

**INDUS UNIVERSITY**  
**INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING**  
**DEPARTMENT OF ELECTRICAL ENGINEERING**

**Teaching & Examination Scheme**

**B.Tech.Sem VI**

Subject Code	Subject	Teaching Scheme				
		Theory (Hrs.)	ABL (Hrs.)	Laboratory (Hrs.)	Total (Hrs.)	Credits
EL410601/ EL410617	High Voltage Engineering	3			3	3
EL410602/ EL410618	Electrical Drives & Control	3			3	3
EL410615N /EL410619	Electrical Machine Design-1	3			3	3
EL410604	Power System Analysis	4			4	4
EL410605	Microcontroller & Application	3			3	3
EL410611	Energy Management & Audit	3	2		5	4
EL410612	Modern Control Theory					
EL410613	Digital Signal Processing					
EL410607	High Voltage Engineering Lab			2	2	1
EL410614	Microcontroller & Application Lab			2	2	1
EL410608	Electrical Drives & Control Lab			2	2	1
EL410616	Electrical Machine Design-1 Lab			2	2	1
EL410610	Power System Analysis Lab			2	2	1
		19	2	10	31	25

**INDUS UNIVERSITY**  
**INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING**  
 Department of Electrical Engineering

**B. Tech. Sem. VI (Electrical Engineering)**

**EL410601/EL410617 High Voltage Engineering**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	00	3	60	30	10	100

**Course Outcome:**

(Note: After completion of this course, the students are expected to ....

- Learn breakdown conduction in Liquid, Solid and Gases.
- Learn Measurement and Generation of High Voltage & Current.
- Testing of Materials and Electrical Apparatus.
- Also Learn Design of High Voltage Lab Layout

**Subject Contents**

**Unit -1**

**Conduction And Breakdown In Gases, solid dielectrics and liquids [12]**

Gases as insulating media- Ionization process-Townsend's current growth equation-Townsend's criterion-determination of  $\alpha, \gamma$ -time lag-streamer theory-Pachen's law-corona discharge-breakdown in non-uniform field –post breakdown phenomenon-vacuum breakdown

Conduction and breakdown in pure liquid and commercial liquid-suspended particle-bubble & cavitations-stress oil volume mechanism-breakdown mechanism in solid like intrinsic breakdown, electromechanical breakdown-treeing & tracking ,thermal , electrochemical & internal discharge breakdown. Breakdown in composite dielectric

**Unit -2**

**Generation of High Voltage AC, DC and Impulse [11]**

Generation of High voltage DC-Half & full wave rectifier, voltage doubler and multiplier circuit, Van De graff generator, Generation of High Voltage AC- Cascade transformer, Resonant transformer, High voltage-high frequency generation, Generation of Impulse Voltages- Generation of standard impulse voltages, multi stage impulse generator-Marx Circuit, Generation of Switching Surges

**Unit-3****[11]****Measurement of High Voltage and Current:**

HVDC measurement by series resistance  $\mu$ -meter, potential divider, generating voltmeter etc., Ripple voltage measurement, HVAC and impulse by series impedance, capacitance potential divider and CVT-PT–electrostatic voltmeter-peak voltmeter, spark gap measurement, factors & its corrections, impulse measurement by potential divider & CRO, CVT. Ohmic shunt for high DC current, hall generator, optical sensors.

**Unit -4****[11]****Testing of Material And Electrical Apparatus:**

Measurement of DC resistivity-measuring cell for solid and liquid, measurement of C & tan  $\delta$ , High voltage shearing bridge, transformer ratio arm bridges, partial discharge measurement-pattern straight detector, balanced detection method, HV testing of insulator, bushing, circuit breaker, cable, transformers, L.A. R.I. measurement.

**Design Planning And Layout Of High Voltage Lab:**

Classification, test facilities, test equipments, layout, grounding and shielding

**Text Books**

1. C.L.Wadhawa, High voltage Engineering New Age Publishers.
2. Kuffel & Zaengl, High voltage Engineering fundamentals, Pergoman press oxford

**Question Paper Pattern :**

Question paper will contain 8 questions (two full questions distributed in four units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

**INDUS UNIVERSITY**  
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 Department of Electrical Engineering

**B.Tech. Sem. VI (Electrical Engineering)**

**EL410602/EL410618 Electrical Drives & Control**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	00	3	60	30	10	100

**Course Outcome:**

After completion of this course, expected outcome from the students,

- Adjustable speed drive (ASD) or variable-speed drive (VSD) describes equipment used to control the speed of machinery.
- Understand the concepts of DC drive, AC drive and their control.
- Many industrial processes such as assembly lines must operate at different speeds for different products. Where process conditions demand adjustment of flow from a pump or fan, varying the speed of the drive may save energy compared with other techniques for flow control.

