COURSES SCHEME

&

SYLLABUS

FOR

B.E.

ELECTRICAL ENGINEERING

2013

Applicable from July 2013 to electrical engineering program

ENGINEERING DEPARTMENTS –COURSE SCHEME (ELE)

COURSES SCHEME & SYLLABUS FOR B.E. (ELECTRICAL ENGINEERING)

SEMESTER – I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UCB002	Chemistry Lab	0	0	3	1.5
2.	UEE101	Electrical Science	3	1	2	4.5
3.	UEI403	Electrical and Electronic Measurements	3	1	2	4.5
4.	UEN001	Environmental Studies	3	0	0	3.0
5.	UTA002	Manufacturing Processes	2	0	3	3.5
6.	UMA001	Mathematics I	3	1	0	3.5
7.	UPH001	Physics	3	1	2	4.5
		Total Credits	17	4	12	25.0

SEMESTER – II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UES003	Applied Mechanics	3	1	2	4.5
2.	UHU001	Communication Skills	2	0	2	3.0
3.	UTA003	Computer Programming	3	0	2	4.0
4.	UTA001	Engineering Graphics	2	4	0	4.0
5.	UMA002	Mathematics-II	3	1	0	3.5
6.	UES004	Thermodynamics	3	1	0	3.5
		Total Credits	16	7	6	22.5

SEMESTER – III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEI201	Analog Electronics Devices and Circuits	3	1	2	4.5
2.	UEE301	Direct Current Machines and Transformers	3	1	2	4.5
3.	UEE302	Electro Magnetic Field Theory	3	1	0	3.5
4.	UMA031	Optimization Techniques	3	1	0	3.5
5.	UHU031	Organizational Behaviour	3	1	0	3.5
6.	UEE303	Power Generation and Associated Economics	3	1	0	3.5
7.	UEI303	Techniques on Signal and Systems	3	1	0	3.5
		Total Credits	21	7	4	26.5

SEMESTER – IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEE401	Alternating Current Machines	3	1	2	4.5
2.	UEI301	Digitial Electronics	3	1	2	4.5
3.	UES031	Fluid Mechanics	3	1	2	4.5
4.	UHU032	Human Values, Ethics and IPR	3	0	0	3.0
5.	UMA032	Numerical and Statistical Methods	3	1	2	4.5
6.	UEE402	Transmission and Distribution of Power	2	1	0	2.5
7.		Elective-I	3	1	0	3.5
		Total Credits	20	6	8	27.0

SEMESTER – V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEI501	Control Systems	3	1	2	4.5
2.	UEE501	Generalized Theory of Electrical Machines	3	1	0	3.5
3.	UEE502	High Voltage Engineering	3	0	2	4.0
4.	UEE503	Network Analysis and Synthesis	3	1	0	3.5
5.	UEE504	Power Electronics	3	1	2	4.5
6.		Elective-II	3	1	0	3.5
7.	UEE591	Summer Training (6 Weeks after 2nd year during summer vacation)	0	0	0	4.0
		Total Credits	18	5	6	27.5

SEMESTER – VI

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEI841	Advanced Control Systems	3	1	0	3.5
2.	UEI503	Digital Signal Processing and Applications	3	1	0	3.5
3.	UEE601	Flexible AC Transmission Systems	3	0	0	3.0
4.	UEI504	Microprocessor and Applications	3	1	2	4.5
5.	UEE602	Power System Analysis and Stability	3	1	0	3.5
6.	UEE603	Switchgear and Protection	3	0	2	4.0
7.		Elective-III	3	1	0	3.5
		Total Credits	21	5	4	25.5

SEMESTER – VII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEE801	Electric Drives	3	1	2	4.5
2.	UHU081	Engineering Economics	3	1	0	3.5
3.	UEE802	Intelligent Algorithms in Power Systems	3	0	2	4.0
4.	UEE804	Operation and Control of Power Systems	3	1	2	4.5
5.		Elective-IV	3	1	0	3.5
6.	UEE 793	Capstone Project	-	-	2	5.0
		Total Credits	15	4	8	25.0

SEMESTER – VIII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEE791	Project Semester	-	-	-	16.0
OR						
ALTERNATE PROJECT SEMESTER						
1.	UEE792	Project	-	-	-	6.0
2.	UEE712	Electrical Engineering Materials	3	1	0	3.5
3.	UPH061	Modern Physics	3	1	0	3.5
4.	UEE711	Alternate Sources of Energy	3	0	0	3.0
		Total Credits	9	2	0	16.0

ELECTIVE-I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR

1.	UCS401	Computer System Architecture	3	1	0	3.5
2.	UEI622	Data Networks	3	1	0	3.5
3.	UEI623	Object Oriented Programming and Applications	2	1	2	3.5
4.	UEI511	Principles of Communication Engineering	3	1	0	3.5
5.	UHU033	Total Quality Management	3	1	0	3.5

ELECTIVE-II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEE521	Electric Machine Design	3	1	0	3.5
2.	UEE522	Energy Auditing and Management	3	1	0	3.5
3.	UEE523	High Voltage Transmission Systems	3	1	0	3.5
4.	UEE524	Power Quality Monitoring and Conditioning	3	1	0	3.5
5.	UMA064	Advanced Engineering Mathematics	3	1	0	3.5

ELECTIVE-III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UCS048	Data Structures and IT	3	1	0	3.5
2.	UCE611	Finite Elements Methods in Engineering Analysis	3	1	0	3.5
3.	UMA062	Graph Theory and Applications	3	1	0	3.5
4.	UTA004	Information Technology	2	1	2	3.5
5.	UPH062	Nano Science and Nano Materials	3	1	0	3.5

ELECTIVE-IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEE841	Industrial Electronics	2	1	2	3.5
2.	UEE845	Microcontrollers and Applications	3	1	0	3.5
3.	UEE842	Power System Instrumentation	3	1	0	3.5
4.	UEE843	Power System Planning	3	1	0	3.5
5.	UEI512	Robotics and Related Instrumentation	3	1	0	3.5
6.	UEE844	Transients in Power Systems	3	1	0	3.5
7.	UEE803	Load Dispatch and Communication	3	1	0	3.5

TOTAL CREDITS: 195

Course Syllabi: UEE101 Electrical Science (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE101; Electrical Science

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (2008) 10thed.*
   - *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).*
   - *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill (2007).*
   - *Chakraborti, A., Basic Electrical Engineering, Tata McGraw–Hill (2008).*
   - *Del Toro, V., Electrical Engineering Fundamentals, Prentice–Hall of India Private Limited (2004).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Basic electrical quantities, Electric circuit sources and Circuit elements and their behavior (Active and Passive).

   Supply Systems: AC Supply System (Single Phase, Three Phase–Three Wire, Three Phase–Four Wire), DC Supply System, Their Specifications and Comparison. D.C. Networks: Mesh and Nodal Analysis, Star-Delta Transformation, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman's Theorem, Duality, Tellegen's Theorem.

   Sinusoidal Steady-State Response of Circuits: Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Series and Parallel circuits, Power and Power factors, Resonance in Series and Parallel circuits, Balanced 3-phase Voltage, Current and Power relations, Unbalanced 3-phase Circuits, 3-phase Power Measurement.

   Magnetic Circuits: Concept of Magnetic Circuits, Magnetic Field due to Steady Electric Current, Magnetic Flux, Flux Density and Magnetic Field Intensity, Interaction of Currents and Fields, B–H Curve, Calculation of Magnetic Circuits, Iron Losses, AC Excitation of Magnetic Circuit, Leakage Flux, Fringing and Stacking, Energy Stored in Magnetic Fields.

   Electromagnetic Induction: Faraday's Law, Self and Mutual Inductance, Dot Convention, Equivalent Inductance, Energy Stored in Electric Fields.

   Energy Conversion Principle: Concept of Co-Energy, Coupling-Field Reaction for Energy Conversion, Mechanical Work, Mechanical Forces and Torques in Singly and Doubly Excited Systems, Concepts of Reluctance and Electromagnetic Torques, Singly Excited Electric Field Systems.

   Single-Phase Transformers: Constructional Feature, EMF Equation, Ideal Transformer, Phasor Diagram, Definition of Voltage Regulation and Efficiency.

   Rotating Electrical Machines: Construction, Operating Principles and Applications of DC Generator, DC Motor, Three Phase Induction Motor and Single Phase Induction Motors.

   Electrical safety and Wiring: Electrical Safety and Standards, House Hold Wiring and Electric Appliances.

   Energy Management: Conservation efforts, Auditing.

Laboratory Work: Kirchhoff's Laws, Network Theorems, A.C. Series and Parallel Circuits, Resonant Circuit, Measurement of Power 3 Phase Circuits, Reactance Calculation of Variable Reactance Choke Coil, Identification and Testing of Devices (R, L, C, Diode), Use of Diode as Rectifier.

5. Specific goals for the course

After the completion of the course, the students will be able to:

- Compute reliably the performance of DC networks and distinguish various supply systems.
- Represent AC quantities through phasors and compute AC system behaviour during steady state.
- Comprehend magnetic circuits analysis and energy conversion principles for different electric systems.
- Realize the importance of transformer in AC systems and calculate the voltage regulation and efficiency of transformers.
- Compare the characteristics and operational aspects of various electric motors and shall choose as per the application.
- Observe and conform the electric safety aspect and conservation efforts.

6. Brief list of topics to be covered

- Supply systems
- Steady state response of circuits
- Magnetic circuits
- Energy conversion
- Single phase transformer
- Rotating electrical machines

Course Syllabi: UEI403 Electrical and Electronic Measurements (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEI403; Electrical and Electronic Measurements

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Golding, E.W., and Widdis, F.C., Electrical Measurements and Measuring Instruments, Pitman (2003).*
   - *Helfrick, A.D., and Cooper, W.D., Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India (2007).*
   - *Kalsi, H.S., Electronic Instrumentation, Tata McGraw-Hill (2007) 2nd ed.*
   - *Nakra, B.C., Chaudhry, K.K., Instrumentation Measurement and Analysis, Tata McGraw-Hill (2003) 2nd ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Units, Systems and Standards: Review of System of Units, SI Units, Classification of Standards, Time and Frequency Standards, Electrical Standards: Standards of Emf and Resistance, Frequency Dependence of Resistance, Inductance and Capacitance.
   Electromechanical Indicating Instruments: PMMC Galvanometer, Ohmmeter, Electrodynamometer, Moving Iron Meter, Rectifier and Thermo-Instruments, Comparison of Various Types of Indicating Instruments.
   Power and Energy Measurement: Electrodynamometer Type of Wattmeter and Power Factor Meter, Power in Poly Phase System: Two Wattmeter Method, Single-Phase Induction and Electronic Energy Meters.
   Bridge Measurements: Wheatstone Bridge and its Sensitivity Analysis, Kelvin Double Bridge, AC Bridges: Applications and Conditions for Balance, Maxwell's Bridge, Hay's Bridge, Schering Bridge, Wien's Bridge, De Sauty's Bridge, Insulation Testing, Ground Resistance Measurement, Varley and Murray Loop Test.
   Instrument Transformers: Current and Voltage Transformers, Constructional Features, Ratio and Phase Angle Errors.
   Magnetic Measurements: Determination of B-H Curve and Hysteresis Loop, Measurement of Iron Losses with Llyod Fisher Square.
   Electronic Instruments: Basic Principle and Advantages, D.C. Voltmeter with Direct Coupled Amplifier, Chopper Stabilized Amplifier, Electronic Multimeter, Digital Voltmeters, General Characteristics Ramp Type Voltmeter, Quantization Error, Digital Frequency Meter/Timer, Q Meter and its Applications, Distortion Meter, Wavemeter and Spectrum Analyzer, Oscilloscopes: Block Diagram, CRT, Electrostatic Deflection, CRT Circuits, Multi-Beam and Multitrace Oscilloscopes, Applications of Oscilloscopes, Storage Type Digital Oscilloscopes.
   Laboratory Work: Experiments Around Sensitivity of Wheat Stone Bridge, Comparison of Various Types of Indicating Instruments, Single-Phase Induction Type Energy Meter, Kelvin Double Bridge, AC Bridges, Measurement of Iron Losses with Llyod Fisher Square, Storage Type Digital Oscilloscopes.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Distinguish various Electromechanical Indicating Instruments.
   - Describe the role of Instrument Transformers.
   - Explain the working and application of various electronic instruments such as CRO, Spectrum Analyzer etc.
   - Apply AC and DC Bridges for various measurements.

6. **Brief list of topics to be covered**

   - Electromechanical Indicating Instruments
   - Power and Energy Measurement
   - Bridge Measurements
   - Instrument Transformers
   - Magnetic Measurements
   - Electronic Instruments

Course Syllabi: UEN001 Environmental Studies (L : T : P :: 3 : 0 : 0)

1. **Course number and name:** UEN001; Environmental Studies

2. **Credits and contact hours:** Credits: 3.0; Hours: 3

3. **Text book, title, author, and year**

   - *Bharucha, E., Textbook of Environmental Studies, Universities Press (2005).*
   - *Chapman, J.L. and Reiss, M.J., Ecology- Principles and Application, Cambridge University Press (LPE) (1999).*
   - *Joseph, B., Environmental Studies, Tata McGraw-Hill (2006).Miller, G.T., Environmental Science- Working with Earth, Thomson (2006).*
   - *Wright, R.T., Environmental Science-Towards a sustainable Future, Prentice Hall (2008) 9thed.*

   b. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Definition and Scope: Importance, Public awareness and education.
   Natural Resources: Introduction, Renewable and Non-Renewable, Forest, Water, Mineral, Food, Energy and Land Resources, Individual and Conservation of Resources, Equitable Use of Resources.
   Ecosystems: Concept, Structure, Function, Energy Flow, Ecological Succession, Forest, Grassland, Desert and Aquatic Ecosystems - Introduction, Characteristic Features, Structure and Function.
   Biodiversity: Genetic, Species and Ecological Diversity, Biogeographical Classification of India, Value and Hot Spots, Biodiversity At Global, National and Local Levels, India As Mega-Biodiversity Nation, Threats to Biodiversity, Endangered and Endemic Species of India, Conservation of Biodiversity, Endangered and Endemic Species, Conservation of Biodiversity.
   Pollution: Definition, Causes, Effects and Control Measures of The Pollution – Air, Soil, Noise, Water, Marine and Thermal and Nuclear Pollution, Solid Waste Management, Role of Individual in Prevention of Pollution, Pollution Case Studies, Disaster Management.
   Social Issues: Sustainable Development, Water Conservation, Environmental Ethics, Climatic Change, Wasteland Reclamation, Environmental Protection Acts and Issues.
   Human Population and The Environment: Population Growth, Environment and Human Health, Human Rights, HIV/AIDS, Value Education, Women and Child Welfare, IT in Human Health and Environment, Case Studies.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Define the environmental issues pertaining to day-to-day living.
   - Explain the importance of the conserving energy and environmental resources.
   - Elaborate the need for intellectual property associated with endemic and valuable biological resources.
   - Describe the causes and consequences of pollution.

- Elucidate the diverse variety of social issues associated with environmental deterioration.

6. **Brief list of topics to be covered**
    - Natural Resources
    - Biodiversity
    - Eco systems
    - Pollution
    - Social issues
    - Human population and environment

Course Syllabi: UTA002 Manufacturing Processes (L : T : P :: 2 : 0 : 3)

1. **Course number and name**: UTA002; Manufacturing Processes

2. **Credits and contact hours**: Credits: 3.5; Hours: 5

3. **Text book, title, author, and year**

   - *Degarmo, E. P., Kohser, Ronald A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2008) 8thed.*
   - *Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Dorling Kingsley (2006) 4thed.*
   - *Martin, S.I., Chapman, W.A.J. , Workshop Technology, Vol.1 & II, Viva Books (2006) 4th ed.*
   - *Zimmer, E.W. and Groover, M.P., CAD/CAM - Computer Aided Designing and Manufacturing, Dorling Kingsley (2008).*
   - *Pandey, P.C. and Shan, H. S., Modern Machining Processes, Tata McGraw Hill (2008).*
   - *Mishra, P. K., Non-Conventional Machining, Narosa Publications (2006).*
   - *Campbell, J.S., Principles of Manufacturing, Materials and Processes, Tata McGraw Hill Company (1999).*
   - *Lindberg, Roy A., Processes and Materials of Manufacture, Prentice Hall of India (2008) 4thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Introduction: Common Engineering Materials and Their Important Mechanical and Manufacturing Properties. General Classification of Manufacturing Processes.
   Metal Casting: Principles of Metal Casting, Patterns, Their Functions, Types, Materials and Pattern Allowances, Characteristics of Molding Sand, Types of Cores, Chaplets and Chills; Their Materials and Functions. Moulds and Their Types. Requisites of a Sound Casting. Introduction to Die Casting.
   Metal Forming and Shearing: Forging, Rolling, Drawing, Extrusion, Bending, Spinning, Stretching, Embossing and Coining. Die and Punch Operation in Press Work, Shearing, Piercing and Blanking, Notching, and Lancing.
   Machining Processes: Principles of Metal Cutting, Cutting Tools, Their Materials and Applications, Geometry of Single Point Cutting Tool. Cutting Fluids and Their Functions, Basic Machine Tools and Their Applications. Introduction to Non-Traditional Machining Processes (EDM, USM, CHM, ECM, and LBM).
   Joining Processes: Electric Arc, Gas, Resistance and Thermit Welding, Soldering, Brazing and Braze Welding, Adhesive Bonding, Mechanical Fastening (Riveting, Screwing, Metal Stitching, Crimping Etc.)
   Plastic Processing: Plastics, Their Types and Manufacturing Properties, Compression Molding, Injection Molding and Blow Molding.
   Modern Trends in Manufacturing: Introduction to Numerical Control (NC) and Computerized Numerical Control (CNC) Machines, Programmable Automation (FMS, CIM, Etc.)

