; Impedance matrix and Y-bus; the method of successive elimination; Node Elimination (Kron Reduction); Triangular Factorization; The Impedance Model and Network Calculations: The bus, admittance and impedance Matrices; Thevenin’s Theorem and Z-bus; Modification of an existing Z-bus; Direct determination of Z-bus; Calculation of Z-bus elements from Y bus ; Power Invariant Transformations; Mutually coupled branches in Z bus. Symmetrical Faults, Transients in RL circuits; internal voltages of loaded machines. Under fault conditions; fault calculations using Z bus; Equivalent circuits; Selection of circuit breakers  Synthesis of unsymmetrical phasors; symmetrical components of unsymmetrical phasors; symmetrical Y and Δ circuits; power in terms of symmetrical components; sequence networks of Y and Δ impedances; sequence networks of a symmetrical Transmission line; sequence Networks of the synchronous Machines; Sequence Networks of Y-Δ Transformers; unsymmetrical services impedances; sequence networks of Y-Δ Transformers; unsymmetrical services impedances; sequence networks; positive, negative and zero sequence networks; Unsymmetrical faults on power systems; single line to ground faults; line to line faults. Double line to ground faults; Demonstration problems; open conductor faults. Load Flow Studies, Steady state and Transient Stability, the swing equation , Application of swing curve & solution of problems using digital computers, stability of loads, effects of mechanical and electrical time lag and delays, Electromechanical behavior of  machine/lines/bus-bar systems equal criterion in machine dynamics | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Elements of Power System Analysis, William B. S., McGraw Hill, (Latest Edition). * Electrical Power Systems, Weedy, B. M., Pergamen, (Latest Edition). | | |

|  |  |  |
| --- | --- | --- |
| **MS-481** | **Entrepreneurship and Leadership** | **2+0** |
| **Prerequisite:** None | | |
| **Objective:**  Entrepreneurship is an important component in the process of  Economic development. The purpose of this course is to analysis the theories of  entrepreneurship and to go for case studies of successful entrepreneurs | | |
| **Course Outline:**  Introduction: The concept of entrepreneurship, The economist view of  entrepreneurship, The sociologist view, Behavioural approach,  Entrepreneurship and Management.  The Practice of Entrepreneurship: The process of entrepreneurship,  Entrepreneurial Management, The entrepreneurial business, Entrepreneurship  in service institutions, The new venture  Entrepreneurship and Innovation: The innovation concepts, Importance of  innovation for entrepreneurship, Sources of innovative opportunities, The  innovation process, Risks involved in innovation  Developing Entrepreneur: Entrepreneurial profile, Trait approach to  understanding entrepreneurship, Factors influencing entrepreneurship, The  environment, Socio cultural factors, Support systems  Entrepreneurship Organization: Team work, Networking organization,  Motivation and compensation, Value system  Entrepreneurship and SMES: Defining SMEs, Scope of SMEs,  Entrepreneurial, managers of SME, Financial and marketing problems of SMEs  Entrepreneurial Marketing: Framework for developing entrepreneurial  marketing, Devising entrepreneurial marketing plan, Entrepreneurial marketing  strategies, Product quality and design  Entrepreneurship and Economic Development: Role of entrepreneur in the  economic development generation of services, Employment creation and  training, Ideas, knowledge and skill development, The Japanese experience  Case Studies of Successful Entrepreneurs | | |
| **Recommended Books:**   * Paul Burns and Jim Dew Hurst: Small Business and Entrepreneurship * P.N. Singh: Entrepreneurship for Economic Growth * Peter F. Drucker: Innovation and Entrepreneurship Peter F. Drucker * John B. Miner: Entrepreneurial Success | | |

|  |  |  |
| --- | --- | --- |
| **EE-499A** | **Final Year Project-I** | **0+3** |
| **Prerequisite:** None | | |
| **Objective:** To give the Students a chance for enhancing their Technical capabilities by Implementing their theoretical and practical knowledge in the field of Research and Development.  **Course Description:**  According to the field chosen.  **Recommended Text(s):**  *Related Materials.* | | |

|  |  |  |
| --- | --- | --- |
| **EE-414** | **Power System Stability and Control** | **3+1** |
| **Objective:** Power System Analysis  Different aspects of power system operation, monitoring and control are covered with an emphasis on SCADA systems | | |
| **Course Outline:**  Introduction to power system control and its importance, modes of power system operation, major tasks of operation  SCADA system*,* control centers, controller tuning, communication sub system, remote terminal unit, data logging  Economic dispatch, characteristics of power generation units, economic dispatch problems with and without consideration of losses, incremental fuel cost, penalty factor, economic power interchange. Voltage, power and frequency control. Evaluation of the effect of speed change on droop characteristics | | |
| **Lab Outline:** Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Power Generation, Operation and Control by Woolen Barg, Latest Edition. * Power System Control Technology by Trosten Cegral, Latest Edition. * Power System Stability and Control, P. Kundur, Latest Edition | | |