**Subject Contents**

**Unit-1**

[13]

**Introduction to Electric Drive, its Dynamics & Control**

Introduction-Block Diagram, Advantages, Parts Of Electrical Drive, Choice of Electric drive, Dynamics of electric drive: fundamental torque equation, multi quadrant operation of drive, equivalent values of drive parameter, components of load torque, nature & classification of load torque, time and energy loss in transient operation, steady state stability, load equalization, Control: modes of operation, closed loop control of drive, thermal model for heating & cooling.

**Unit-2**

[12]

**DC motor Drive:**

DC motor-Types and their performance, armature back emf, torque, speed equations, starting, braking methods, Speed control classification, Controlled rectifier fed dc drives, Single phase fully controlled & half controlled Rectifier Control of dc Separately Excited motor, three phase fully controlled rectifier control of dc separately excited motor, multi quadrant operation of separately excited dc motor, Chopper control of separately excited dc motor drive, closed loop control of dc drive.

**Unit-3****[12]****Induction Motor drive**

Introduction, Analysis and performance of 3-phase induction motor, Operation of I.M with unbalanced source voltages and single-phasing, with unbalanced rotor impedance, Analysis of I.M fed from non-sinusoidal voltage supply. Braking methods, Types of speed control, pole changing, Stator voltage control, variable frequency control, (V/F control), VVVF Control, slip speed control, VSI Controlled I.M drive, CSI control of drive, Comparison of CSI & VSI, Rotor Resistance control, slip power recovery scheme, Static Scherbius drive, Static Kramer drive.

**Unit-4****[8]****Advanced Control Techniques**

Vector Control of 3-ph Induction motor, Direct & Indirect Control, Direct Torque Control (DTC), space vector control.

**Textbooks :**

1. Electric drives: concepts and applications by Vedam Subrahmanyam ( McGraw Hill)
2. Fundamentals of Electric drive - 2<sup>nd</sup> edition by G. K. Dubey (Narosa Publication)

**Reference Books:**

1. Electric Motor Drives, Modelling, Analysis and Control by R. Krishnan (PHI Learning Pvt Ltd)
2. Thyristor DC Drives by P C Sen (john wiley)
3. Modern Power Electronics and AC drives by Bimal K Bose (PHI Learning Pvt Ltd)
4. Electric Drives by Ion Boldea & SayedNasar (Tayelor & Francis)
5. Electric Drives by N.K DE & P. K Sen, (PHI Learning Pvt Ltd.)
6. Theodore Wildi, "Electronical machines, drives and power systems", Sixth edition, Pearson Education.
7. Fundamentals of Electric Drives and Control by B.R Gupta & V. Singhal, (S.K Kataria & Sons Publisher).

**Question Paper Pattern:**

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**B.Tech. Sem. VI (Electrical Engineering)**

**EL410615N/EL410619 Electrical Machine Design-I**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	00	3	60	30	10	100

**Course Outcome:**

(Note: After completion of this course, the students are expected to ....)

- Study traditional methodologies for the analysis and the design of the electrical machines.
- Develop the knowledge about the calculation of total MMF in the machine and design of various electromagnets.
- Develop skills in designing various transformers and choke coils.
- Compare out power torque parameters for different size machine.
- Calculate the heat losses, core losses and mechanical losses of dc /induction/synchronous machine.

**Subject Contents**

**Unit-1**

**General Aspects**

**[10]**

Insulating Materials & Classifications, heating of electrical machines , Cooling of Transformer and rotating machines, Electrical and Magnetic Loading , output coefficient, factor affecting size of machines, selection of B av & ac, Duty cycle and equivalent ratings.

**Design of Transformer: (Constructional Details)**

Types of transformers, position of HV and LV windings, core and yoke cross sectional area, importance of mitered joints. Different types of transformers windings. Different methods for cooling of transformer, Different positions of tapings.