Laboratory Work: Relevant Shop Floor Exercises Involving Practice in Pattern Making, Sand Casting, Machining, Welding, Sheet Metal Fabrication Techniques, Fitting Work, and Surface Treatment of Metals. Demonstration of Forge Welding, TIG/MIG/GAS/Spot/Flash Butt Welding, Demonstration on Shaper, Planer, and Milling Machine.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Identify and understand the basic manufacturing processes like single and multipoint machining, forming, welding, casting etc.
   - Acquire basic operational skills in different manufacturing processes like machining, forming, welding, casting, sheet metal operations, pattern making etc.

6. **Brief list of topics to be covered**

   - Metal casting
   - Metal forming and shearing
   - Machining process
   - Joining process
   - Plastic processing

Course Syllabi: UMA001Mathematics-I (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA001; Mathematics-I

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007) 9thed.*
   - *Stewart James, Essential Calculus; Thomson Publishers (2007) 6thed.*
   - *Wider David V, Advanced Calculus: Early Trancedentals, Cengage Learning (2007).*
   - *Apostol Tom M, Calculus, Vol I and II John Wiley (2003).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Successive Differentiation: Higher Order Derivatives, Nth Derivatives of Standard Functions, Nth Derivatives of Rational Functions, Leibnitz Theorem.
   Applications of Derivatives: Mean Value Theorems and Their Geometrical Interpretation, Cartesian Graphing Using First and Second Order Derivatives, Asymptotes and Dominant Terms, Graphing of Polar Curves, Polar Equations for Conic Sections.
   Sequences and Series: Introduction to Sequences and Infinite Series, Tests for Convergence/Divergence: Limit Comparison Test, Ratio Test, Root Test, Cauchy Integral Test, Cauchy Condensation Test. Alternating Series, Absolute Convergence and Conditional Convergence.
   Series Expansions: Power Series, Taylor Series, Convergence of Taylor Series, Error Estimates, Term by Term Differentiation and Integration, Multiplication and Division Process in Power Series.
   Partial Differentiation: Functions of Several Variables, Limits and Continuity, Chain Rule, Change of Variables, Partial Differentiation of Implicit Functions, Taylor Series of Two Variables, Directional Derivatives and Its Properties, Maxima and Minima by Using Second Order Derivatives.
   Multiple Integrals: Change of Order of Integration, Change of Variables, Applications of Multiple Integrals to Areas and Volumes.
   Vector Calculus: Differentiation and Integration of Vector Valued Functions, Velocity, Acceleration, Tangent, Principle Normal and Binormal Vectors, Curvature, Torsion and TNB Frame. Scalar and Vector Fields, Gradient, Divergence and Curl. Line Integrals, Work, Circulation and Flux. Green's Theorem in Plane, Gauss-Divergence and Stoke's Theorem (Without Proof).

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Apply the knowledge of calculus to plot graphs of functions, approximate functions and solve the problem of maxima and minima.
   - Evaluate multiple integrals and their application to engineering problems.

- Use vector analysis to calculate derivatives and integrals of vector-valued functions, relative positions, projections and work.
- Evaluate integral theorems of Green, Gauss & Stokes to find lines, surfaces & volumes.

6. Brief list of topics to be covered

- Successive differentiation
- Sequence and series
- Series expansion
- Partial differentiation
- Multiple integral
- Vector calculus

Course Syllabi: UPH001 Physics-I (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UPH001; Physics-I

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

- *David, J. G., Introduction to Electrodynamics, Pearson Education (2003).*
- *Ghatak, A., Optics, Tata McGraw Hill Publishing Co. Ltd, New Delhi (2006).*
- *Beiser, A., Concept of Modern Physics, Tata McGraw Hill Publishing Co. Ltd, New Delhi (2003).*
- *RajendranBaldev Raj and Palanichary P.V., Science & Technology of UltrasonicsIst Edition, Narosa Publications (2007).*
- *Schiff L. I., Quantum Mechanics, 3rd Edition MC- Graw Hill, (2007)*
- *Chattopadhyay D. and Rakshit P.C., Practical Physics, 7th Edition, New Central Book Agency (2002)*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Sound Waves: Introduction, Reverberation, Eyring's Formula, Absorption Coefficient, Conditions for Good Acoustical Design, Production and Detection of Ultrasonic Waves and Their Applications.
   Electromagnetic Waves: Introduction, Maxwell's Equations in Differential and Integral Forms, Concept of Displacement Current, Electromagnetic Wave Equations for Free Space, Conducting and Dielectric Medium, Poynting Theorem, Concept of Wave Guides.
   Light: Interference: Thin Films, Wedge-Shaped Films, Non-Reflecting Films, Newton Rings, Michelson Interferometer, Diffraction: Single, Double and Multiple Slits, Dispersive and Resolving Powers. Polarization, Its Production, and Detection.
   Quantum Mechanics: Origin of Quantum Hypothesis, De-Broglie Hypothesis of Matter Waves, Uncertainty Principle, Wave Function and Wave Mechanics, Schrodinger Equation: Steady State Form, Quantum Mechanical Operators, Expectation Value, One Dimensional Solutions: Zero Potential, Step Potential, Potential Barrier and Potential Well.
   Laser: Basic Concepts, Laser Properties, Laser Systems: Ruby, Nd:YAG, He-Ne, Excimer, and Semiconductor Lasers.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Mechanical vibrations and their applications as well as acoustics and their use in design of a hall.
   - Ultrasonic waves, Lasers as well as Interference, diffraction, and polarization and their industrial applications.
   - Maxwell's equations and their applications in deducing several important parameters in different media.
   - Quantum mechanics and its engineering applications.

6. **Brief list of topics to be covered**
    - Sound waves
    - Electromagnetic waves
    - Light
    - Laser
    - Quantum mechanics

Course Syllabi: UES003 Applied Mechanics (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UES003; Applied Mechanics

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Bhattacharya, B., Engineering Mechanics, Oxford University Press (2008).*
   - *Singh, D. K., Mechanics of Solids, Pearson Education Ltd. (2002).*
   - *Nanda, S., Basu, N. and Nayak, P. C., Introduction to Mechanics, Narosa Publishing House (1999).*
   - *Shames, I. H. and Piltarresi, J. M., Solid Mechanics, Prentice Hall of India (1993).*
   - *Crandall, S. H., Dahl, N. C. and Lardner, T. V. Mechanics of Solids: An Introduction, McGraw Hill International (1994).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Equivalent Force Systems: Vector Algebra, Planar Force Systems, Coplanar Collinear Forces, Concurrent Forces, Coplanar Parallel Forces, Basic Concepts of Force-Couple Systems, Varignon's Theorem, Simplest Equivalent for General Force System, Distributed Force Systems.
   Equations of Statics and Its Applications: Simple Frictionless Rigid Body Assemblies, Equations of Equilibrium, Free Body Diagrams, Support Reactions, Two-Force Members, Plane Trusses.
   Centre of Gravity, Mass and Area Moment of Inertia: Centroid of Simple and Built Up Section, Second Moment of Area.
   Axial Stress and Strain: Concept of Stress and Strain, Generalized Hooke's Law, Stress-Strain Diagram of Ductile and Brittle Materials, Properties of Engineering Materials, Statically Determinate and Indeterminate Problems, Compound and Composite Bars, Thermal Stresses.
   Torsion of Circular Shafts: Basic Assumptions, Torsion Formula, Power Transmitted by Shafts, Design of Solid Hollow Shafts Based on Strength and Stiffness.
   Shear Force and Bending Moment Diagrams: Types of Load on Beam, Classification of Beams, Shear Force and Bending Moment Diagrams: Simply Supported, Overhung and Cantilever Beams Subjected to Any Combination of Point Loads, Uniformly Distributed and Varying Load and Moment, Relationship Between Load, Shear Force and Bending Moment.
   Theory of Pure Bending: Derivation of Flexural Formula for Straight Beams, Bending Stress Calculation for Beams of Simple and Built Up Sections, Flitched Beams.
   Shear Stresses in Beams: Shear Stress Formula for Beams, Shear Stress Distribution in Beams.
   Analysis of Plane Stress and Strains: Transformation Equations for Plane Stress and Plane Strain, Mohr's Stress Circle, Relation Between Elastic Constants, Strain Measurements, Strain Rosettes.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Learn the concept of equivalent force systems related vector and scalar systems.
- Explain the equations of statics for free body diagrams.
- Learn the concept of centre of gravity, mass and moment of inertia.
- Analyze the concept of axial stress and strain, torsion of circular shafts, shear force and bending moment diagrams, and analysis of plane stress and strains.

6. **Brief list of topics to be covered**
    - Equivalent Force System
    - Stress and Strain
    - Gravity, Mass and Moment of Inertia
    - Equations of Statics
    - Torsion of Circular Shafts
    - Shear Force and Bending Moment Diagrams
    - Shear Stresses in Beams

Course Syllabi: UHU001 Communication Skills (L : T : P :: 2 : 0 : 2)

1. **Course number and name:** UHU001; Communication Skills

2. **Credits and contact hours:** Credits: 3.0; Hours: 4

3. **Text book, title, author, and year**

- *Sen, L., Communication Skills. Prentice Hall of India (2004).*
- *Dhar, M., The Funda of Mixology: What bartending teaches that IIM does not, Srishti Publications (2008).*
- *Narayan, R. K., Under the banyan tree and other stories. Penguin Classics. (2007).*
- *Board of Editors. Popular Short Stories, Oxford University Press. (2000).*
- *Lesikar R. V., and Flatley M. E., Basic Business Communication Skills for empowering the internet generation. Tata McGraw Hill (2004) 10th ed.*
- *Sharma R. C., and Mohan K., Business Correspondence and Report Writing. Tata Mc-Graw Hill (1994).*
- *Rodriques, M. V., Effective Business Communication. Concept Publishing Company. (2003).*

a. Other supplemental materials
   - Nil

4. **Specific course information**

a. Brief description of the content of the course (catalog description)

Fundamentals of Communication: Communication Defined, Models of Communication, Barriers in Communication, Perception and Communication, Essentials of Good Communication.

Modes of Human Communication: Basic Differences in The Principal Modes of Human Communication – Reading, Writing, Listening, Speaking and Non-Verbal Communication.

Spoken Communication: Importance of Spoken Communication, Designing Receiver-Oriented Messages, Comprehending Cultural Dimension.

Making Oral Presentations: Functions of Presentations, Defining Objective, Audience Analysis, Collection of Materials, Organization of Materials, Body Language, Effective Delivery Techniques.

Written Communication: Fundamentals of Sentence Structure, Writing As a Process.

Fundamental of Technical Writing: Special Features of Technical Writing, The Word Choice, Developing Clarity and Conciseness, Report Writing, Business Letters, Applications and Resumes.

Transactional Analysis: Three Human Ego States, 4 Life Positions, Different Types of Transactions.

The Significance of Communication in a Business Organization: Channels of Communication – Downwards, Upwards, Horizontal, Consensus, and Grapevine.

Literary Discussions: Analysis and Discussion of The Novel The Funda of Mix-Ology and Short Stories From The Books Under The Banyan Tree and Other Stories and Popular Short Stories.

Laboratory Work:

Audio-Visual Aids for Effective Communication: The Role of Technology in Communication, The Role of Audio-Visuals, Designing Transparencies, Computer-Aided Presentation Software, Etc.

Software-Aided Activities in Developing Communication Skills:

Proper Pronunciation, Learning to Use The Correct Tense, Business Writing, Report Writing,Connected Speech, Building Up Vocabulary, Awareness About The Common Errors in The Usage of English, etc.

Case Studies, Group Discussions, Presentations

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Select proper channel of communication.
- Communicate verbally in a group as well as individually.
- Update with the latest trends in business letter writing, resume and report writing.
- Analyze the role of literature in our lives through discussion of prescribed novel and short stories.

6. **Brief list of topics to be covered**

- Fundamentals of Communication
- Modes of human communication
- Spoken communication
- Written communication
- Making Oral presentations
- Fundamental of technical writing

Course Syllabi: UTA003 Computer Programming (L : T : P :: 3 : 0 : 2)

1. **Course number and name:** UTA003; Computer Programming

2. **Credits and contact hours:** Credits: 4.0; Hours: 5

3. **Text book, title, author, and year**

   - *KernighanBrian W. and Ritchie, Dennis M, The C Programming language, Dorling Kingsley (2008) 2nd ed.*
   - *Balagurusamy, E., Programming in ANSI C, TMH Publications (2007) 3rded.*
   - *Stroustrup, Bjarne, The C++ Programming Language,. Addison Wesley (2000) 3rded.*
   - *Kanetkar, Yashavant, Let Us C, BPB 7th Ed. (2006) 8thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Elements of computer processing, Hardware and software, Introduction and feature wise comparison of various Operating Systems, Including DOS, Windows and Linux, Problem solving-Algorithms and Flowcharts.

   C Programming Basics: Basic program construction, Structure of a C program, Compilation process. Various compilers available on different OS/ environments including Turbo C, Borland C, GC, GCC, MSVC. Console I/O (printf, scanf), Preprocessor directives, Comments, Data types, Type conversions, Operators - Arithmetic, Relational, Logical, Conditional, Increment/decrement, Library functions, Header files.

   Loops and Decision Statements: for loop, *while* loop, *do* loop, Various forms of *if* statement, *switch* statement, *break* statement, *continue* statement, *goto* statement, arrays and strings, Declaring an array, Initializing arrays, Accessing the array elements, Working with multidimensional arrays, Declaring and initializing string variables, Arithmetic operations on characters, String handling functions (string.h), Pointers, Pointers to pointers, Declaring and initializing pointers, Pointer expressions, Pointer increment and scale factor, Pointers and arrays, Pointers and strings.

   Functions: Defining functions, passing arguments to functions, returning values from functions, Reference arguments, Variables and storage classes, Static functions, Pointers and functions.

   Structures and Union: Declaring and initializing a structure, Accessing the members of a structure, Nested structures, Array of structures, Using structures in functions, Pointers and structures, Declaring and initializing a union.

   Files: Reading and writing to text and binary files, Character I/O, String I/O, File pointers, Error handling, Redirection, Command line arguments.

   Structured Programming vs. Object Oriented Programming.

   Laboratory work: Introduction to Hardware - CPU, Storage devices & media, VDU, I/O Devices. Basic Operating System (DOS/UNIX) commands. Simple programs to demonstrate the use of constants, Variables, printf, scanf and operators. Programs using Loops: Solution of quadratic equation, Summation of finite series, Fibonacci series, Prime numbers, Factorial. Menu driven programs using switch statement. Use of continue and break statements, Conditional operators. Passing variables to functions by values and by reference, Number

conversion using array, Sorting, Merging, Arithmetic operations on matrices. String manipulation: Comparing, Copying, Reversing, Findinglength, Extracting characters. Simple programs demonstrating the concept of Pointers, Passing values to functions using pointers for arrays, Structures. Creating various types of records using structures. Storing and retrieving records from a file, copying a data file. Randomly accessing a record, Use of command line arguments.

5. Specific goals for the course

After the completion of the course, the students will be able to:

- Explain the hardware and software concepts of computer system.
- Explain the C programming basics.
- Elaborate the concept of Functions, Structures and Union.
- Differentiate between Structured programming Vs Object oriented programming.

6. Brief list of topics to be covered

- C Programming Basics
- Loops and Decision Statements
- Functions
- Structures and Union
- Files

Course Syllabi: UTA001 Engineering Graphics (L : T : P :: 2 : 4 : 0)

1. **Course number and name:** UTA001; Engineering Graphics

2. **Credits and contact hours:** Credits: 4.0; Hours: 6

3. **Text book, title, author, and year**

   - *Gill, P.S., Engineering Drawing - Geometrical Drawings, S.K. Kataria (2008).*
   - *Mohan, K.R., Engineering Graphics, DhanpatRai Publishing Company (P) Ltd (2002).*
   - *French, Thomas E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company (2005).*
   - *Bhatt, N.D. and Panchal, V.M., Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House (2006) 49th ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Use of drafting tools, Lettering, Dimensions and Standards, Line Conventions.
   Projection Systems: Projection Planes, Projection systems, Orthographic projections of points in first angle projection system and third angle projection system, Orthographic projections of lines on reference planes, True length of line using rotation of view method, Traces of lines, Auxiliary planes and their applications, Projections of Lamina parallel/inclined to reference planes, Projection of solids- Polyhedra, Solids of revolution, Sections of solids- Section plane parallel / inclined to reference planes, Intersection of solids.
   Development of Surfaces: Development of surfaces like Prism, Pyramid, Cylinder, Cone, Sphere etc. using Parallel Line Method, Radial Line Method, Triangulation method.
   Orthographic Projections: Extracting Orthographic projections from given pictorial views.
   Isometric Views: Extracting Isometric projections from given Orthographic views using box method, Offset method.
   Missing Lines and Missing Views: Evaluating missing lines and missing views from given orthographic views.
   Computer Aided Drafting: Introduction to computer drafting tools like AutoCAD. Demonstration of commands like Line, Circle, Arc, Rectangle, MText and Dimensioning etc.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Imagine and visualize the geometric details of engineering objects.
   - Translate the geometric information of engineering objects into engineering drawings.
   - Use computer aided drafting in their respective engineering field.

6. **Brief list of topics to be covered**
   - Projection Systems
   - Development of surfaces
   - Orthographic Projections
   - Isometric views
   - Missing Lines and Missing Views

- Computer Aided Drafting

Course Syllabi: UMA002 Mathematics-II (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA002; Mathematics-II

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press (1976).*
   - *Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill (2009) 2nd ed.*
   - *Kasana, H.S., Complex Variables: Theory and Applications, Prentice Hall of India (2004) 2nd ed.*
   - *Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006) 8th ed.*
   - *Ram Babu, Engineering Mathematics, Pearson Education (2009).*
     Tom M, Calculus, Vol I and II John Wiley (2003).