|  |  |  |
| --- | --- | --- |
| **EE-415** | **Power System Protection** | **3+1** |
| **Prerequisite:** Power System Analysis | | |
| **Objective:**  The course presents different types of relays, relaying schemes, circuit breakers and fuses. Topics like discrimination and coordination are also introduced | | |
| **Course Outline:**  Introduction to protection system, types of faults, effect of faults, fuse as protective device, types of fuses, characteristics of fuses, selection and application of fuses, discrimination and coordination, current transformer and its operation, relay construction, basic relay terminology, electromagnetic relays, thermal relays, static relays and introduction to microprocessor based protective relays, over current protection, distance protection, impedance relay, operation of impedance relay in different zones, reactance relay, differential protection of transformers, generator protection, bus bar protection, arc voltage, arc interruption, re-striking voltage and recovery voltage, resistance switching, current chopping circuit breaker, classification of circuit breakers, oil circuit breakers, air-blast circuit breakers, SF6 circuit breakers, vacuum circuit breakers, operational mechanism and rating of circuit breakers. | | |
| **Lab Outline:**  Lab work will be based upon above theoretical work. | | |
| **Recommended Books:**   * Switchgear and Protection by S. Rao, Khanna Publisher, Latest Edition. * Fundamentals of Power System Protection by Paithanker & Bhide, Prentice Hall, Latest Edition. | | |

|  |  |  |
| --- | --- | --- |
| **EE-416** | **High Voltage Engineering** | **3+1** |
| **Prerequisite:** Power Transmission | | |
| **Objective:** To provide students with an introduction to high voltage engineering, phenomena and technology.  To understand high voltage generation and measurement. | | |
| **Course Outline:** Introduction to high voltage engineering  Withstand levels, S curves; insulation coordination; breakdown mechanisms in solids, liquids, gases and vacuum.  Testing Non-destructive testing of apparatus; insulation resistance, tan A, partial discharge measurements; life testing, accelerated life testing; Weibull statistics.  System over voltages Occurrence and characteristics; power frequency and harmonics, switching and lightning over voltages; transient calculations, Bewley lattice diagrams; wave tables; attenuation and distortion of surges; overvoltage protection devices; rod and expulsion gaps; surge diverters.  Circuit breakers Aims, types, general principles of operation.  HV testing HV production for test objects; impulse generators; series resonant a.c. test sets; d.c. test sets; measurement of high voltages; absolute measurement methods; series impedance and meter methods; impedance dividers. | | |
| **Lab Outline:** Having successfully completed the module, you will be able to:  Design high voltage generator. Select the right technique to measure different types of high voltages. Choose the right surge device to eliminate overvoltages of high voltage apparatus. | | |
| **Recommended Books:**  Diesendorf W, Insulation Co-ordination in High-Voltage Electric Power Systems, Butterworths 1974  Gallagher T J and Pearmain A J, High Voltage Measurement, Testing and Design, Wiley 1983  Kuffel E, High Voltage Engineering, 2nd Edition, Newnes 2000 | | |

|  |  |  |
| --- | --- | --- |
| **HS-361** | **Professional and Social Ethics** | **2+0** |
| **Prerequisite:** None | | |
| **Objective:** To provide students the understanding of ethics in organization | | |
| **Course Outline:** Introduction to professional psychology. Psychological testing. Educational psychology. Industrial/organizational psychology. Social psychology. Health psychology. Clinical psychology . Positive psychology. Legal, ethical, and professional issues.  Motivation and job satisfaction. Group and work. Group and inter-group behaviour. Leadership. Patterns of work. Conflict and consent in work. Organizational culture.  The study of social life. Exploring the global village. Sociology as a science. The sociological imagination. The development of sociology. Pioneers of sociology. Nature, scope and subject matter of sociology. Brief historical development of sociology. Society and community. Relationship with other social sciences. Social interaction processes. | | |
| **Recommended Books:**   * Crow, L., & Crow, A. (2000) Educational Psychology, New Delhi: Eurosia Publishing House Ltd. * Spiegel, P. K., & Koocher, G. P. (1998), Ethics in Psychology, New York: Oxford University Press * Snyder, C. R., & Lopes, S.J. (2000), Handbook of Positive Psychology, New York: Oxford University Press. * Compton, W. C. (2005), Introduction to Positive Psychology, USA, Thomson Wadsworth. * Debra, L. N. & James Compbell Quick, (2000) Organizational Behaviour (3rd Ed), Cincinnat: South Western. * Fred Luthans, Alexander, D. S. & Edwin, A. Locke (2000) (Eds), Handbook of Principles of Organizational Behaviour, London: Blackwell. * Brannon, L. & Reist, J. (2000), Health Psychology: An Introduction to Behaviour and Health (4th Ed.), USA Wadsworth. * Donohue, W. & Ferguson, K. (Eds), (2003), Handbook of Professional Ethics for Psychologists; Issues, Questions and Controversies, London: Sage Publications. * Meyers, D. (2005), Social Psychology, 8th Ed. McGraw Hill Inc. * Cooper, J. & Hogg, M. (2003) Handbook of Social Psychology, Sage Publications | | |

|  |  |  |
| --- | --- | --- |
| **EE-499B** | **Final Year Project-II** | **0+3** |
| **Prerequisite:** None | | |
| **Objective:** To give the Students a chance for enhancing their Technical capabilities by Implementing their theoretical and practical knowledge in the field of Research and Development | | |