**Unit-2**

**Design of Transformer: (Design Details)**

**[15]**

Output equation for 3 phase transformers, window space factor, factors affecting window space factor. Relation between emf per turn and transformer rating, factors affecting constant K, stacking factor, examples. Selection of flux density and current density, Window dimensions, Yoke dimensions and overall core dimension calculations, examples. Design of HV and LV windings (No. of turns and area of cross section). Estimation of operating characteristics.

Primary and secondary winding resistance. Leakage reactance calculation of only cylindrical coil with equal height, Leakage reactance of unequal windings and heights, only formula. No load current calculations for 3 phase transformers. Temperature rise of transformer, design of tank with tubes, calculation of dimension of tank, examples. Optimum design Design for minimum cost. Design for minimum loss. Variation of output and losses in transformer with linear dimensions. Dry transformer, high frequency transformer

### **Unit-3**

#### **Design of D.C. Machines: [10]**

Introduction, output equation, mmf calculation Selection of Number of poles, core length, armature diameter, Carter's fringing curves, length of air gap, examples on above topics costing

#### **Armature design**

Choice of armature winding, armature conductor, number of armature slots, slot dimensions, slot loading, design of armature core, Problems on above topics, costing

### **Unit-4**

#### **Design of field systems: [10]**

Pole design, design of field winding of shunt, series and compound machines, examples, Design of interpole, effects and minimization armature reaction Design of Commutator and brushes, Improvement in commutation, Performance calculation & Design consideration for large machines, HV machines and miniature DC motors

#### **Design of current transformers**

Introduction, construction Design principles OF C.T & P.T. , winding design, Behavior of transformer under normal and abnormal condition.

#### **Text Book(s)**

1. Sawhney, A.K. "A Course in Electrical Machine Design", DhanpatRai and Sons, New Delhi.
2. Sen, S.K., "Principles of Electrical Machine Design with Computer Programmes," Oxford and IBH Publishing Co. Pvt Ltd., New Delhi, 1987.

#### **Reference Books**

1. Upadhyay, K.G., "Design of Electrical Machine," New Age International Publishers, New Delhi.
2. V.N.Mittle&A.Mittal."Design of Electrical Machines" Standard Publishers Distributors, Delhi-32.

#### **Question Paper Pattern :**

Question paper will contain 8 questions (two full questions distributed in four units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

**INDUS UNIVERSITY**  
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**Department of Electrical Engineering**

**B.Tech. Sem. VI (Electrical Engineering)**

**EL410605 Microcontrollers & Applications**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	00	3	60	30	10	100

**Course Outcome:**

- Getting familiar with the architecture of 8051 family microcontrollers.
- Learn the assembly and embedded C language Programming of 8051.
- Learn the interfacing of microcontroller and based on that develop various Application using Microcontroller.

**Subject Contents**

**Unit -1** **[11]**

**Introduction to 8051 Microcontroller:**

Introduction, Difference between Microprocessors and Microcontrollers. Overview of 8051 Microcontroller family. Overview of PIC, ARM, AVR microcontrollers.

**Architecture of 8051 Microcontroller:**

Introduction, 8051 microcontroller hardware, Pin diagram of 8051, input/output pins, ports and circuits. Internal RAM and ROM, SFR's, interfacing with external memory, timers and counters, interrupts, Serial data communication (UART).

**Unit -2** **[11]**

**8051 Assembly language Programming:**

Addressing modes, data transfer instructions, Logical instructions, Arithmetic instructions, Branching (Jump & Call) instructions, Bit addressable instructions and special instructions, Interrupts and interrupt handler sub routines (Interrupt Service Routines).

**Unit -3** **[12]**

**8051 Programming in Embedded C:**

Introduction, Data types in embedded C, arithmetic and logical operators, Control statements and loops in embedded C, Functions and Arrays in embedded C. Programming of input/ output ports, Programming of Timer & counters, writing interrupt service routines in Embedded C, Programming of UART in embedded C.

**8051 Interfacing:**

Introduction, Interfacing and C programming of 8051 with keyboard, Interfacing and C programming of 8051 with 7-segment display, Interfacing and C programming of 8051 with LCD display, Interfacing and C programming of 8051 with ADC-DAC and sensors.

**Text Books:**

1. The 8051 Microcontroller and embedded systems using Assemble and C. by – Muhammad Ali Mazidi and Janice Gillipse Mazidi( Pearson Education).