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Linear Algebra: Row Reduced Echelon Form, Solution of System of Linear Equations, Matrix Inversion, Linear Spaces, Subspaces, Dimension and Basis, Linear Transformation and Its Matrix Representation. Eigen-Values, Eigen-Vectors, Diagonalisation, Special Type of Matrices and Their Properties.
   Complex Variables: Basics of Complex Plane, Analytic Functions, Cauchy-Riemann Equations, Harmonic Functions, Elementary Functions: Exponential, Trigonometric, Hyperbolic, and Their Inverses, Complex Exponents.
   Ordinary Differential Equations: Classification and Construction of Differential Equations, Exact Differential Equations, Bernoulli, Riccati Equation, Claiurat Form, Second and Higher Order Differential Equations, Solution Techniques: using one known solution, Cauchy - Euler Equation Method of Undetermined Coefficients, Variation of Parameters Method, Operator Method, Engineering Applications of Differential Equations.
   Laplace Transform: Definition and Existence of Laplace Transforms and Its Inverse, Properties of The Laplace Transforms, Unit Step Function, Impulse Function, Applications to Solve Initial and Boundary Value Problems.
   Fourier Series: Introduction, Fourier Series on Arbitrary Intervals, Half Range Expansions.
   Partial Differential Equations: Introduction, First Order Equations, Lagrange Linear Equations, Charpits Method (Including Standard Forms).

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Solve differential equations of first and second order using various analytical methods.
   - Solve ordinary and partial differential equations using the Laplace transform and Fourier series.

- Apply the concept and consequences of analyticity and the Cauchy-Riemann equations on harmonic and entire functions.
- Solve systems of linear equations and analyze vectors in R^n geometrically and algebraically.
- Analyze vector spaces and subspaces over a field, and to find linear transformations and their properties, matrices of linear transformations.

6. **Brief list of topics to be covered**
    - Linear Algebra
    - Complex Variable
    - Ordinary Differential Equations
    - Laplace Transform
    - Fourier Series
    - Partial Differential Equations

Course Syllabi: UES004 Thermodynamics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UES004; Thermodynamics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Sonntag, R.E., Borgnakke, C. and Van Wylen, G.J., Fundamentals of Thermodynamics, John Wiley (2007) 6th ed.*
   - *Nag, P.K., Engineering Thermodynamics, Tata McGraw Hill (2008) 3rd ed. Rao, Y.V.C., Thermodynamics, Universities Press (2004).*
   - *RathaKrishana, E., Fundamentals of Engineering Thermodynamics, Prentice Hall of India (2005) 2nd ed.*
   - *Cengel, Y. A. and Boles, M., Thermodynamics: An Engineeing Approach, Tata McGraw Hill (2008).*
   - *Rogers, G. and Mayhew, Y., Engineering Thermodynamics, Pearson Education (2007) 4th ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Basic Concepts: Concept of Continuum, Macroscopic approach, Thermodynamics system & properties, Various processes, Thermodynamic equilibrium, Ideal gas, Vander Walls equation of state, Compressibility chart, Process: Flow and non-flow process, Cycle concept of work and heat, Specific heats, Zeroth law, Energy and its form, Pure substance, Thermodynamic diagrams, Triple point, Steam tables and their use.
   First Law of Thermodynamics: Concept of internal energy & enthalpy, Energy equation as applied to a close and open system, PMM1, Transient flow processes.
   Second Law of Thermodynamics & its Corollaries: Kelvin Plank and Clausius statements, Reversible and Irreversible processes, Carnot cycle, Clausius theorem and concept of entropy, Principle of increase of entropy, PMM2, Thermodynamic Temperature scale, Second law analysis of control volume, Availability, Irreversibility, Availability function for open and closed system & second law efficiency.
   Thermodynamic Cycles: Rankine cycle, Vapour compression refrigeration cycle, Air standard cycles: Otto, Diesel, Dual and Brayton cycles.
   Non-Reacting Gas Mixtures: Properties of mixtures of gases and vapours, Adiabatic saturation, Properties of air.
   Thermodynamic Relations: Maxwell & T-ds equations.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Understand the basic principles of thermodynamics like conservation of mass, conservation of energy and the second law of thermodynamics.
   - Formulate and solve engineering problems involving closed and open systems for both steady state and transient processes.

- Analyze the performance of various power cycles and to identify methods for improving thermodynamic performance.

6. **Brief list of topics to be covered**
    - First Law of Thermodynamics
    - Second Law of Thermodynamics
    - Thermodynamic Cycle
    - Non-Reacting Gas Mixtures
    - Thermodynamic Reactions

Course Syllabi: UEI201 Analog Electronic Devices and Circuits (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEI201; Analog Electronic Devices and Circuits

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education (2007) 9th ed.*
   - *Millman, J. and Halkias, C.C., Integrated Electronics, Tata McGraw Hill (2006).*
   - *Neamen, Donald A., Electronic Circuit Analysis and Design, McGraw Hill (2006) 3rd ed.*
   - *Sedra A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press (2006) 5th ed*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   PN Junction: Depletion region, Junction capacitance, Diode equation (no derivation), Effect of temperature on reverse saturation current, Construction and Working, V-I characteristics and simple applications of Junction diode, Zener diode and Tunnel diode.
   Bipolar Junction Transistor (BJT): PNP and NPN transistors–current components in BJT: BJT static characteristics (Input and Output), Early effect, CB, CC, CE configurations (cut-off, active, and saturation regions), CE configuration as two port network: h-parameters, h-parameter equivalent circuit. Biasing and load line analysis.
   Field Effect Transistor (FET): Structure and working of JFET and MOSFET, output and transfer characteristics, Experimental arrangement for studying the characteristics and to determine FET parameters. Application of FET as voltage variable resistor and MOSFET as a switch, Advantages of FET over transistor.
   Power Supplies: Rectifiers: Half-wave, Full-wave and bridge rectifiers, Efficiency, Ripple factor, Regulation, Harmonic components in rectified output, Types of filters: Choke input (inductor) filter, Shunt capacitor filters; Block diagram of regulated power supply, Series and shunt regulated power supplies, Three terminal regulators (78XX and 79XX), Principle and working of switch mode power supply (SMPS).
   Amplifiers: Analysis and frequency response of single stage RC coupled CE amplifier. Feedback Amplifiers: Positive and negative feedback, Effect of feedback on gain, band width, noise, input and output impedances.
   Oscillators: Condition for sustained oscillation, R-C phase shift, Hartley, Colpitts, Crystal and Wien Bridge Oscillators, Negative Resistance oscillator.
   Wave shaping circuits: Switching characteristics of diodes and transistors including square wave response, High pass and low pass filters using R-C Circuits and operational amplifiers; R-L, R-L-C circuits, Attenuators, Clipping and clamping circuits, Clamping circuit theorem, Comparators.
   Laboratory work
   Familiarity with CRO and electronic components, Diodes and BJT characteristics, FET characteristics, Zener diode as voltage regulator, Series voltage regulator, RC coupled amplifier in CE mode, I/O characteristics of Transistor in CE mode, DC load line, Testing of diode and Transistor, Rectifiers. Use of Bistable, Astable and monostable multi-vibrator, Hartley and

Colpitts Oscillator, Clipper and Clamper circuit, Computer simulation, Experiments in analysis, Design and characterization of electronic circuits.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Demonstrate the construction and working of different type of electronic devices such as diodes, BJT, FET.
   - Analyse the characteristics of different type of electronic devices such as diodes, BJT, FET.
   - Design different type of circuits such as rectifiers, clippers, clampers, filters etc.
   - Design power supplies and solve problems related to amplifiers and oscillators.

6. **Brief list of topics to be covered**

   - PN Junction Diode
   - BJT
   - FET
   - Amplifiers
   - Oscillators

Course Syllabi: UEE301 Direct Current Machines and Transformers (L: T: P:: 3:1:2)

1. **Course number and name:** UEE301; Direct Current Machines and Transformers

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Bimbhra, P.S., Electrical Machinery, Khanna Publishers (2008) 2nd ed.*
   - *Mukherjee, P.K. and Chakravorty, S., Electrical Machines, DhanpatRai (2004) 2nd ed.*
   - *Nagrath, I.J. and Kothari, D.P., Electric Machines, Tata McGraw Hill (2004) 3rd ed.*
   - *Bimbhra, P.S., Generalized Theory of Electrical Machines, Khanna Publishers (2007) 5th ed.*
   - *Toro, Vincert, Electromechanical Devices for Energy Conversion, Prentice Hall of India (2004) 2nd ed.*
   - *Fitzgerald, A.E., Kingsley, C. Jr. and Umans, Stephen, Electric Machinery, McGraw Hill (2002) 6th ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Single phase Transformers: Introduction, Basic principle, Types of Transformer, Construction of single–phase Transformer, Transformer windings, Terminals and leads, Bushings, Tapping, Cooling of transformer, Transformer oil, Conservator and breather, Buchhloz relay, Transformer tank, EMF equation of a Transformer, Step–up and step–down transformer, Transformer on no–load and on load, Magnetic leakage, Transformer with resistance and reactance, Equivalent resistance and reactance, Equivalent circuit, Open circuit or no load test, Short circuit or impedance test, Separation of core losses, Total approximate voltage drop of a transformer, Exact voltage drop, Per unit resistance, Leakage reactance and impedance voltage drop, Voltage regulation of a Transformer, Calculation of voltage regulation, Losses in a transformer, Efficiency of a Transformer, Condition for maximum efficiency, All day efficiency, Polarity test of a single–phase transformer, Sumpner's test, Parallel operation of single–phase Transformers, Load sharing of two transformers, Auto transformer.

   Three–phase Transformer: Advantages of three phase Transformer, Principle of operation, Construction of three phase transformers, Three–phase transformer connections, Open delta or V–V connection, Scott connection or T–T connection, Three–phase to two–phase conversion, Three–phase to six–phase conversion, Three–winding Transformer, Parallel operation of Transformers, Rating of Transformers.

   Special purpose Transformers: Instrument transformers (CT and PT), Earthing Transformer, Pulse Transformer, High frequency Transformer, Converter Transformer.

   General concepts of Rotating Electrical Machines: Electromagnetic torque, Reluctance torque, Constructional features of rotating electrical machines, Classifications of rotating electrical machines, Construction of DC machines, Principle of DC generator, Principle of DC motor, Lap winding, Wave winding, Electrical and mechanical degrees.

   DC Generators: Classification of DC generator, Brush drop, EMF equation, Derivation of generated emf, Losses in DC generator, Power stages, Condition for maximum efficiency, Armature reaction, Demagnetising and cross–magnetising conductors, Demagnetising

ampere–turns per pole, Cross–magnetising ampere–turns per pole, Compensating windings, Commutation, Value of reactance voltage, Methods of improving commutation, Equalizer rings, Characteristic of DC generators, Voltage build up of shunt generators, Conditions for build–up of shunt generator, Voltage regulation, Parallel operation of DC generators, Applications of DC generators.

DC Motors: Voltage equation, Back emf, Condition for maximum mechanical power, Armature torque of a motor, Relation of speed with back emf and flux, Characteristic of DC motors, Speed control of DC motors, Ward–Leonard control (Voltage control), Necessity of starter for starting of DC motor, Three point starter, Four point starter, DC shunt motor starter design, Electric breakings of DC shunt and series motors, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test or back to back test, Retardation test or Running test, Field's test. Uses of DC motors.

Laboratory Work: DC Machines: Characteristics of generators and motors, Speed control, Efficiency, DC generators in parallel; Transformers: Open and short circuit tests, Parallel operation, Harmonics in no-load current, Three-phase connections, 3–phase to 2–phase and 6–phase conversions.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Test the transformer and calculate its efficiency and performance in distribution system.
- Scrutinize three-phase transformer connections and use special purpose transformer for measurement and protection.
- Select appropriate DC motor for specific purpose and can compute their steady performance.
- Compute the performance with DC generators and can supply increasing load with parallel operation.
- Thoughtfully select the speed control and starting method of DC motor.

6. **Brief list of topics to be covered**

- Single Phase Transformer
- Three Phase Transformer
- Special Phase Transformer
- DC Generator
- DC Motor

Course Syllabi: UEE302 Electro Magnetic Field Theory (L : T : P :: 3 : 1 : 0)

1. **Course number and name:**UEE302; Electromagnetic Field Theory

2. **Credits and contact hours:**Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Hayt, W.H., Engineering Electromagnetics, Tata McGraw Hill (2008) 7th ed.*
   - *Kraus, J.D., Electromagnetics, McGraw Hill (2006) 5thed.*
   - *Sadiku, M.N.O, Elements of Electromagnetics, Oxford University Press (2009) 4th ed.*
   - *Jordan, E.C. and Balmain K.G., Electromagnetic Waves and Radiating Systems, Prentice Hall of India (2008) 2nd ed.*
   - *Paramanik, A, Electromagnetism: Theory and Applications, Prentice Hall of India (2006) 2nd ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Vector Analysis: Review of vector algebra, Review of cartesian, Cylindrical and spherical coordinate systems, Introduction to del Δ (operator, Use of del operator as gradient, divergence, curl).

   Electrostatic fields: Introduction to coulomb's law, Gaussian law and its applications in determination of field of spherical and cylindrical geometries, Laplace's and poisson's equation in various coordinate systems. Effect of dielectric on capacitance, Boundary conditions at electric interfaces, Method of images and its applications.

   Magnetostatics: Introduction to ampere's law, Magnetic vector potential, Magnetic forces, Boundary conditions at magnetic interfaces.

   Time Varying Fields and Maxwell's Equations: Continuity of charge, Concept of displacement current, Maxwell's equation in integral and differential form: for static fields, for time varying fields, for free space, for good conductors, for harmonically varying fields, Poynting theorem: Energy stored and radiated power, Complex poynting vector, Properties of conductor and dielectrics, Wave equations for free space, Wave equations for conductors.

   Uniform Plane Waves: Introduction, Uniform plane wave propagation: Wave equations, Transverse nature of uniform plane waves, Perpendicular relation between $\vec{E}$ and $\vec{H}$, EM waves in charge free, Current free dielectric, Reflection by ideal conductor: Normal incidence, reflection and transmission with normal incidence at another dielectric, Plane wave in lossy dielectric, Wave impedance and propagation constant, Depth of penetration, Surface impedance and surface resistance.

   Transmission Lines and Matching Networks: Introduction, Circuit representation of parallel plane transmission lines, Transmission lines with losses, Characteristic impedance, Characteristic impedance at radio frequencies, Propagation constant, Attenuation constant and phase constant, An infinite line equivalent to a finite line terminated in its characteristic impedance, Reflection, Reflection coefficient, Expression for input impedance in terms of reflection coefficient, Standing wave ratio (SWR), Relation between SWR and reflection coefficient, Location of voltage maxima and minima, Impedance matching devices, Principle of impedance matching devices, Smith Chart.

Wave Guides: Introduction, Simple waveguides between two infinite and parallel conducting plates, Transverse Electric (TE) Waves or HWaves, Transverse magnetic (TM) Waves or EWaves, Characteristic of TE and TM waves, Transverse Electromagnetic (TEM) waves, TEM mode in a hollow wave guide, TM and TE mode solutions of rectangular waveguides, Difference between TE and TM modes.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Calculate electric and magnetic fields in different coordinates for various charge and current configurations.
- Demonstrate different aspects of plane wave in dielectric and conducting media.
- Realize the analogy of wave with transmission line and calculate the transmission line performance.
- Select the appropriate guide for electromagnetic waves.

6. **Brief list of topics to be covered**

- Vector analysis
- Electrostatic fields
- Magnetostatics
- Time Varying Fields and Maxwell's Equations
- Uniform plane waves
- Waveguides

Course Syllabi: UMA031 Optimization Techniques (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA031; Optimization Techniques

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Taha, H.A., Operations Research: An Introduction, Prentice Hall of India (2007) 8th ed.*
   - *Kasana, H.S., Introductory Operation Research: Theory and Applications, Springer Verlag (2005).*
   - *Rardin, Ronald L., Optimization in Operations research, Pearson Education (2005). Ravindran A, Phllips D.T. and Solberg J.J. Operation Research: Principles and Practice, John Wiley (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.
   Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex and revised simplex methods, Exceptional cases in LP, Duality theory, Dual Simple method, Sensitivity analysis.
   Network Analysis: Transportation problem (with transshipment), Assignment problem, Traveling-salesman problem, Shortest route problem, Minimal spanning tree, Maximum flow problem.
   Integer Programming: Branch and bound algorithm, Travelling salesman problem.
   Dynamic programming: Forward recursions, General problem, Reliability problem, Capital budgeting problem, Cargo-loading problem.
   CPM and PERT: Drawing of networks, Removal of redundancy, Network computations, Free slack, Total slack, Crashing, Resource allocation.
   Non-Linear Programming: Characteristics, Concepts of convexity, maxima and minima of functions of n-variables using Lagrange multipliers and Kuhn-Tuker conditions, One dimensional search methods, Fibonacci, golden section method and gradient methods for unconstrained problems.
   Software: Introduction to software for optimization techniques (TORA).

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Formulate and solve linear programming problems.
   - Solve the problems on networks models such as Transportation, Assignment, Shortest path, minimal spanning tree, and Maximal flow.
   - Solve the problems of Project Management using CPM and PERT
   - Solve Non-linear Programming problems of some kinds.
   - Implement the Linear programming techniques using C or any other optimization software.