**Reference Books:**

1. The 8051 Microcontroller Architecture, Programming & Applications by- Kenneth J. Ayala (Penram International)
2. Programming and Customizing the 8051 Microcontroller by MykePredko Tata Mcgraw Hill.
3. 8051 Microcontrollers: MCS51 family and its variants by Satish Shah, Oxford University Press.
4. The 8051 Microcontroller & Embedded systems using Assembly and C. by – K. J. Ayala, D.V. Gadre ( Cengage Learning, India Edition).

**Question Paper Pattern :**

Question paper will contain 8 questions (two full questions distributed in four units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

**INDUS UNIVERSITY**  
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**B.Tech. Sem. VI (Electrical Engineering)**

**EL410604 Power System Analysis**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
60	00	00	4	60	30	10	100

**Course Objective:**

After completion of this course, expected outcome from the students,

- To study short circuit symmetrical and unsymmetrical condition.
- To study power flow Analysis using different mathematical methods.

**Subject Contents**

**Unit-1** **[16]**

**Load Flow Study:**

Importance, Power flow equation, bus classification, problem formulation & constraint, methods of load flow study, Gauss-Seidel method, Newton-Raphson method, Decouple method & fast decouple method, comparison, algorithms.

**Unit-2** **[14]**

**Power System Stability:**

Stability concept, steady-state stability, swing equations, multi-machines, equal area criteria, critical clearing angle and critical clearing time, transient disturbance, solution of swing equation, numerical methods, transient stability, factors affecting transient stability, improving system stability methods.

**Unit-3** **[14]**

**Symmetrical Fault Analysis:**

Per Unit System, Reactance Diagram, Fault, sources of fault power, percentage reactance, base KVA, switching operation of R-L circuit, three-phase short-circuit on three-phase alternator, Algorithms for short circuit studies. Fault limiting reactor- types, construction, methods of locating reactors.

**Unit-4** **[16]**

**Symmetrical Component:**

Properties of symmetrical components, sequence components, their relation, star-delta transformer, symmetrical component for unsymmetrical faults.

**Unsymmetrical Fault Analysis:**

Faults, types, sequence impedance & network, sequence network for synchronous machine, transmission line, transformers, various faults at unloaded generators, three-phase L-G, L-L, L-L-G, open conductor fault, bus impedance matrix method for analysis of unsymmetrical faults

**Reference Books:**

1. Power System Analysis, Prabhakundur
2. Power System Analysis & Design, B. R. Gupta, Wheeler
3. Modern Power System Analysis, I. J. Nagrath & D. P. Kothari, TMH
4. Elements Power System Analysis, W. D. Stevenson, TMH
5. A Text Book of Power System Engineering, Sony, Gupta, Bhatnagar and Chakraborty, Dhanpat Rai
6. Power System Analysis, M. A. Pai, TMH
7. Power System Analysis, Hadi Sadat, TMH

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**B.Tech. Sem VI (Electrical Engineering)**  
**Elective -II**  
**EL410611 Energy Management and Audit**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	30	4	60	30	10	100

**Course Outcome:**

- To study the concepts behind economic analysis and load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

**Subject Contents**

**Unit - 1** **[11]**

**Introduction**

Need for energy management–energy basics–designing and starting an energy management program – energy accounting – energy monitoring, Targeting and reporting–energy audit Process

**Unit - 2** **[12]**

**Energy Cost and load Management**

Important concepts in an economic analysis–economic models–time value of money –utility rate structures – cost of electricity –loss evaluation. Load management: demand control techniques – utility monitoring and control system- HVAC and energy management – economic justification.

**Unit - 3** **[10]**

**Energy audit for motors, Systems and Electrical Equipments**

Systems and equipment – electric motors – transformers and reactors – capacitors and synchronous machines.

**Unit - 4** **[12]**

**Metering For Energy Management**

Relationships between parameters–Units of measure–typical cost factors– utility meters– timing of meter disc for kilowatt measurement–demand meters–paralleling of current transformers–instrument transformer burdens –Multitasking solid-state meters – metering location vs. requirements –Metering techniques and practical examples.

**Reference Books:**

1. Eastop T.D, Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.
2. Reay D. A. “Industrial Energy Conservation”, first edition, Pergamon Press, 1977.
3. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 1996.