6. **Brief list of topics to be covered**
    - Linear Programming
    - Network Analysis
    - Integer Programming
    - Dynamic Programming
    - Non-Linear Programming

Course Syllabi: UHU031 Organizational Behaviour (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UHU031; Organizational Behaviour

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Robbins, S.P., Organizational Behaviour, PHI (2007) 8th ed.*
   - *Lufthans F., Organizational Behaviour, Irwin Mc-Graw Hill. (2007) 11th ed.*
   - *Hellriegal, D., and Slocum, J.W., Organizational Behaviour, Southwestern Educational Publishing (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction to Organizational Behaviour: Today's Organizations, Challenges, Foundations of Organizational Behaviour, Individual Behaviour: Perception, Values, Attitudes Motivation theories.Employees Motivations in Organization, Management by Objectives Learning Processes, Reward and Punishment.
   Foundations of Group Behaviour: Interpersonal Communication, Leadership, Emotional Intelligence. Power & Polities, Conflict Process, Negotiations, Stress and Coping, Inter-Group Relations, Team Working.
   A Macro Perspective of Organizational Behaviour: Organization Structure – Key Elements, Types and Basic Models, Work Design, Organizational Change, and Learning Organizations.
   Organizational Behaviour: Future Challenges Gender Diversity at the place of work, changing world Scenario, Role of External Environment.
   Achieving Competitive: Advantage Management of change, International issues in Organizational Behaviour

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Explain individual behavior in an organization.
   - Describe foundation of group behavior.
   - Explain different models of organization structure.
   - Elucidate challenges in organization behavior especially in the challenging world scenario.

6. **Brief list of topics to be covered**
   - Introduction to Organizational Behaviour
   - Foundations of Group Behaviour
   - A Macro Perspective of Organizational Behaviour
   - Organizational Behaviour

Course Syllabi: UEE303 Power Generation and Associated Economics (L:T:P::3:1:0)

1. **Course number and name:** UEE303; Power Generation and Associated Economics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Arora, S.C and Domkundawar, S., a course in Power Plant Engineering, Dhanpat Rai (2002) 2nd ed.*
   - *Deshpande, M.V., Power Plant Engineering, Tata McGraw Hill (2004).*
   - *Gupta, B.R., Generation of Electrical Energy, S. Chand (1998).*
   - *Deshpande, M.V., Electrical Power System Design, McGraw Hill (2004).*
   - *Wood, A.J. and Wollenberg, B.F., Power Generation and Control, John Wiley (2004).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Energy sources and their availability, Principle types of power plants, their special features and applications, present status and future trends.
   Hydro Electric Power Plants: Essentials, Classifications, Hydroelectric survey, Rainfall run off, Hydrograph, Flow duration curve, Mass curve, Storage capacity, site selection, Plant layout, various components, Types of turbines, Governor and speed regulation, Pumped storage, Small scale hydro–electric plants (mini and micro).
   Steam Power Plant: General developing trends, Essentials, Plant layout, Coal–its storage, Preparation, Handling, Feeding and burning, Ash handling, Dust collection, High pressure boilers and steam turbines, their main components like super heaters, Economizers, Pre–heaters etc., Fuel efficiency/heat balance.
   Gas Turbine Power Plants: Field of use, Components, Plant layout, Comparison with steam power plants, combined steam and gas power plants.
   Nuclear Power Plant: Nuclear fuels, Nuclear energy, Main components of nuclear power plant, Nuclear reactors types and applications, Radiation shielding, Radioactive and waste disposal safety aspect.
   Non-Conventional Power Generation: Geothermal power plants, Electricity from biomass, direct energy conversion systems, Thermo-electric conversion system, Fuel cells, Magneto Hydro dynamic system.
   Power Plant Economics: Cost of electrical energy, Selection of type of generation and generation equipment, Performance and operating characteristics of power plants, Economic scheduling principle, Load curves, Effect of load on power plant design, Methods to meet variable load, Load forecasting, electric tariffs. Theory of peak load pricing, Theory and issues of real time pricing comparison of public supply and private generating units.
   Cogeneration: Definition and scope, Cogeneration technologies, Allocation of costs, Sale of electricity and impact on cogeneration.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

- Apply knowledge of India’s power scenario, power system structure and related agencies.
- Harness power from conventional and renewable sources.
- Select the methods and size of plant generating power for overall economy.
- Decide the tariff structure for different type of users.

6. **Brief list of topics to be covered**
    - Hydro Electric Power Plants
    - Steam power plants
    - Gas turbine power plants
    - Nuclear power plants
    - Non-Conventional Power Generation
    - Power Plant Economics
    - Cogeneration

Course Syllabi: UEI303 Techniques on Signal and Systems (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI303; Techniques on Signal and Systems

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Oppenheim, A.V. and Willsky, A.S., Signals and Systems, Prentice Hall of India (1997) 2nd ed.*
   - *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall (2007) 4th ed.*
   - *Lathi, B.P., Signal Processing and Linear System, Oxford University Press (2008).*
   - *Roberts, M.J., Fundamentals of Signals and Systems, McGraw Hill (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Signals and Systems, Classification of signals, Continuous time signals and its classifications, Standard continuous time signals, Classification of continuous time systems, Discrete time signals and its classifications, Concept of frequency in discrete time signals, Standard discrete time signals, Discrete time systems, Classification of discrete time systems, Nyquist rate, Sampling theorem, Aliasing, Convolution, Correlation.

   Fourier Series: Introduction, Dirichlet Conditions, Determination of Fourier Coefficients, Wave symmetry, Exponential form of Fourier Series.

   Fourier Transform: Introduction, Condition for existence of Fourier Integral, Fourier Transform of Gate function, Impulse Function, Shifted impulse function, One-sided exponential function, Two-sided exponential function, $\sin(t)e^{-a(t)}$, Signum function, f(t) = 1 and unit step functions; Properties of Fourier Transform: Linearity, Time Scaling, Time Differentiation, Time Shifting Property, Translation in the frequency domain, Modulation theorem, Symmetry or duality property, Time convolution property, Frequency convolution, Frequency differentiation, Time integration, Fourier transform of f(-t) and Symmetry properties of Fourier Transform; Energy density and Power Spectral Density, Nyquist Theorem, System Analysis using Fourier Transform.

   Laplace Transform: Introduction, Region of Convergence (ROC), Inverse Laplace Transform, Properties of Lapalce Transform, Laplace transform of a derivative $\frac{df(t)}{dt}$, Laplace transform of an integral $\int f(t)dt$, Laplace transform of unit step function, Impulse function, Ramp function, Parabolic function, $f(t) = e^{at}u(t)$, $f(t) = e^{-at}u(t)$, Sinusoidal function, Cosine function, Hyperbolic sine and cosine functions, Damped sine and cosine functions, Damped hyperbolic sine and cosine functions, t^n. Laplace transform of two sided functions and their ROCs, Initial value theorem and final value theorem, Partial fraction Expansions.

   z-Transform: Introduction, Region of Convergence (ROC), Properties of z-transform: Linearity, Time shifting, Scaling in z-domain, Time reversal, Differentiation in z-domain, Convolution in z-domain, Correlation of two sequences, Multiplication of two sequences, Conjugate of complex sequence, Real part of a sequence, Imaginary part of a sequence. Initial value theorem, Final Value theorem, Partial Sum, Parseval's Theorem, z-transform of standard

sequences, Inverse z-transform, Pole-Zero plot, System function of LTI system, Causality and Stability in terms of z-transform.

Random Signals: Introduction, Probability, Random variables, Gaussian distribution, Transformation of random variables, random processes, stationary processes, Correlation and Covariance Functions, Regularity and Ergodicity, Gaussian Process.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Explain the basics of signals and systems.
   - Solve different type of problems related to Fourier series and Fourier transforms.
   - Use Laplace transforms and Fourier transforms for different applications.
   - Describe the concept of random signals.

6. **Brief list of topics to be covered**

   - Basics of signals and systems
   - Fourier Series
   - Fourier Transform
   - Laplace Transform
   - Z- Transform
   - Random Signals

Course Syllabi: UEE401 Alternating Current Machines (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE401; Alternating Current Machines

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Bimbhra, P.S., Electrical Machinery, Khanna Publishers (2008) 2nd ed.*
   - *Mukherjee, P.K. and Chakravorty, S., Electrical Machines, DhanpatRai and Co. (P) Ltd. (2004) 2nd ed.*
   - *Nagrath, I.J. and Kothari, D.P., Electric Machines, Tata McGraw Hill (2004) 3rd ed.*
   - *Bimbhra, P.S., Generalized Theory of Electrical Machines, Khanna Publishers (2007) 5th ed.*
   - *Toro, Vincert, Electromechanical Devices for Energy Conversion, Prentice Hall of India (2004) 2nd ed.*
   - *Fitzgerald, A.E., Kingsley, C. Jr., and Umans, Stephen, Electric Machinery, McGraw–Hill (2002) 6thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Synchronous Generators/Alternators: Introduction, Difference between DC generator and alternator, Advantages of rotating field over rotating armature, Construction, Stator, Rotor, Excitation system, Methods of ventilation, Working Principle, Armature winding, Types of armature winding: Single layer winding, Double layer winding, Full pitch and short pitch winding, Concentrated and distributed winding; EMF equation of an alternator: Pitch factor, Distribution factor, Winding factor, Generalized expression for emf in a full pitch and short pitch coil. Harmonics in generated emf parameters of armature winding, Armature resistance, Armature reaction: Unity power factor, Zero lagging power factor, Zero leading power factor, Armature reaction reactance, Equivalent circuit of an alternator, Voltage equation of an alternator, Phasor diagram of a loaded alternator for various types of loads, Voltage regulation of an alternator, Determination of voltage regulation, Load characteristic of alternators, Output power equation of an alternator, Input power equation of an alternator, Two reaction theory of salient pole alternator, Torque–angle characteristic of a salient–pole alternator, Maximum reactive power for a salient–pole alternator, Losses and efficiency, Determination of X_d and X_q, Capability curves, Prime mover characteristic, Infinite bus, Need for parallel operation of alternators, Synchronising procedures of alternator, Synchronising power and synchronising Torque co–efficient, Hunting, Oscillations of synchronous machines.

   Synchronous Motors: Introduction, Voltage equation of a synchronous motor, Phasor diagram of a loaded a synchronous motor for various types of loads; Operation at constant load with variable excitation, V–curves and Inverted V–curves, Complex power input and output of synchronous motor, Maximum output power, Characteristics and performance of synchronous motor, Torque of a synchronous motor, Salient pole synchronous motor, Two–reaction model, Power developed by salient pole Synchronous motor, Damper Windings, Methods of starting of synchronous motors, Applications of synchronous motors, Synchronous condensers.

Three–Phase Induction Motors: Introduction, Construction and working principle of a three–phase induction motor, Slip of an induction motor, Effect of slip on rotor parameters: Effect on rotor frequency, Effect on magnitude of rotor induced emf, Effect rotor resistance and reactance, Effect on rotor power factor, Effect on rotor current. Torque–slip characteristics, Torque ratios, Full load and maximum torque ratios, Starting torque and maximum torque ratio, Speed torque characteristics, Power flow diagram, Efficiency, Synchronous watt, Measurement of slip, Equivalent circuit, Starting of induction motors, No–load test or open circuit test, Blocked rotor test or short circuit test, Circle diagram, Speed control of induction motor, Crawling, Cogging, Deep cage rotors, Double cage rotors, Applications of induction motors.

Single Phase Motors and Special Machines: Classification, Production of rotating field, Working principle, Double revolving field theory, Rotor slip with respect to two rotating fields, Equivalent circuit of single–phase single winding induction motor, Determination of equivalent circuit parameters, Split phase induction motor, Capacitor motor, Permanent split capacitor motor; Shaded pole motor, Single–phase synchronous motor, Universal motor, Stepper motor.

Laboratory Work: Voltage regulation, Direct and quadrature axis reactances, Power angle characteristics, Operating characteristics, Synchronizing, Parallel operation and load division, Sudden short circuit analysis and determination of sub transient, Transient and steady state reactances and various time constants, Determination of positive, negative and zero sequence reactances, Synchronous motor starting, Efficiency. Three phase induction motors: starting methods, Equivalent circuit parameters, Load test, Polarity test, Single phasing, Efficiency, Schrage motor, Single-phase induction motors: Equivalent circuit parameters, Load test, and efficiency.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Simulate the steady-state and transient state performance of induction and synchronous machines to identify performance measures
- Validate and identify the machine parameters.
- Select the appropriate AC motor for different large power application.
- Analyse the stability of single machine – infinite bus system and form the grid to supply large load.
- Choose the appropriate fractional horse power motor as per the usage in daily life.

6. **Brief list of topics to be covered**

- Synchronous Generators/Alternators
- Synchronous Motors
- Three–Phase Induction Motors
- Single Phase Motors and Special Machines

Course Syllabi: UEI301 Digital Electronics (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEI301; Digital Electronics

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Floyd, T.L. and Jain, R. P., Digital Fundamentals, Pearson Education (2008) 10th ed.*
   - *Tocci, R. and Widmer, N., Digital Systems: Principles and Applications, Pearson Education (2007) 10th ed.*
   - *Mano, M. M. and Ciletti, M., Digital Design, Pearson Education (2008) 4th ed.*
   - *Kumar, A., Fundamentals of Digital Circuits, Prentice Hall (2007) 2nd ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Difference between analog and digital systems, Advantages and Disadvantages of digital system.

   Number Systems: Introduction, Number systems: Decimal, Binary, Octal, Hexadecimal; Conversions; Representation of Signed Numbers, Sign magnitude, 1's complement, 2's complement, r's complement; Binary Arithmetic – addition, subtraction, multiplication and division, Binary codes: Weighted and non-weighted codes, Sequential codes, Self-complementing codes, Excess-3 code, Gray code, Error-detecting codes, Error-correcting codes, Hamming code, Alphanumeric codes.

   Minimization Techniques: Introduction, Boolean Algebra: Laws and Theorems, Demorgan's Theorem, Simplification of Boolean functions by Boolean algebra, K-map method and Quine-McClusky method in SOP and POS forms, Advantages and disadvantages of different minimization techniques.

   Combinational Circuits: Introduction, Logic Gates: Basic gates, Universal gates, Derivation of other gates from universal gates, Half adder, Full adder, Parallel Binary adder, Serial adder, BCD adder, Half and Full subtractor, Binary multiplier, Dividers, ALU, Code converters, Magnitude comparators, Parity Generators/checkers, Encoders, Priority encoder, Decoders, Multiplexers, Multiplexer as function generator, Demultiplexer.

   Sequential Circuits: Introduction, Flip-flops: Types, their conversions and applications, Registers: Serial/Parallel in/out, Bi-directional, Universal shift register, Counters: Synchronous, Asynchronous, Decade, Binary, Modulo-n, Shift register counters; Design of Synchronous sequential circuits.

   Memories: Introduction and classification of ROM, ROM organization, Static and Dynamic RAM, DRAM Refreshing, Representative circuits for cells using BJT and FET's, Timing diagrams of memories, Memory expansion using IC's, Flash memory, CCD, Magnetic Memories.

   Logic circuits: Introduction, Specification terminology: Fan out, Unit load, Current and voltage parameters; TTL, ECL, MOS, CMOS logic families and their comparison, Tristate Logic, Interfacing of TTL and CMOS logic families.

Converters: Digital to Analog conversion, R-2R ladder DAC, Weighted Resistor DAC, Analog-to-Digital (A/D or ADC) conversion, Flash type, Counter type ADC, Dual-slope ADC, Successive approximation type ADC.

Laboratory work

To consider various important codes and the logic for converting from one to another, 74146, 7476, 7483, 7485, 7490, 7492, 7495, 74121, 74123, 74126, 74151, 74163, 74180, 74181, 74190, 74192, 74195, 74196, Shift register and binary counting using JK flip flop, asynchronous/synchronous up/down counters, Variable modulus counters, Usage of IC tester, Computer simulation using EDA tools.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Describe the number systems, conversions and their applications.
- Apply minimization techniques such as K maps, Tabular method etc for the design of digital circuits.
- Design combinational and sequential circuits.
- Differentiate various type of memories and there use in different applications.
- Demonstrate the concept of logic circuits and converters.

6. **Brief list of topics to be covered**

- Number System
- Minimization techniques
- Combinational and Sequential Circuits
- Memory
- Logic Circuit and Converters

Course Syllabi: UES031 Fluid Mechanics (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UES031; Fluid Mechanics

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Streeter, V.L., Wylie E. B. and Bedford, K.W., Fluid Mechanics, McGraw Hill Book Company (1998).*
   - *Jain, A.K., Fluid Mechanics including hydraulic machines, Khanna Publishers (2004).*
   - *Kumar D.S., Fluid Mechanics and Fluid Power Engineering, S. K. Kataria (2009).*
   - *Subramanya, K., Theory and Application of Fluid Mechanics, Tata McGraw Hill (2001).*
   - *ModiP.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House (2002).*
   - *Shames I.H., Mechanics of Fluid, McGraw Hill (2005).*
   - *Fox, R.W. and McDonald, A.T., Introduction to Fluid Mechanics, John Wiley and Sons (2008) 5thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Physical properties of fluids, Types of fluids.
   Fluid statics: Basic equation for pressure field, Measurement of pressure, Hydrostatic forces on immersed plane and curved surfaces, Buoyancy and flotation.
   Fluid kinematics: Methods of describing fluid motion, Velocity and acceleration of a fluid particle, Type of fluid flows, Displacement of a fluid particle, Circulation and vorticity, Continuity equation, Velocity potential and stream function.
   Fluid dynamics: Euler's equation, Bernoulli's equation, Momentum equation, Kinetic energy and momentum correction factors.
   Flow though pipes: Energy losses, HGL and TEL, Concept of equivalent pipe, Pipes in series and parallel, Flow through a siphon, Transmission of power.
   Flow measuring devices: Venturimeter, Orificemeter, Pitot tube, Rotameter, Circular orifice, Current meter, Notches.
   Dimensional analysis: Methods of dimensional analysis, Model studies.
   Open channel flow: Types of channels, Classification of flows, Uniform flow formulae.
   Turbines and pumps: Brief description of types and working of turbines and pumps.
   Laboratory work: Verification of Bernoulli's Theorem, Calibration of Venturimeter, Determination of hydrostatic force and its location on a vertically immersed surface, Calibration of orifice meter, to check the stability of a ship model, Determination of friction factor for pipes of different materials, Determination of hydraulic coefficients of an orifice, Verification of momentum equation, Determination of loss coefficients for various types of pipe fittings, Calibration of a triangular notch, to check the calibration of rotameter, Visualization of laminar and turbulent flow.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

- Learn about different types of fluid flows; different methods applied for describing fluid in motion.
- Learn about different types of energies associated with Fluid in motion.
- Learn about the measurement of flow in pipes and flow in open channels.
- Explain the concept of equivalent pipe; Energy losses in flow in pipe.
- Learn about types and working of turbines and pumps.

6. **Brief list of topics to be covered**
    - Fluid Statics
    - Fluid Kinematics
    - Fluid Dynamics
    - Flow through pipes
    - Open channel flow
    - Turbines and Pumps

Course Syllabi: UHU032 Human Values, Ethics and IPR (L : T : P :: 3 : 0 : 0)

1. **Course number and name:** UHU032; Human Values, Ethics and IPR

2. **Credits and contact hours:** Credits: 3.0; Hours: 3

3. **Text book, title, author, and year**

   - *Narayanan, P., Intellectual Property Law, Eastern Law House (2007) 3rd ed.*
   - *Tripathi A.N., Human Values, New Age International (P) Ltd (2008).*
   - *Robbins, S.P., Organizational Behavior, Prentice Hall of India (2007)8th ed.*
   - *Journal of Intellectual Property Rights, published by National Institute of Science Communication, CSIR.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Values: Concept, Types, Rokeach Value Survey.
   Different Kinds of Values: Individual, Societal, Material, Psychological, Cultural, Moral and Ethical, Spiritual; The Burgeoning Crises at Each of these levels.
   Modern Approach to the Study of Values: Analyzing Individual Human Values such as Creativity, Freedom, Wisdom and Love; Value Spectrum for a Good Life; The Indian Concept of Values, Comparison of eastern and western concept of values.
   Ethics: Values, Morals and Ethics; Need for Ethics in Professional Life; Kohlberg's Theory of Moral Development and Its Applicability to Engineers.
   Professional Ethics: Values in Work Life; Professional Ethics and Ethos; Codes of Conduct, Whistle-Blowing, Corporate Social Responsibility, Case Studies on Ethics in Business.
   Introduction to IPR: Nature and Enforcement, International Character of IPRs, Role of IPRs in Economic Development.
   Patents: Introduction to Patents, Object of Patent Law, Inventions not Patentable, Obtaining Patents, Rights and Obligations of a Patentee.
   Copyrights: Introduction to Copyrights, Subject-Matters of Copyright, Rights Conferred by Copyright, Infringement, Assignment and Licensing of Copyrights, Copyright Societies, International Copyright, Performer's Rights.
   Trademarks: Functions, Significance and types of Trademarks, Distinctiveness and Deceptive Similarity, Registration Procedure, Trademark Registry, Grounds for Refusal of Registration of Trademarks, Concurrent Use, Character Merchandising.
   Trade Secrets: Meaning, Types of Trade Secrets, Statutory Position of Trade Secrets in India, Proofs Required in Trade Secret Litigation Case.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Explain different kind of ethics and values.
   - Apply professional ethics in business.
   - Explain the role of IPRs in professional life.
   - Elucidate the importance of patents and copyrights.

6. **Brief list of topics to be covered**
    - Ethics and Values
    - Professional Ethics in Business
    - IPRs
    - Patents and Copyrights

Course Syllabi: UMA032 Numerical and Statistical Methods (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UMA032; Numerical and Statistical Methods

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Conte, S.D and Carl D. Boor, Elementry Numerical Analysis: An Algorithmic approach, Tata McGraw Hill, New York (2005).*
   - *Johnson, R., Miller, I. and Freunds, J., Miller and Freund's Probability and Statistics for Engineers, Pearson Education(2005) 7th ed.*
   - *Gerald C.F and Wheatley P.O., Applied Numerical Analysis, Pearson Education (2008) 7thed.*
   - *Mathew, J.H., Numerical Methods for Mathematics, Science and Engineering, Prentice Hall Inc.J (2002).*
   - *Meyer, P.L.. Introductory Probability and Statistical Applications, Oxford (1970) 2nded.*
   - *Jain M.K., Iyengar, S.R.K., and Jain, R.K. Numerical Methods for Scientific and Engineering Computation, New Age International (2008) 5thed.*
   - *Walpole, Ronald E., Myers, Raymond H., Myers, Sharon L. and, Keying Ye, Probability and Statistics for Engineers and Scientists, Pearson Education (2007) 8thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Numerical Methods (60% Weightage).
   Floating-Point Numbers: Floating-point representation, Rounding, Chopping, Error analysis, Condition and instability.
   Non-Linear Equations: Bisection, Secant, Fixed-point iteration and Newton-Raphson methods, Order of convergence.
   Linear Systems and Eigen-Values: Gauss-elimination method (using Pivoting strategies) and Gauss-Seidel Iteration method. Rayleigh's power method for eigen-values and eigen-vectors.
   Interpolation: Finite differences, Newton's Forward and Stirling interpolating polynomials, Lagrange and Newton's divided difference interpolation formula with error analysis.
   Numerical Integration: Newton-Cotes quadrature formulae (with error) and Gauss - Legendre quadrature formulae.
   Differential Equations: Solution of initial value problems using Taylor Series, Euler's and Runge-Kutta (up to fourth order) methods.
   Statistical Methods (40% Weightage)
   Random Variables: Definition, Distribution Function, Discrete and Continuous Random Variables, Probability functions, Cummulative distributions functions, Mathematical expectation.
   Probability Distributions: Binomial, Poisson, Geometric, Uniform, Normal, Exponential and Log- Normal distribution.
   Sampling Distributions: Sampling distribution of Means and variance, Chi-Square distribution, t - distribution and F - distribution.

Hypothesis Testing: General concepts, Testing a Statistical Hypothesis, one and two tailed tests, Critical region, Confidence interval estimation. Single and two sample tests on proportion, mean and variance.

Linear Regression and Correlation: Linear Regression, Least Square principal and the Fitted models, Karl Pearson's Correlation Coefficient, Rank Correlation, Lines of Regression (two variables only).

Laboratory Work

Programming exercises on numerical and Statitical methods using C or C++ languages.

1. To detect the interval(s) which contain(s) root of equation f(x)=0 and implement bisection Method to find root of f(x)=0 in the detected interval.
2. To find the root of f(x)=0 using Newton-Raphson and fixed point iteration methods.
3. To evaluate the Newton's Forward Lagrange and divided difference interpolating polynomials of degree $\leq$ n, Based on (n+1) points.
4. To solve linear system of equations using Gauss elimination (without pivoting) method.
5. To solve linear system of equations using Gauss- seidel method.
6. To find the dominant eigen-value and associated eigen-vector by Rayleigh power method.
7. To integrate a function numerically using trapezoidal and Simpson's rule.
8. To solve the initial value problem using modified Euler's and Runge-kutta methods.
9. Generation of random numbers for Binomial and Poisson distributions using Linear Congruential Generator Algorithm.
10. Regression analysis using least square principle.
11. Correlation analysis for bivariate distribution.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Understand the various approaches dealing the data using theory of probability.
- Analyze the different samples of data at different level of significance using various hypothesis testing.
- Develop a framework for estimating and predicting the different sample of data for handling the uncertainties.
- Understand error, source of error and its affect on any numerical computation and also analyzing the efficiency of any numerical algorithm.
- Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
- Solve system of linear equations numerically using direct and iterative methods.
- Understand the methods to construct interpolating polynomials with practical exposure.

6. **Brief list of topics to be covered**

- Floating-Point Numbers
- Non-Linear Equations
- Linear System and Eigen Values
- Interpolation
- Numerical Integration, Differential Equation
- Random Variables
- Probability Distributions
- Sample Distributions
- Hypothesis Testing
- Linear Regression and Correlation

Course Syllabi: UEE402 Transmission and Distribution of Power (L : T : P :: 2 : 1 : 0)

1. **Course number and name:** UEE402; Transmission and Distribution of Power

2. **Credits and contact hours:** Credits: 2.5; Hours: 3

3. **Text book, title, author, and year**

   - *Chakrabarti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai (2008).*
   - *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008) 4thed.*
   - *Gupta, B.R., Power System Analysis and Design, S. Chand (2009).*
   - *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw–Hill (2007).*
   - *Pabla, A.S., Electric Power Distribution, McGraw Hill (2008).*
   - *Stevenson, W.D., Power System Analysis, McGraw–Hill (2007) 4thed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Structure of power systems, Growth of power systems–Indian overview, Interconnections and their advantages, Transmission system planning.
   Transmission Lines: Choice of voltage and frequency, Types of conductor, Size of conductor, Electrical parameters of transmission lines, Resistance, Inductance and capacitance, GMR and GMD.
   Mechanical design of overhead transmission lines: Tension and sag calculations, Effect of weather conditions, Sag template, Stringing charts, Vibrations and vibration damper.
   Insulators: Insulator types, String efficiency, Grading rings, Arcing horns, Armored rods.
   Transmission Line Performance: Characteristics and performance of power transmission lines: Short, Medium, Long lines, Generalized constants, Power flow, regulation, Power circle diagrams, Series and shunt compensation, Corona visual and disruptive, Critical voltage, Corona loss, Electrostatic and electromagnetic interference with communication lines.
   Insulated Cables: Constructional features, Parameters, Cable laying procedures, Fault location Methods, High voltage cables, Thermal characteristics, Comparison of rating of single core and multi core cables, Introduction to XLPE cables.
   Distribution Systems: Primary and secondary distribution, Ring main and radial systems, Systematic design of distribution systems.
   EHV transmission and HVDC transmission: An introduction, Configurations and comparison Indian electricity rules: Introduction and familiarization.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Understand the structure of power system.
   - Analyse the transmission line models and evaluate its performance parameters.
   - Design the transmission lines under various working conditions.
   - Describe and select the configurations of different line insulators and evaluate their performance.

- Supervise the laying of cables and fault detection in cables.
- Design the distribution system network.

6. **Brief list of topics to be covered**
    - Transmission Lines
    - Insulators
    - Distributed systems
    - EHV transmission and HVDC transmission

Course Syllabi: UEI501 Control Systems (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEI501; Control Systems

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Gopal, M., Digital Control System, Wiley Eastern (1986).*
   - *Nagrath, I.J. and Gopal, M., Control System Engineering, New Age International (P) Limited, Publishers (2003).*
   - *Ogata, K., Modern Control Engineering, Prentice-Hall of India Private Limited (2001).*
   - *Kuo, B.C., Automatic Control System, Prentice-Hall of India Private Limited (2002).*
   - *Sinha, N.K., Control System, New Age International (P) Limited, Publishers (2002).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Basic Concepts: Historical review, Definitions, Classification, Relative merits and demerits of open and closed loop systems
   Mathematical Models of Physical Systems: Linear and non-linear systems, Transfer function, Mathematical modeling of electrical, Mechanical, Thermal, Hydraulic and pneumatic systems, Analogies, Block diagrams and signal flow graphs.
   Components: AC and DC servomotors and tachogenerators, Potentiometers, Synchros, Stepper motors.
   Analysis: Time and frequency domain analysis, Transient and frequency response of first and second order systems, Correlationship between time and frequency domain specifications, Steady-state errors and error constants, Concepts and applications of P, PD, PI and PID types of control.
   Stability: Definition, Routh-Hurwitz criterion, Root locus techniques, Nyquistcriterion, Bode plots, Relative stability, Gain margin and phase margins, M and N circles, Nichol's charts
   MATLAB: Introduction, Applications in solution of control system problems.
   Compensation: Lead, Lag and lag-lead compensators, Design of compensating networks for specified control system performance.
   Components: D.C. and A.C. Servomotors, D.C. and A.C. Tachogenerators, Potentiometers and optical encoders, Synchros and stepper motors, Introduction to PLCs, their hardware and ladder diagram programme.
   State Space Analysis: Concepts of state, State variables and state models, State space equations, Transfer function, Transfer model, State space representation of dynamic systems, State transition matrix, Decomposition of transfer function, Controllability and observability.
   Laboratory Work
   Linear system simulator, Compensation design, D.C. position control and speed control, Synchro characteristics, Servo demonstration, Stepper motor, Potentiometer error detector, Rate control system, Series control system, Temperature control system.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

- Distinguish between open loop and closed loop systems.
- Develop the mathematical models of different physical systems.
- Analyze the stability of a given control system.
- Explain the concept of modern control theory.

6. **Brief list of topics to be covered**
    - Mathematical Models of Physical Systems
    - Components
    - Analysis
    - Stability
    - Compensation
    - State Space Analysis

Course Syllabi: UEE501 Generalized Theory of Electrical Machines (L:T:P::3:1:0)

1. **Course number and name:** UEE501; Generalized Theory of Electrical Machines

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Bimbhra, P.S., Generalized Theory of Electric Machines, Khanna Publishers (2006).*
   - *Kraus, P.C., Analysis of Electric Machine, McGraw–Hill (2000).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)
   Introduction: Reference frame theory, 3-Φ→2-Φ transformation, Physical concept of park's transformation, Volt-ampere and torque equations, Space vector concept.
   3-Φ Induction Machine: Performance equations in different rotating frames, Equivalent circuit, Different inductance, Effect of voltage and frequency on the performance, Braking, Unbalance operations.
   Synchronous Machine: General machine equation in different frame, Dynamic analysis, Power angle characteristics, Phases diagram for cylindrical rotor and salient pole machine, Electromagnetic and reluctance torque, Electric braking of synchronous machine.
   DC Machine: Transfer function for DC machine, (Shunt, Series and compound), Linearization technique, Analysis under motoring and generating made, Dynamic analysis.
   Advance Machines: 1-Φ synchronous motor, 2-Φ servomotor, AC tachometers, Switched reluctance motor, Brushless DC motor.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Express the revolving field and reference frame theory
   - Develop mathematical model of three-phase AC machines and parameters in different reference frame.
   - Simulate the transient performance of three-phase AC machines in different reference frames.
   - Investigate the transient performance of different DC machines.
   - Select special purpose small machines for different applications.

6. **Brief list of topics to be covered**
   - 3-Φ Induction Machine
   - Synchronous Machine
   - DC Machine
   - Advanced Machine

Course Syllabi: UEE502 High Voltage Engineering (L : T : P :: 3 : 0 : 2)

1. **Course number and name:** UEE502; High Voltage Engineering

2. **Credits and contact hours:** Credits: 4.0; Hours: 5

3. **Text book, title, author, and year**

   - *Khalifa, M., High Voltage Engineering: Theory and Practice, Marcel Dekker Inc. (2000).*
   - *Naidu, M.S. and Kamraju, V., High Voltage Engineering, Tata McGraw–Hill (2008).*
   - *Wadhwa, C .L. High Voltage Engineering, New Age International (P) Limited, Publishers (2006).*
   - *Dass, R., Extra High Voltages, Tata McGraw–Hill (2006).*
   - *Kind, D. and Feser, K, High Voltage Test Techniques, Reed Educational and Professional Publishing Limited (2001).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Introduction to AC and DC impulse high voltages and their use, Problems in dealing with high voltages.

   Breakdown in Gases: Elementary ideas on ionization by electron collision, Townsend mechanism, Townsend first and second ionization coefficients, Paschen law, Breakdown in non-uniform fields and corona discharges, Vacuum breakdown mechanisms, Breakdown in liquids, Fundamentals of insulating oils, Conduction and breakdown in pure and commercial liquids.

   Breakdown in Solids: Fundamentals of solid insulating materials intrinsic, Electromechanical and thermal breakdown. Breakdown in simple and composite dielectrics. Insulation design principles: Types of insulating materials, Temperature classification, Factor affecting dielectric strength, Insulation design of rotating machines, Transformers, Transmission lines, Switch gear. etc.

   Generation of High Voltages: Generation of high voltages. Characteristics parameters of high alternating voltages, Testing transformers in cascade, Series Resonant Circuits and their advantages; Characteristics parameters of high direct voltages; Half and Full wave rectifier circuits. Voltage doubler and cascade circuits, Electrostatic generator, Characteristics parameters of impulse voltages, Single state impulse generator circuits, Analysis and calculations of circuit parameters, Multistage impulse operation circuits, Tripping of impulse generator and synchronization with oscilloscope.

   Measurement of High Voltages: Measurement of direct, Alternating and impulse voltages by electrostatic voltmeters, Sphere gap, Uniform field gap, Ammeter in series with high voltage resistors and voltage divider (Resistive, Capacitive and mixed).

   Non-Destructive High Voltage Tests: Loss in a dielectric, Dielectric loss measurement by schering bridge, Partial discharges at alternating voltages; External and internal partial discharges and discharge measurements.

   Laboratory Work

   Alternating voltages, Voltage measurement by sphere gap and Chubb and Fortesque methods. Impulse voltage: Experimental setup for standard lightning wave, Efficiency and peak voltage

measurement by sphere gap impulse voltage time curves. Use of standard software package for the Electric Stress calculations in H.V. bushings. Liquid dielectric: Breakdown voltage, Conductivity and Dissipation Factor measurement with Schering Bridge, Partial discharge measurements.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Conceptualize the idea of high voltage and safety measures involved.
- Analyse the breakdown mechanism of solids, liquids and gases.
- Design insulation associated with various power system components such as transformer, rotating machines and switchgear.
- Analyse and calculate the circuit parameters involved in generation of high voltages.
- Measure direct, alternating and impulse high voltage signals.
- Measure the dielectric loss and partial discharge involved in non-destructive high voltage tests.