**Question Paper Pattern :**

Question paper will contain 8 questions (two full questions distributed in four units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

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**B. Tech. Sem VI (Electrical Engineering)**

**Elective -II**  
**EL410612 Modern Control Theory**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	30	4	60	30	10	100

**Course Outcome:**

- Learn the analysis & design of nonlinear control system.
- Learn the state variable analysis and its representation.

**Subject Contents**

**Unit-1**

**[10]**

**State variable analysis:**

Introduction, concepts of state, state variables and state model, state-space representation for linear continuous-time systems and discrete-time systems. Time domain solution of state equations: Solution of homogeneous state equations, state transition matrix, methods for evaluation of matrix exponential ( $e^{At}$ ), solution of non-homogeneous state equations.

**Unit-2**

**[12]**

**State-space representation:** State-space representation of high-order differential equations, state space representation of transfer function in controllable, observable and diagonal form, relationship between state equations and transfer function. Signal flow graph of state equations, decomposition of transfer function, diagonalization, eigen values and eigen vectors, modal matrix.

**Controllability and observability:** Concepts, alternative tests on controllability and observability, relationship between controllability, observability and transfer function, pole placement by state feedback, design of state feedback controller.

**Unit-3**

**[11]**

**Nonlinear Control Systems and Analysis**

Introduction, Definition of nonlinear systems, Difference between linear and nonlinear systems, Characteristics of nonlinear systems, limit cycle, jump resonance, Common physical nonlinearities.

**Phase Plane Analysis:** Phase plane method- basic concept, phase trajectories, phase portrait, singular points and their types/classification, Construction of phase trajectories using isocline method, delta method.

**Describing Function (DF) Analysis:**

Derivation of general DF, DF of common non-linearities, Stability analysis of nonlinear system by DF method, Prediction and stability of limit cycle, DF of Relay(on-off), Dead-zone, Hysteresis, Saturation and Friction-controlled Backlash.

**Text Books:**

1. M. Gopal, "Modern Control System Theory", Wiley Eastern Ltd., New Delhi.
2. M. Gopal, "Digital control & state variable method", PHI
3. K.Ogata,"Modern Control Engineering",3rd.ed. Prentice Hall of India(P)Ltd., New Delhi.
4. U.A. Patel "Control System Engineering", Mahajan Publication.

**Reference Books:**

1. GeneF. Franklin, J David Powell, Abbas Emami-Naeini, Feedback Control of Dynamic systems, 5<sup>th</sup>ed Pearson Educations.
2. Shankar Sastry, Marc Bodson, "Adaptive Control", Prentice Hall of India (P) Ltd., 1993.
3. John Doyle, Bruce Francis, Allen Tannenbaum, "Feedback Control Theory"
4. Ken dutton, Steve Thompson & Bill, "The art of control engineering".

**Question Paper Pattern :**

Question paper will contain 8 questions (two full questions distributed in four units) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit.

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**B.Tech. Sem VI (Electrical Engineering)**  
**Elective –II**

**EL410613 Digital Signal Processing**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
45	00	30	4	60	30	10	100

**Course Outcome:**

- To understand the analysis of signals in digital domain & its application
- To learn the Filter Design
- To understand the Architecture of the DSP Processor

**Subject Contents**

**Unit - 1** **[14]**

**Analysis of Signals**

Fourier Series (Trigonometric and exponential), Fourier Transform Convolution concept, Sampling theorem, Analog to digital Conversion, Discrete time signals, Analysis of Discrete time systems, Z transform, inverse Z transform with properties.

**Analysis of Signals in Digital Domain**

Discrete Fourier Transform (DFT) and inverse DFT, FFT algorithm, frequency analysis of discrete time signal, power density, energy density.

**Unit - 2** **[10]**

**FIR Filter:**

Symmetric, Anti-symmetric Filter design using windows, frequency sampling techniques, brief idea about alternation theorem and equi-ripple filter, design structure-direct form and cascade form, structure realization.

**Unit -3** **[10]**

**IIR Filter:**

Basic concepts of analog filter design using Butterworth and chebyshev applications IIR filter design methods such as impulse invariance, bilinear transform, frequency warping concept, frequency transformations, filter structures, A) Direct Form B) Parallel form C) Cascade form.