6. **Brief list of topics to be covered**

- Breakdown in Solids
- Breakdown in Gases
- Generation of High Voltages
- Measurement of High Voltages

Course Syllabi: UEE503 Network Analysis and Synthesis (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE503; Network Analysis and Synthesis

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Hayt, W., Engineering Circuit Analysis, Tata McGraw–Hill (2006).*
   - *Hussain, A., Networks and Systems, CBS Publications (2004).*
   - *Valkenberg, Van, Network Analysis, Prentice–Hall of India Private Limited (2007).*
   - *Chakarbarti, A., Circuit Theory, DhanpatRai and Co. (P) Ltd. (2006).*
   - *RoyChowdhuary, D., Networks and Systems, New Age International (P) Limited, Publishers (2007).*
   - *Sudhakar, A., Circuits and Networks, Tata McGraw–Hill (2006).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Graph theory and Network equations: Graph, Tree and link branches, Network matrices, Incidence matrix, Basic loop and cut set matrices, Relation between network matrices, Choice of linearly independent network variables, Topological equations for loop current and topological equation for nodal voltage, Source transformation Tellegen's theorem and its applications.

   Network Theorems and Two Port Network for AC circuits: Thevenin's theorem, Norton's theorem, Millman's theorem, Reciprocity Theorem and Maximum Power Transfer Theorem as applied to A.C. circuits, Two port network description in terms of open circuits impedance, Short circuit admittance, Hybrid and inverse hybrid, ABCD and inverse ABCD parameters, Image parameters, Inter-connection of two port network, Indefinites admittance matrix and its applications, Duality networks.

   Inductively Coupled Circuits: Dot convention, Coefficient of coupling, mutual inductance in loop and nodal equations.

   Filters : Classification of filters, Analysis of prototype filter section, Analysis of a prototype Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, M–Derived Filter, Low Pass Filter with RC and RL Circuits, High Pass Filter with RC and RL Circuits, Low Pass Filter with RLC Circuit. Introduction of Different Types of Active Filters.

   Attenuators: Attenuation, Types of attenuators, Symmetrical T–type attenuator, Symmetrical π–type attenuator, Symmetrical bridged T–type attenuator, Symmetrical lattice type attenuator, Asymmetrical L–type attenuator, Asymmetrical π–type attenuator.

   Network Synthesis: Synthesis vs. analysis, Elements of circuit synthesis, LL FPB networks, Purpose and scope of network synthesis.

   Positive Real Functions: Definition, Necessary and sufficient conditions for a function to be positive real, Testing of driving point functions for positive realness.

   FOSTER and CAUER Forms: Foster and cauer forms of LC Networks, Synthesis of RC and RL networks.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Describe the underlying concepts of AC electric networks
- Solve electric circuits by applying various network laws and theorems.
- Represent complex network as two port network and can use it for impedance matching, transmission line modelling etc.
- Synthesise the RC, RL, LC networks for given function.
- Design the passive filter(s) and/or attenuator(s) for the various applications.

6. **Brief list of topics to be covered**
    - Graph Theory and Network Equations
    - Network Theorems and Two Port Network for AC Circuits
    - Inductively Coupled Circuits
    - Filters and Attenuators
    - Network Synthesis
    - Positive Real Functions

Course Syllabi: UEE504 Power Electronics (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE504; Power Electronics

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Dubey, G.K., Doradla, S.R., Joshi, A. and Sinha, R.N.K., Thyristorised Power Controllers, New Age International (P) Limited, Publishers (2004).*
   - *Rashid, M., Power Electronics, Prentice–Hall of India Private Limited (2006).*
   - *Mohan, N., Undel, T.M. and Robbins, W. P., Power Electronics: Converter Applications and Design, John Wiley and Sons (2007).*
   - *Jain, A., Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd. (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Review of power semiconductor devices, their characteristics, Thyristors, Their static and dynamic characteristics, Turn-on and Turn - off methods and circuits, Ratings and protection of SCRs, Other members of Thyristor family, Series and Parallel operation of thyristors, Firing circuits for SCRs.
   Phase Controlled Converters: Principle of Phase Control, Single Phase Half Wave Circuit with Different Types of Loads, Single Phase and Three Phase Semi Converter and Full Converter Bridge Circuits with Line Commutation, Continuous and Discontinuous Conduction Effect of Source Inductance on Single Phase and Three Phase Full Converters, Single Phase and Three Phase Dual Converters and Their Operation with Circulating and Non Circulating Currents.
   DC Choppers: Principle of chopper operation, Control strategies, Types of choppers, Step up and step down choppers, Types of choppers, Steady state time domain analysis with R, L, and C type loads, Voltage, Current and Load commutated Choppers.
   Inverters: Single phase VSI, Half Bridge and Full Bridge Inverters and their steady state analysis, Modified McMurray Half Bridge Inverter, Series and Parallel Inverters, and Three Phase Bridge Inverters with 180^0 and 120^0 modes. Single-phase PWM Inverters. Current Source Inverters, CSI with R load (qualitative approach).
   AC Voltage Controllers: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load.
   Cycloconverters: Principles of operation, Single phase to single phase step up and step down Cycloconverters. Three phase to single phase and three-phase to three-phase Cycloconverters, Output voltage equation for a Cycloconverter.
   Laboratory Work: SCR V-I characteristics, Methods of turning on of an SCR through gate triggering, DC -DC Chopper, Solid state fan regulator, Semi Converter and Full Converter with R and RL type of loads, DC Shunt Motor Speed Control, Single phase AC voltage controller with R load, Simulation of all Converters using software CASPOC.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Identify the power – electronic devices and inference their usage as switch for energy conversion and control.
- Select and design appropriate converter configuration / topology for typical power application such as DC drive, AC drive, HVDC and FACTS.
- Design the firing and commutation circuit for different converter configurations.
- Use power converters for harmonic mitigation, voltage and frequency control.

6. **Brief list of topics to be covered**
    - Phase Controlled Converters
    - DC Choppers
    - Inverters
    - AC Voltage Controllers
    - Cycloconverters

Course Syllabi: UEI841 Advanced Control Systems (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI841; Advanced Control Systems

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Bandyopadhyay, M.N., Control Engineering: Theory and Practice, Prentice–Hall of India Private Limited (2003).*
   - *Ogata, K., Discrete–time Control Systems, Pearson Education (2005).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Nonlinear Control Systems: Introduction to Nonlinear systems, Liapounov's method for stability study, Phase plane method, Describing functions.

   Optimal Control Theory: Introduction, Optimization by steepest decent method, Optimization with constraint gradient method, Minimization of functions by numerical methods: Fletcher–Powell method, Newton–Raphson method; Optimal control problem: Characteristics of the plant, Requirements of the plant, Plant data supplied to the Controller; Mathematical procedures for optimal control design: Calculas of variations, Pontryagin's optimum policy, Bang–Bang Control, Hamilton–Jacobi Principle, Dynamic Programming; State regulator problem, Parameter optimization.

   z–Plane Analysis of Discrete–Time Control Systems: Introduction, Impulse sampling and data hold, Obtaining the z–transform by the convolution integral method, Reconstructing original signal from sampled signals, The pulse transfer function, Realization of digital controllers and digital filters.

   Design of Discrete–time Control Systems by Convolution Methods: Introduction, Stability analysis of closed–loop systems in the z–plane, Transient and steady state response analysis, Design based on the root–locus method, Design based on the frequency–response method, Analytical design method.

   State–Space Analysis: Introduction, State–space representations of discrete–time systems, Solving discrete–time state–space equations, Pulse transfer function matrix, Discretization of continuous time state space equations, Liapunov stability analysis, Controllability, Useful transformations in state–space analysis and design, Design via pole placement, State observer, Servo systems.

   Quadratic Optimal Control Systems: Introduction, Quadratic optimal control, Steady–state quadratic optimal control, Quadratic optimal control of a servo system.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Study the non-linear system behavior by phase plane and describing function methods and learn about the stability of linear and nonlinear systems by Lyapunov method
   - Develop analysis and design skills in optimal control and robust control

- Assure knowledge of state space and state feedback in modern control systems, pole placement, design of state observers and output feedback controllers
- Design and fine tune PID controllers and understand the roles of P, I and D in feedback control
- Familiarize themselves with the scholarly literature in modern control systems

6. **Brief list of topics to be covered**
    - Nonlinear Control Systems
    - Optimal Control Theory
    - z–Plane Analysis of Discrete–Time Control Systems
    - Design of Discrete–time Control Systems by Convolution Methods
    - State–Space Analysis

Course Syllabi: UEI503 Digital Signal Processing and Applications (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI503; Digital Signal Processing and Applications

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Helmut, U. and Willibald, W., Protection Techniques in Electrical Engg. Systems, Marcel Dekker Inc. (2001).*
   - *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing, Prentice-Hall of India Private Limited (1996).*
   - *Rabiner, C.R. and Gold, B., Theory and Applications of Digital Signal Processing, Prentice-Hall of India Private Limited (2000).*
   - *Antonion, A., Digital Filters: Analysis Design and Application, Prentice-Hall of India Private Limited (1999).*
     Oppenhein, A.V. and Schafer, R.W., Digital Signal Processing, Prentice-Hall of India Private Limited (1998).

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Representations of discrete signals and systems and basic operators, z-Transforms, Causality and Stability in terms of z-transform, Bilateral z-transform, Computation of z-transform.
   Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Series, Discrete Fourier Transform and its Properties, Efficient Computation of DFT using FFT algorithms, Linear Filtering Approach to Computation of DFT.
   Digital Filter Structure: Describing Equation, Structures for FIR Systems and Structure for IIR Systems, Representation of Structures using Signal Flow Graph.
   Design of Digital Filters: Introduction, Difference between analog filters and digital filters, Implementation of digital filter, Types of filters, LTI systems as filters, Design of IIR filters from analog filters, IIR filter design using Butterworth Approximation, Frequency transformation, FIR filters design, Least square filter design, Designing digital filter from pole-zero placement, Butterworth filter design using Bilinear transformation, FIR filter design using windows, Design of filters using pole-zero combination.
   Hardware Architecture of DSP Processor: Introduction, Desirable features of DSP processors, Types of architectures, Internal architecture of ADSP-21xx family, Features of ADSP-21xx family processors, System interface, Instruction set of ADSP-21xx, ADSP-21xx Development tools, ADSP-210x Processors, TMS DSP processor,.
   Analysis of Finite Word-length Effects: Introduction, the quantization process and errors, Analysis of coefficient quantization effects in FIR filters, A/D conversion noise analysis, Analysis of arithmetic roundoff errors, Dynamic range scaling, Low sensitivity digital filters, Reduction of product round off errors, Limit cycles in IIR filters, Round off errors in FFT algorithms.
   Applications: Dual-tone multi frequency signal detection, Spectral analysis using DFT, Short term DFT, Musical sound processing, oversampling A/D converter, Oversampling D/A converter, Protection.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Express discrete-time signals analytically and visualize them in the time and frequency domain.
   - Design and implementation digital filters.
   - Illustrate the architecture and use of digital signal processors.
   - Apply DSP techniques in different fields.

6. **Brief list of topics to be covered**

   - DFT and FFT
   - Digital Filter Structure
   - Design of Digital Filters
   - Hardware Architecture of DSP Processor
   - Analysis of Finite Word-length Effects

Course Syllabi: UEE601 Flexible AC Transmission Systems (L : T : P :: 3 : 0 : 0)

1. **Course number and name:** UEE601; Flexible AC Transmission Systems

2. **Credits and contact hours:** Credits: 3.0; Hours: 3

3. **Text book, title, author, and year**

   - *Ghosh, A. and Ledwich,G., Power Quality Enhancement Using Custom Power Devices, Kluwer Academic Publishers (2005).*
   - *Hingorani, N.G. and Gyragyi, L., Understanding FACTS: Concepts and Technology of Flexible AC Transmission System, Standard Publishers and Distributors (2005).*
   - *Sang, Y.H. and John, A.T., Flexible AC Transmission Systems, IEEE Press (2006).*
   - *Mathur, R.M. and Verma, R.K., Thyristor Based FACTS Controllers for Electrical Transmission Systems, IEEE Press (2002).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)
   Power Transmission control: Fundamental of ac power transmission, Transmission problems and needs, The emergence of FACTS, FACTS controller and consideration
   Power Electronics fundamentals: Basic function of power electronics, Power semiconductor device for high power converters, Static power convertor structures, AC controller based structure, DC link convertor topologies, Convertor output and harmonic control.
   Shunt Compensation: Shunt SVC principles, Configuration and control, STATCOM, Configuration applications.
   Series Compensation: Fundamental of series compensation, Principle of operation, Application of TCSC for different problems of power system, TCSC lay out, SSSC principle of operation.
   Phase Shifter: Principle of operation, Steady state model of static phase shifter, Operating characteristics of SPS, Power current configuration of SPS application.
   Unified Power Flow Controllers: Basic operating principles and characteristics, Control UPFC installation applications, UPFC model for power flow studies.
   Simulation: Aim open loop simulation of FACTS device, closed loop solutions.

5. **Specific goals for the course**
   After the completion of the course the students will be able to:
   - Decide the scheme for power system stability and voltage control.
   - Decide the converter configuration for different power systems applications such as HVDC, FACTS etc.
   - Decide the usage of different FACTS compensators for different purposes.
   - Compute the harmonics on AC and DC side and decide their filtering.

6. **Brief list of topics to be covered**
   - Power Transmission control
   - Power Electronics fundamentals
   - Series and shunt compensation

- Phase shifter
- Unified Power Flow Controllers

Course Syllabi: UEE602 Power System Analysis and Stability (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE602; Power System Analysis and Stability

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Chakrabarti, A., Sony, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai and Co. (P) Ltd. (2008).*
   - *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw–Hill (2007).*
   - *Stevenson, W.D., Power System Analysis, McGraw–Hill (2007).*
   - *Gupta, B.R., Power System Analysis and Design, S.Chand and Company Limited (2009).*
   - *Pabla, A.S. , Electric Power Distribution, Tata McGraw–Hill (2008).*
   - *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)
   Representation of Power System: Per unit System, Representation of power system components, Regulating Transformers (Tap changing and Phase Shifting), Generators, Transmission line ands loads, Phase shift in star-delta transformer, Sequence impedance of transmission line, Transformer and generators, Sequence networks of power system. Transmission lines and loads, Y-Bus and Z-Bus formulation.
   Load Flow Study: Load flow problem, Power flow equations, Load flow solution using Gauss Seidal and Newton Raphson methods, Decoupling between real and reactive power control, Decoupled and fast decoupled methods, Comparison of load flow methods. Reactive power compensation.
   Fault Analysis: Symmetrical fault, Algorithm for symmetrical fault analysis, Unbalanced faults (Single line to ground fault, Line to line and double line to ground, Open conductor), Bus Impedance matrix method for the analysis of unsymmetrical shunt faults.
   Power System Stability: Concepts of types of stability limits, Steady state stability analysis, Transient stability analysis, Swing equation and its solution by point-by-point method, Equal area criterion, Critical clearing angle and improvement of transient stability.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Develop an appropriate mathematical model of power system.
   - Carry out power flow analysis of practical power system for balanced three-phase system.
   - Decide generation scheduling of thermal units leading to overall economy.
   - Conduct studies during balanced and unbalanced faults to decide the fault levels and circuit breaker ratings.
   - Analyze the stability of single machine-infinite bus system and can decide the critical clearing time of circuit breakers.

6. **Brief list of topics to be covered**
    - Representation of Power System
    - Load Flow Study
    - Fault analysis
    - Power system stability

Course Syllabi: UEE603 Switchgear and Protection (L : T : P :: 3 : 0 : 2)

1. **Course number and name:** UEE603; Switchgear and Protection

2. **Credits and contact hours:** Credits: 4.0; Hours: 5

3. **Text book, title, author, and year**

   - *Chakraborti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai and Co. (P) Ltd. (2008).*
   - *Pathinkar, Y.G. and Bhide, S.R., Fundamentals of Power System Protection, PHI Learning Pvt. Limited (2008).*
   - *Rao, S.S., Switchgear and Protection, Khanna Publishers (2007).*
   - *Deshpande, M.V., Switchgear and Protection, Tata McGraw–Hill (2005).*
   - *Elmore, W.A., Protective Relaying Theory and Applications, ABB Power T and D Company Inc. (2003).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: A protection system and its attributes, System transducers, various power system elements that needs protection.
   Fuses: Types, Ratings and characteristics, Construction and application of HRC fuses, Limitations, Introduction to MCBs, Application of fuses.
   Circuit Breakers: Theory of arc formation and its extinction (AC and DC), Re-striking and recovery voltage, Current chopping, Duties of switchgear, Circuit Breakers: Specifications of circuit breakers, Different types of circuit breakers like oil, Air, Vacuum and SF6, Comparative merits and demerits. HVDC circuit breaker system.
   Earthing: Earthing requirements, Earthing practices, Earth resistivity and earth gradient, Neutral shift.
   Protective Relays: Functions, Constructional and operating principles of electromagnetic type like over-current, Directional, Differential and distance relays, Characteristics, General equation, Basic principles of static relaying, Phase and amplitude comparator, Static Relays.
   Protection Schemes: Over–current protection of transmission lines, Differential protection, Transformer protection, Busbar protection, Distance protection of transmission line, Carrier aided protection of transmission lines, Generator protection, Induction motor protection, over–voltage protection.
   Recent Trends in Relays: Numerical relays, under frequency relay.
   Laboratory Work
   Sequence impedance and their calculations, Symmetrical fault level measurement on a D.C. network analyzer, Unsymmetrical fault level measurement on a D.C. network analyzer for various types of faults, Measurement of ground resistivity and resistance of a ground electrode, Plotting of characteristics of different types of relays, Performance or different types of protection schemes, ABCD constants of an artificial transmission line, String efficiency of insulator string. Use of standard software package for Short Circuit studies and relay co-ordination.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Select the protection elements such as fuse, circuit breakers and relays etc. for a given configuration.
   - Design the basic earthing requirement for residential and other purposes.
   - Select required protection measures against overcurrent, overvoltage in transmission lines.
   - Select suitable protection scheme for different power system equipments.

6. **Brief list of topics to be covered**

   - Fuses
   - Circuit Breakers
   - Earthing
   - Protective Relays
   - Protection schemes

Course Syllabi: UEE801 Electric Drives (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE801; Electric Drives

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Dubey, G.K., Power Semiconductor Controlled Drives, Prentice Hall Inc. (1989).*
   - *Pillai, S.K., a Course in Electric Drives, New Age International (P) Limited, Publishers (1989).*
   - *Bose, B.K., Modern Power Electronics and AC Drives, Prentice–Hall of India Private Limited (2006).*
   - *Dubey, G.K., Fundamentals of Electric Drives, Narosa Publications (2001).*
   - *Sen, P.C., Thyristor DC Drives, John Wiley and Sons (1981).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Definitions and Dynamics of Electric Drives: Concept of electric drive and its classifications, Types of loads, Four-quadrant drive, Dependence of load torque on various factors, Dynamics of motor-load combination, Steady state stability of an electric drive system, Load Equalization.
   Drive Features of Importance: Multi-quadrant operations of DC and AC motors, Energy relations during starting and braking.
   Static Control of Motors: Contactors and relays for electric drives, Control circuits for automatic starters of DC and AC motors including definite time accelerating type.
   Estimation of Motors Rating: Thermal modeling of motors, Types of duty cycles, Calculation of motor rating for duty cycles, Overload factor calculation for short and intermittent duty cycle, Use of load diagrams.
   Semiconductor Controlled Drives: Control of DC drives fed through single-phase and three-phase semi converter and full-converter phase-controlled configurations. Their analysis, Regeneration and braking through static power converters, Control of three phase induction motors by stator voltage and frequency control for speeds below and above synchronous speed. Static rotor resistance control, Static Kramer and Scherbius drives.
   Programmable Logic Controllers: Introduction, relative merits over hard-wired logic and relay, PLC based design of power converters, PLC based control of DC and AC Drives, Energy efficient drives, Losses in electrical drive system, Measure of energy conservation in electric drive, Use of efficient semiconductor converters, Energy efficient operation of drive, Improvement of quality of supply.
   Laboratory Work
   Starting and running characteristics of converter fed AC and DC motor control, Harmonic analysis of AC and DC Drives, V/f based drive, Microprocessor based Drive, PLC based drive. Project on drives using standard software.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

- Conceptualize the basic drive system and analyse it for different types of loads.
- Analyse the motor situation during starting and braking.
- Develop control circuitry and devices for control of motor.
- Estimate the motor rating for different condition of load.
- Design the converter circuit for control purpose along with its different configuration.
- Use PLC and converter control to drive on the basis of energy efficiency.

6. **Brief list of topics to be covered**
    - Definitions and Dynamics of Electric Drives
    - Static Control of Motors
    - Estimation of Motors Rating
    - Semiconductor Controlled Drives
    - PLCs

Course Syllabi: UHU081 Engineering Economics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UHU081; Engineering Economics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Salvatore, D. and Srivastav, R., Managerial Economics: Principles and Worldwide Applications, Oxford University Press, Sixth Edition. (2008) 6th ed.*
   - *Peterson, H. Craig & Lewis, W. Chis. &Jain, Sudhir K Managerial Economics, Prentice Hall of India (2008) 4th ed.*
   - *Dwivedi, D.N., Managerial Economics, Vikas Publishing House Pvt. Ltd (2008) 7th ed.*
   - *Sikdar, S., Principles Macro Economics, Oxford University Press (2006).*
   - *Bhole, L.M., Financial Institutions and Markets, Tata McGraw Hill (2007) 6th ed.*
   - *Pindyck, R.S. and Rubinfeld, D.I, Microeconomics, MacMillan (2007).*
   - *Dutt, R. and Sundaram, K.P.M., Indian Economy, S. Chand & Company Ltd. (2009).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)
   Introduction and Scope of Engineering Economics.
   Demand and Supply: Meaning of Demand and supply, Determinants of demand and Supply.
   Demand Forecasting: Purpose of Forecasting Demand, Determinants of demand forecasting, Methods of Demand Forecasting, Criteria for the good forecasting method.
   Cost of Production: Explicit and Implicit costs, Marginal, Incremental and Sunk costs, Opportunity cost, Short-run cost function, Total Average and Marginal costs, Long-run costs, Break-even analysis.
   Theory of Production: Law of Variable Proportions and Laws of returns to scale. Depreciation: Definite and characteristics of term Depreciation, causes of Depreciation, computation of Depreciation.
   Markets Structures and Pricing Theory: Perfect competition, Monopoly, Monopolistic competition, and Oligopoly.
   Investment Decision: Capital Budgeting, Methods of Project Appraisal
   (Payback Period, IRR, NPV, BCR).
   Overview of Financial Markets: Money Market, Stock Market, Mutual Fund.
   National Accounting: Meaning, Methods and Current Trends.
   Inflation &Deflation: Meaning, Measures and Impact on Indian economy.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:

   - Explain elasticity of demand and demand forecasting.
   - Describe market structure and pricing theory.
   - Do estimation, cost accounting and depreciation calculation.
   - Do breakeven analysis and take investment decisions.

6. **Brief list of topics to be covered**

- Demand and Supply
- Cost of Production
- Theory of Production
- Markets Structures and Pricing Theory
- Investment Decision
- National Accounting
- Inflation & Deflation

Course Syllabi: UEE802 Intelligent Algorithms in Power System (L : T : P :: 3 : 0 : 2)

1. **Course number and name:** UEE802; Intelligent Algorithms in Power System

2. **Credits and contact hours:** Credits: 4.0; Hours: 5

3. **Text book, title, author, and year**

   - *Lin, C., Lee, G., Neural Fuzzy Systems, Prentice Hall International Inc. (2000).*
   - *Rajashekran, S. and VijaylaksmiPai, G.A., Neural Networks, Fuzzy Logic and Genetic Algorithm Systhesis and Applications, Prentice–Hall of India Private Limited (2004).*
   - *Taylor, C.W., Power System Stability, McGraw–Hill (2007).*
   - *Kosko, B., Neural Networks and Fuzzy Systems: a Dynamical systems Approach to Machine Intelligence, Prentice–Hall of India Private Limited (1992).*
   - *Zurda, J.M., C++ Neural Networks and Fuzzy Logics, BPS Publication (2001).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Concept of artificial intelligence, Problem solving methods and searching techniques.

   Fuzzy Systems: Fuzzy sets, Operation on fuzzy sets, Fuzzy relations, Fuzzy measures, Fuzzy logic, Fuzzy controller.

   Artificial Neural Networks: Fundamental concepts, Basic models, Learning rules, Single layer and multi-layer feed-forward and feedback networks, Supervised and unsupervised learning, Recurrent networks, Modular network, Self organizing maps, Function networks, Neural network controller.

   Genetic Algorithm: Basic principle, Evolution of genetic algorithm, Hybrid genetic algorithm.

   Hybrid Systems: Integrated neural- fuzzy system simulated evolution for neural network learning, Fast learning algorithms for training NN.

   Applications: Short term and long term load forecasting, Identification, Classification, Fault location and fault diagnosis, Stability evaluation, Economic load dispatch, Voltage estimation, Hydro-thermal scheduling, DC/AC four quadrant drive control.

   Laboratory Work

   Training algorithms of neural networks and fuzzy logic, Implementation of fuzzy logic, Neural Networks (NN) and Genetic Algorithms on various applications, Use of MATLAB tools of fuzzy logic and NN.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Implement fuzzy controllers by modelling the human intelligence into mathematical model.
   - Mathematically model the human learning capability and solve classification, control system and optimization problem.
   - Obtain the optimum solution of well formulated optimisation problem using evolutionary approach.
   - Formulate hybrid intelligent algorithms for typical electrical application.

6. **Brief list of topics to be covered**
    - Fuzzy Systems
    - Artificial Neural Networks
    - Genetic Algorithm
    - Hybrid Systems

Course Syllabi: UEE804 Operation and Control of Power Systems (L : T : P :: 3 : 1 : 2)

1. **Course number and name:** UEE804; Operation and Control of Power Systems

2. **Credits and contact hours:** Credits: 4.5; Hours: 6

3. **Text book, title, author, and year**

   - *Chakraborti,A., Soni,M.L., Gupta,P.V. and Bhatnagar,U.S., a Text Book on Power System Engineering, DhanpatRai and Co. (P) Ltd. (2008).*
   - *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw Hill (2007).*
   - *Stevenson, W.D., Power System Analysis, McGraw–Hill (2007).*
   - *Gupta, B.R., Power System Analysis and Design, S. Chand and Company Limited (2009).*
   - *Pabla, A.S., Electric Power Distribution, Tata McGraw–Hill (2008).*
   - *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Economic Operation of Power Systems: Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, Minimum and maximum power generation limits.

   Economic Dispatch: Economic dispatch problem with and without transmission line losses, Unit Commitment, Their solution methods.

   Hydrothermal Co-ordination: Hydro-scheduling, Plant models, Scheduling problems, Hydro-thermal scheduling problems and its approach.

   Power System Control: Power system control factors, Interconnected operation, Tie-line operations, Reactive power requirements, During peak and off peak hours, Elementary ideas of load frequency and voltage, Reactive power control , Block diagrams of P-f and Q-V controllers, ALFC control, Static and dynamic performance characteristics of ALFC and AVR controllers, Excitation systems.

   Power System Security: Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.

   Dynamic Modelling of Power System components: Generators, Linear and non linear model using d-q transformation, Power capability curve, Reactive capability limits, V curves and compounding curves, Excitation systems, Turbine and speed governing systems, Loads.

   Small Scale Stability Analysis: State space representation, Eigen value and participation factor analysis.

   Voltage Stability: Basic concepts, Voltage collapse, P-V and Q-V curves, Impact of load, Static and dynamic analysis of voltage stability, Prevention of voltage collapse.

   Laboratory Work

   Steady state power limit of a transmission line, Simulation studies of steady state stability of a power system, Characteristics of induction regulator, Volt-ampere characteristics of solar cell and determination of its internal, Resistance, Simulation of different transmission line models on PC, Simulation of steady state operation of a power system on PC, Simulation of load flow

methods and power system stability problems, Use of standards software packages for operation and control of power system.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Decide the scheduling of thermal units and hydro-thermal units for overall economy.
   - Develop small scale model of alternator, excitation and governing systems.
   - Design and apply control for frequency and voltage of power system represented by single or multi-area.
   - Comprehend power system security and contingency.
   - Computation of small scale and voltage stability.

6. **Brief list of topics to be covered**

   - Economic Operation of Power Systems
   - Economic dispatch
   - Hydrothermal Co-ordination
   - Power System Control
   - Power System security
   - Dynamic Modelling of Power System components
   - Voltage stability

Course Syllabi: UEE793 Capstone Project (L : T : P :: 0 : 0 : 2)

1. **Course number and name:** UEE793; Capstone Project

2. **Credits :** Credits: 5

3. **Specific course information**

   Course Objective: To facilitate the students learn and apply an engineering design process in electrical engineering, including project resource management. As a part of a team, the students will make a project, that emphasizes, hands-on experience, and integrates analytical and design skills. The idea is to provide an opportunity to the students to apply what they have learned throughout the course of graduate program by undertaking a specific problem.
   Course Description: Capstone Project is increasingly interdisciplinary, and requires students to function on multidisciplinary teams. It is the process of devising a system, component or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs." It typically includes both analysis and synthesis performed in an iterative cycle. Thus, students should experience some iterative design in the curriculum. As part of their design experience, students have an opportunity to define a problem, determine the problem scope and To list design objectives. The project must also demonstrate that students have adequate exposure to design, as defined, in engineering contexts. Engineering standards and realistic constraints are critical in engineering design. The program must clearly demonstrate where standards and constraints are taught and how they are integrated into the design component of the project. Each group will have 4-5 students. Each group should select their team leader and maintain daily diary. Each Group will work under mentorship of a Faculty supervisor. Each group must meet the assigned supervisor (2hrs slot/week) till the end of the semester (record of attendance will be maintained), as per the time slot which will be provided to them by the respective supervisor. This is mandatory requirement for the fulfilment of the attendance as well as the successful completion of the project. The faculty supervisor of the project will continuously assess the progress of the works of the assigned groups.

4. **Specific goals for the course**
   After the completion of the course, the students will be able:
   - To identify design goals and analyze possible approaches to meet given specifications with realistic engineering constraints.
   - To design an electrical engineering project implementing an integrated design approach applying knowledge accrued in various professional courses.
   - To perform simulations and incorporate appropriate adaptations using iterative synthesis.
   - To use modern engineering hardware and software tools.
   - To work amicably as a member of an engineering design team.
   - To improve technical documentation and presentation skills.

Course Syllabi: UEE791 Project Semester (L : T : P :: 0 : 0 : 0)

1. **Course number and name:** UEE791; Project Semester

2. **Credits :** Credits: 16

3. **Specific course information**

Course Objectives

The project semester is aimed at developing the undergraduate education programme in Electrical Engineering to include a practical training in a professional engineering set up (a company, top educational institution, research institute etc.) hereafter referred to as host "organization" as deemed appropriate. The participating organizations are selected that are either already visiting Thapar University for placement or are forming new relationships of mutual benefit. The project semester gives the student the opportunity to translate engineering theory into practice in a professional engineering environment. The technical activity in the project semester should be related to both the student's engineering studies and to the host organization's activities and it should constitute a significant body of engineering work at the appropriate level. It should involve tasks and methods that are more appropriately completed in a professional engineering environment and should, where possible, make use of human and technology resources provided by the organization. It consolidates the student's prior learning and provides a context for later research studies. The student remains a full time registered student at Thapar University during the project semester and this activity is therefore wholly distinct from any industrial interactions which may occur over vacation periods.

Assessment Details

Each student is assigned a faculty supervisor who is responsible for managing and assessment of the project semester. The faculty supervisor monitors the student's progress in a semester and interacts with the industry mentor during his/her visit to the host organization twice. This includes a Reflective Diary which is updated throughout the project semester, an Interim Project Report, a Final Report with Learning Agreement/Outcomes and a Final Presentation & Viva which involves the faculty Supervisor and some other members from the department. The mentor from the host organization is asked to provide his assessment on the designated form. The faculty supervisor is responsible for managing and performing the assessment of the project semester experience.

4. **Specific goals for the course**

After the completion of course, the students will be able to:

- Acquire knowledge and experience of software and hardware practices in the area of project.
- Carry out design calculations and implementations in the area of project.
- Associate with the implementation of the project requiring individual and teamwork skills.
- Communicate their work effectively through writing and presentation.
- Demonstrate the knowledge of professional responsibilities and respect for ethics.

Course Syllabi: UEE712 Electrical Engineering Materials (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE712; Electrical Engineering Materials

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Electrical Engineering Materials Adrianus J Dekker, Phi Learning Publishers.*
   - *Electrical Properties of Materials, 8th Edition by Solymar, L, Oxford University Press-New Delhi.*
   - *Introduction to Electrical EngineeringMaterials 4th Edn. 2004 Edition by Indulkar C, S. Chand & Company Ltd-New Delhi.*
   - *Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Elementary Materials Science Concepts: Bonding and types of solids, Crystalline state and their defects, Classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity, skin effect, Hall effect.
   Dielectric Properties of Insulators in Static and Alternating field: Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, Internal field in solids and liquids, Properties of Ferro-Electric materials, Polarization, Piezoelectricity, Frequency dependence of Electronic and Ionic Polarizability, Complex dielectric constant of non-dipolar solids, dielectric losses.
   Magnetic Properties and Superconductivity: Magnetization of matter, Magnetic Material Classification, Ferromagnetic Origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density.
   Conductivity of metals: Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals.
   Semiconductor Materials: Classification of semiconductors, semiconductor conductivity, temperature dependence, Carrier density and energy gap, Trends in materials used in Electrical Equipment.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Learn the basics of materials used in electrical engineering.
   - Realize the dielectric properties of insulators in static and alternating fields.
   - Explain the importance of magnetic properties and superconductivity.
   - Explain the behavior of conductivity of metals and classifications of semiconductor materials.

6. **Brief list of topics to be covered**
   - Elementary Materials Science Concepts

- Dielectric Properties of Insulators
- Magnetic Properties and Superconductivity
- Conductivity of metals
- Semiconductor materials

Course Syllabi: UPH061 Modern Physics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UPH061; Modern Physics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Beiser, A., Concept of Modern Physics, McGraw Hill Publications (1997).*
   - *Singh, J., Modern Physics for Engineers, John Willey & Sons (2005).*
   - *Eisberg, R., and Resnick, R., Quantum Physics of Atoms, Solids, Nuclei and Particles, John- Willey (2003).*
   - *Bernstein, J., Fishbane, P.M., Gasiorowicz, S., Modern Physics, Pearson Education (2003).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Need of Modern Physics: Overview of Classical, Wave Packet and Uncertainty Principle, Need for Quantum Mechanics, Waves as particles: Black Body Radiation, Photoelectric Effect, Particles as Waves. Specific Heat of Metals, Atomic Spectra, Wave Particle Duality.
   Evolution of Quantum Mechanics: Schrodinger Wave Equations, Wave Functions, Expectation Value, Ehrenfest Theorem, Particle in a Box, Finite Potential Well, Harmonic Oscillator, Tunneling Effect.
   Applications of Quantum Mechanics: Ohmic Contacts. Field Emission Devices, Scanning Tunneling Microscopy, Tunneling in Semiconductor Diodes and Superconductors., Free Particle Problems and Density of State, Particle in a Periodic Potential; Bloch Theorem; Kronig-Penney Model for Band Structure and its Applications in Metals, Insulators, Semiconductors and Superconductors.
   Quantum Statistics: Maxwell-Boltzman Statistics, Need for Quantum Statistics, Bose-Einstein and Fermi, Dirac(FD) statistics; Applications of Bose Einstein Statistics to Photons and Phonons, Application of FD Statistics to FD Degeneracy of Electron Gas in Metals; Heat Capacity of Metals; Einstein and Debye Model of Solids.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Explain the basic concepts of quantum physics such as wave packet and uncertainty principle.
   - Describe the evolution of quantum mechanics.
   - Demonstrate the application of quantum mechanics.
   - Explain the basics of quantum statistics.