**Basics of DSP architecture:**

Introduction to programmable DSPs, multiplier and multiplier accumulator, modified bus structures and memory access schemes, multi-ported memory, pipelining, VLIW architecture, on-chip peripherals, Effect of finite word length, recent trends in DSP system design, overview of Multimedia Applications Platform (OMAP), Evolution of FPGA based DSP system design

**Text Books:**

1. Digital Signal Processing–John Proakis and Manolakis (Prentice Hall of India Pvt .Ltd.)
2. Digital Signal Processing-A Computer based approach–S. K .Mitra (Tata McGraw Hill Publication)
3. Digital Signal Processors-B. Venkat Ramaniand Bhasker (Tata Mc Graw Hill Publishing Co., New Delhi)

**Reference Books:**

1. Discrete– time signal processing–A. V. Oppenheim, Schafer, Buck(Pearson Prentice Hall)
2. Signals and Systems–A. V. Oppenheim, Willisky (Prentice Hall of India Pvt .Ltd.)

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**EL410607 High Voltage Engineering Lab**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
00	30	00	1	60	00	40	100

**Laboratory Experiment List**

Sr.No.	Index
1.	To study of High voltage Laboratory.
2.	To Determine the Dielectric Strength of Transformer Oil.
3.	Determination of Breakdown Voltage for Different Types of Insulating Materials.
4.	To Determine the Break down Characteristics of Air for Different shapes of Electrodes.
5.	To Study the components, control and operation of 300kV, 3kJ Impulse Generator & Observe the Impulse Wave form on Digital Storage Oscilloscope.
6.	Study of Horn Gap Type Lighting Arrester.
7.	Testing of Pin type Insulator.
8.	To Study the Effect of Movement of Impurities in Liquid Dielectric.
9.	Electric Field Plotting using Electrolytic Tank.
10.	To Understand Partial Discharge Measurement.

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**B.Tech. Sem. VI (Electrical Engineering)**

**EL410608 Electrical Drives & Control Lab**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
00	30	00	1	60	00	40	100

**Laboratory Experiment List**

Sr. No.	Index
1	To study the operation of a DC Drive.
2	To study the operation of AC Drive
3	To study V/f control of Induction motor using IPM PEC16DSMO1 module & Micro-2407 trainer kit.
4	Develop a MATLAB program, to plot torque-speed characteristics of poly phase Induction motor.
5	Develop a MATLAB program, to plot torque-speed characteristics of stator voltage controlled induction machine.
6	Develop a MATLAB program, to plot torque-speed characteristics of Variable voltage variable frequency controlled induction machine.
7	Develop a MATLAB program to plot torque-speed characteristics of single phase half controlled rectifier fed separately excited DC machine.
8	Develop a MATLAB program to plot torque-speed characteristics of single phase fully controlled rectifier fed separately excited DC machine.
9	Analyze the speed control of DC motor drive in armature voltage control mode of operation using MATLAB Simulink
10	Analyze the open loop control of stator voltage control of induction motor drive using MATLAB Simulink.

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**EL410614 Microcontrollers & Application Lab**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
00	30	00	1	60	00	40	100

**Laboratory Experiment List**

Sr. No.	Index
1	Introduction to 8051 keil $\mu$ -vision4 Simulator and Trainer Kit.
2	Assembly Level Programming based on Arithmetic operation.
3	Assembly language programming based on data transfer and branch operation.
4	Assembly level programming based on data transfer, logical and branch operations.
5	Simulate program based on I/O operations.
6	Simulate Program based on Timer in 8051
7	Simulate Program based on Embedded C.
8	Generate PWM using 8051 microcontroller.
9	Simulate Program based on serial communication.
10	Interface 16x2 LCD with 8051.
11	Interface DAC with 8051
12	Interface ADC with 8051

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**B.Tech. Sem. VI (Electrical Engineering)**

**EL410616 ELECTRICAL MACHINE DESIGN-1 LAB**

Teaching Scheme				Examination Scheme			
Class Room Contact Hrs	Practical	Activity Based Learning	Credits	University Examination	Mid Sem Examination	Continuous Evaluation	Total Marks
00	30	00	1	60	00	40	100

**Laboratory Experiment List**

Sr. No.	Title
1.	Introduction to Electrical machine design
2.	Sketches of components of D.C. machine
3.	Sketches of components of Transformer
4.	Designing of D.C. Machine in drawing sheet
5.	Designing of Transformer in drawing sheet
6.	Designing of Current Transformer in drawing sheet