6. **Brief list of topics to be covered**
   - Need of Modern Physics
   - Evolution of Quantum Mechanics
   - Applications of Quantum Mechanics
   - Quantum Statistics

Course Syllabi: UEE711 Alternate Sources of Energy (L : T : P :: 3 : 0 : 0)

1. **Course number and name:** UEE711; Alternate Sources of Energy

2. **Credits and contact hours:** Credits: 3.0; Hours: 3

3. **Text book, title, author, and year**

   - *Rai, G.D., Non Conventional Energy Sources, Khanna Publishers (2005).*
   - *Rao, S. and Parulekar, B.B., Energy Technology: Non Conventional, Renewable and Conventional, Khanna Publishers (2005).*
   - *Wadhwa, C.L., Generation, Distribution and Utilization of Electric Energy, New Age International (P) Limited, Publishers (2007).*
   - *Simon, Christopher A., Alternate Source of Energy, Rowman and LittleField Publishers Inc. (2007).*
   - *Venikov, V.A. and Putyain, E.V., Introduction to Energy Technology, Mir Publishers (1990).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Introduction: Global and national energy scenarios, Concept of energy services, Patterns of energy supply, Energy resource availability, Cultural, Economic and national security aspects of energy consumption. Forms and characteristics of renewable energy sources. Energy classification, Source and utilization, Thermodynamic power cycles and binary cycles.
   Solar Energy: Solar radiation, Flat plate collectors, solar concentration, Thermal applications of solar energy, Photovoltaic technology and applications, Energy storage.
   Biomass Energy: Energy from Biomass, Thermo chemical, biochemical conversion to fuels. Biogas and its applications.
   Wind Energy: Wind characteristics, Resource assessment, Horizontal and vertical axis wind turbines, Electricity generation and water pumping, Micro/Mini hydro power system, Water pumping and conversion to electricity, Hydraulic ram pump.
   Other Alternate Sources: Ocean thermal energy conversion, Geothermal, Tidal, Wave energy, MHD, Fuel cells. Environmental Issues of energy services.
   Stand alone generating units: Synchronous generator and induction generator, Operation and characteristics, Voltage regulation. Lateral aspects of Renewable Energy technologies and systems.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Realise the national energy scenario and work for managing the different alternating available energy resources.
   - Design solar energy based system for various applications.
   - Synthesize biomass energy and utilize it in house hold applications.
   - Design wind energy based electric power generating system.
   - Explore the application areas of Geothermal, Fuel cell, MHD and Ocean energy.

- Analyse the operational characteristics of stand-alone generating unit for renewable energy applications.

6. **Brief list of topics to be covered**
    - Solar Energy
    - Biomass Energy
    - Wind Energy
    - Stand alone generating units

Course Syllabi: UCS401 Computer System Architecture (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UCS401; Computer System Architecture

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Mano, Morris M., Computer System Architecture, Prentice Hall (1992) 3rd ed.*
   - *Hayes, J.P., Computer Architecture and Organization, McGraw Hill (1998) 3rd ed.*
   - *Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture a Quantitative Approach, Pearson Education Asia (2006) 4th ed.*
   - *Leigh, W.E. and Ali, D.L., System Architecture: software and hardware concepts, South Wester Publishing Co. (2000).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)
   Basics of Digital Electronics: Codes, Logic gates, Flip flops, Registers, Counters, Multiplexer, Demultiplexer, Decoder, Encoder.
   Register Transfer and Micro operations: Register transfer Language, Register transfer, Bus & memory transfer, Logic micro operations, Shift micro operation.
   Basic Computer Organization: Instruction codes, Computer instructions, Timing & control, Instruction Cycles, Memory reference instruction, Input/Output & Interrupts, Complete computer description & design of basic computer.
   Control Unit: Hardwired vs. Micro programmed control unit.
   Central Processing Unit: General register organization, Stack organization, Instruction format, Data transfer & manipulation, Program control, RISC, CISC.
   Computer Arithmetic: Addition & subtraction, Multiplication Algorithms, Division algorithms.
   Input-Output Organization: Peripheral devices, I/O interface, Data transfer schemes, Program control, Interrupt, DMA transfer, I/O processor.
   Memory Unit: Memory hierarchy, Processor vs. memory speed, High-speed memories, Cache memory, Associative memory, Interleave, Virtual memory, Memory management.
   Introduction to Parallel Processing: Pipelining, Characteristics of multiprocessors, Interconnection structures, Interprocessor arbitration, Interprocessor communication & synchronization.
   Case Studies: Case studies of some contemporary advanced architecture for processors of families like Intel, AMD, IBM etc./ **Seminar on State-of the-art technology.**

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Explain the basics of digital electronics.
   - Elaborate basic computer organization, control unit and central processing unit.
   - Do binary addition, subtraction, multiplication and division.
   - Explain the input output organization of a processor.

- Differentiate between various types of memories.

6. **Brief list of topics to be covered**
    - Basics of Digital Electronics
    - Register Transfer and Micro operations
    - Basic Computer Organization
    - Introduction to Parallel Processing

Course Syllabi: UEI622 Data Networks (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI622; Data Networks

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Dimitri, P., Gallager, B., Data Networks, Prentice–Hall of India Private Limited (2004).*
   - *Tanenbaum, A.S., Computer Networks,Prentice–Hall of India Private Limited (2005).*
   - *Dumas, M.B., Principles of Computer Networks and Communications, Prentice–Hall of India Private Limited (2003).*
   - *Steven, W.R., TCP/IP Illustrated (Vol. 2): The Implementation, Addison Wesley, (2002).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction to Computer Networks: Uses of computer networks, Types of networks, Connection oriented and connectionless services.
   Layered Network Architecture: The OSI Reference model, The TCP/IP reference model, Comparison of OSI and TCP reference models.
   Physical Layer: Overview of communication channels, Maximum Data Rate of a channel, Transmission media, Twisted pair, Coaxial, Fiber optics, Microwave, Satellite etc., Telephone system, Trunks and Multiplexing (PDH, SDH), Switching, Packet switching and circuit switching, N-ISDN, Broadband ISDN and ATM, Virtual circuits Vs Circuit switching, Transmission in ATM networks, Frame relay.
   Data Link Layer: Error detection and correction, ARQ, Flow control and framing in data link layer, Sliding windows protocols, HDLC, Data link layer in Internet, Data layer in ATM.
   Medium Access Sublayer: Queuing models, Little's theorem, M/M/1, M/M/m and M/G/1, Queuing systems. Static and dynamic allocation of channels in LANs, Multiple access protocols, Throughput, Delay and stability of ALOHA systems. CSMA and CSMA/CD Systems, IEEE 802 standards for Ethernet, Token bus and token ring, High speed LANS-FDDI.
   Network Layer: Routing algorithms, Dijkstra algorithm, Bellman Ford algorithm, Optimality principle, Congestion control algorithms, Internetworking, The network layer in Internet, Network layer in ATM.
   Transport Layer: Internet Transport Protocols (TCP and UDP), ATM adoption layer, performance of computer networks.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Explain the concept of computer networks and OSI reference model.
   - Describe the working of physical layer components/devices.
   - Elaborate the working of different protocols of computer networks.
   - Explain the routing algorithms, error detection and correction in data networks.

6. **Brief list of topics to be covered**
   - Introduction to Computer Networks

- Layered Network Architecture
- Physical layer
- Data link layer
- MAC layer
- Network layer
- Transport layer

Course Syllabi: UEI623 Object Oriented Programming and Applications (L : T : P :: 2 : 1 : 2)

1. **Course number and name:** UEI623; Object Oriented Programming and Applications

2. **Credits and contact hours:** Credits: 3.5; Hours: 5

3. **Text book, title, author, and year**

   - *Aho, A.V., Hopcraft, J.E . and Ullman, J.D., Data Structures and Algorithms, Addison Wesley (2004).*
   - *Langsam, Y., Augenstein, M. J. and Tenenbaum, A. M., Data Structures with C and C++, Prentice–Hall of India Private Limited (2000).*
   - *Tremblay, J.P. and Sorenson, P.G. Data StructuresOrganization and Architecture – Designing for Performance , Prentice–Hall of India Private Limited(2004).*
   - *Pattric, N., The C++ Complete Reference, McGraw–Hill (1982).*
   - *Larman, Craig, Applying UML and Patterns, Pearson Education (2005).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Need of Object Oriented Programming (OOP), Advantages of OOP, Characteristic of Object Oriented Languages, Basic concepts of C, Basic concepts of Turbo C++/ Visual C++.
   C++ Programming: Data Types, Operators and Statements, Writing a Program in C++: Declaration of variables, Statements, Simple C++ programs, Features of iostream.h, Manipulator functions, Input and Output Stream Flags, Control Statements, Functions and Program Structures, Arrays, Pointers, Enumerated data types.
   UML: Basic concepts of Unified Modeling Language, Class diagrams, State machine diagrams and flow diagrams.
   Classes and Objects: Introduction, Structures and Classes, Declaration of Class, Member functions, defining the Object of a Class, Accessing a member of class, Array of class objects, Unions and classes, Nested class.
   More on Classes: Constructors, Destructors, Inline member functions, Static class members, Friend functions, Dynamic memory allocations, this pointer.
   Inheritance: Introduction, Single inheritance, Types of base classes, Types of derivation, Ambiguity in single heritance, Array of class objects and single heritance, Multiple heritance, Container classes, Member access control.
   Overloading: Function overloading, Operator overloading, Overloading of binary operators, overloading of unary operators.
   Polymorphism: Introduction, Early binding, Polymorphism with pointers, Virtual functions, Late binding, Pure virtual functions, Abstract base classes, Constructors under inheritance, Destructors under inheritance, Virtual Destructors, Virtual base classes.
   Templates and Exception Handling: Function Template, Class template, Exception handling.
   Data File Operations: Opening and Closing of Files, Stream state member functions, Reading/Writing a character from a file, Binary file operations, Classes and file operations, Array of class objects and file operations, Nested classes and file operations, Random access file processing.

Application of OOP in Data Structure: Data Structures - Sparse matrices, Stacks, Queues, recursion, Applications of recursion, linked lists (singly linked, doubly linked and circular linked lists). General graph features, Trees, Binary trees and their applications, Traversal algorithms for binary trees, Threaded binary tree, breadth first search, Depth first search and heuristic search algorithms, B trees and Game trees, Memory mapping.
Laboratory Work: Introduction to Turbo C++/Visual C++, Simple class programs, Structured programming based on UML, Accessing function among classes, Time display, Use of constructor and destructor, String concatenation using operator overloading, Inheritance in currency conversion, Software designing based on OOPS, Applications based on various concepts of OOP.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Demonstrate the concept of OOPS.
   - Have a practical hand on programming concepts by the use of conditional statements, pointers, arrays classes, polymorphism etc.
   - Demonstrate the inheritance concept, use of OOPS in data structures.

6. **Brief list of topics to be covered**
   - C++ Programming
   - UML
   - Classes and Objects
   - Inheritance
   - Overloading
   - Polymorphism
   - Templates and Exception Handling

Course Syllabi: UEI511 Principles of Communication Engineering (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI511; Principles of Communication Engineering

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Blake, R., Electronic Communication Systems, Thomson Business Information (2008).*
   - *Lathi, B.P., Modern Analog and Digital Communication, Oxford University Press (2007).*
   - *Kennedy, G., Electronic Communication Systems, McGraw–Hill (2002).*
   - *Schweber, W., Electronic Communication Systems, Prentice–Hall of India Private Limited (2002).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction to Electronic Communication: Evolution of Communication System, Elements of Communication systems, Types of electronic communications, Baseband signals and base-band transmission, Modulation techniques, Bandwidth requirements.

   Amplitude Modulation: Introduction, Equation of AM signal, Modualtion index and percentage of modulation for sinusoidal AM, Frequency spectrum of the AM wave, Representation of AM wave, Average power for sinusoidal AM wave, Effective voltage and current for sinusoidal AM, Modulation, Low and high level modulation and their comparison, Low modulator, High level modulator: Basic requirements, modulator circuits: Collector modulator Class C Amplifier, Grid Modulated Class C Amplifier, Pulse Modulated Class C Amplifier, Amplitude modulated transmitters.

   Single Sideband Modulation: Introduction, Suppression of carrier, Suppression of unwanted sideband, Extensions.

   AM Receivers: Functions of receivers, Types of receivers, Characteristics of radio receiver, AM receivers, Double conversion receivers, Single and independent sideband receivers, Modified system (pilot carrier SSB system).

   Frequency Modulation: Frequency modulation theory, Characteristic of frequency modulation, Mathematical representation of frequency modulated wave, Frequency modulators, Pre–emphasis, De–emphasis, Directly modulated FM transmitter, Phase modulation, Indirect method of FM modulation, Wide and narrow band FM transmission, Advantages and disadvantages of FM, Comparison of FM and AM system, Comparison of FM and PM system.

   FM Receiver: FM receiver, Basic FM demodulators, Noise triangle in FM, Capture effect, FM stereo system.

   Pulse Modulation: Introduction, Classification of pulse modulation, Continuous vs discrete time signals, Sampling process, Pulse amplitude modulation, Pulse time modulation, Pulse position modulation, Comparison of PAM and PPM systems, Pulse code modulation, Multiplex transmission, Crosstalk, Comparison of FDM and TDM, Differential pulse code modulation, Delta modulation, Adaptive delta modulation, Sigma–delta A/D conversion, Comparison between PCM, DM, ADM and DPCM.

Audio Communication: Microphones, Loudspeakers, Speakers enclosures and baffles, High Fidelity Systems, Streophony, Tone control circuits, Public address systems, Recent trends in sound recordings.
Telephony: Principles of telephony, Telephone transmitter and receiver, Side tone, Necessity for telephone exchange, Tones in telephony, Automatic exchange, Pulsed and DTMF dialing, Electronic telephone exchanges, E10B Electronic exchange, Teleprinters.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Explain the basic concepts of communication systems, various AM and FM modulators.
   - Explain the working and application of AM receivers.
   - Describe the working of FM receivers and their applications.
   - Differentiate between various types of pulse modulation.
   - Explain the working of audio communication and telephony system.

6. **Brief list of topics to be covered**
   - Introduction to Electronic Communication
   - Amplitude Modulation
   - AM Receivers
   - Frequency Modulation
   - FM Receivers
   - Pulse Modulation

Course Syllabi: UHU033 Total Quality Management (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UHU033; Total Quality Management

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

- *Besterfield, D.H, Michna, C.B., Besterfield, G.H., Sacre, M.B., Total Quality Management. Pearson Education, Asia (2006).*
- *Mitra, A., Fundamentals of Quality Control and Improvement. PHI. (2007).*
- *Grant, E.L., Statistical Quality Control, Tata Mc-Graw Hill (1996).*
- *Shiba, S., Grahan, A., Walden, D., a New American TQM, Four Revolutions in Management. Productivity Press (1993).*
- *Jain, P. L. Quality Control and Total Quality Management. Tata Mc-Graw Hill. (2004).*
- *Ross, J. E., Total Quality Management. St. Lucie Press. (1995) 2nd ed.*
- *Kanji G. K., Total Quality Management. Chapman & Hall. (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Introduction to Total Quality Management: Culture, the TQM axioms, Cost of Quality, Tools for Quality: Management Tools, Statistical Tools, TQM and Japanese success; TQM implementation in India.
   The Evolution of Quality Concept: Quality Movement, Development of four fitnesses i.e. Fitness to Standard, Fitness to Use, Fitness of Cost, Fitness to Latent Requirements, Comparative study of philosophies of Deming, Juran and Crosby.
   Technical Tools for Quality: SQC, Control charts for Variables and Attributes, Acceptance Sampling, Operating Characteristic Curves, Taguchi's Approach to Experimental Design and Off Line Quality Control, Measurement System Analysis, Process Capability Studies (PPk, Cpk, Cp, Pp), Risk Management.
   Management Tools for Quality: Four Revolutions in Management Thinking: Continuous Improvement, Customer Focus, Total Participation and Societal Networking, Kaizen, PDCA, Six Sigma Methodology; Reactive and Proactive Improvement, Seven QC tools, 7 – step improvement programme, Quality Function Deployment, Failure Mode and Effect Analysis (FMEA), 5 S, Benchmarking, Quality by Design, Concept of Teams, Poke-Yoke, Total Quality Control, QC Circles, Suggestion Schemes.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Explain the concept of TQM and its advantages.
   - Describe the four fitnesses.
   - Select appropriate technical tools for quality.
   - Demonstrate the use of management tools for quality.

6. **Brief list of topics to be covered**

- Introduction to Total Quality Management
- The Evolution of Quality Concept
- Technical Tools for Quality
- Management Tools for Quality

Course Syllabi: UEE521 Electric Machine Design (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE521; Electric Machine Design

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Hamdi, E.S., Design of Small Electrical Machine, John Wiley and Sons (1994).*
   - *Ramamoorty, M., Computer Aided Design of Electrical Equipment, Eastern Press Private Limited (1989).*
   - *Say, M.G., Design and Performance of Machines, CBS Publications (1981).*
   - *Smith, S.P. and Say, M.G., Electrical Engineering Design Manual, Chapman and Hall (1984).*
   - *Walker, J.H., Large AC Machines: Performance and Operation, BHEL (1997).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Design of Machines, Factors, limitations, Modern trends. Materials: Conducting, magnetic and insulating materials.
   Magnetic Circuits: Calculations of mmf for air gap and teeth, real and apparent flux densities, iron losses, field form, leakage flux, specific permanence.
   Heating and Cooling: Modes of heat dissipation, Temperature gradients, types of enclosures, types of ventilation, conventional and direct cooling, amount of coolants used, Ratings.
   Armature Windings: Windings for DC and AC machines and their layout.
   Design of Transformers: Output equation, Types of transformer windings, design of core and windings and cooling tank, performance calculations.
   Concepts and Constraints in Design of Rotating Machines: Specific loading, output equation and output co-efficient, effects of variation of linear dimension.
   Skeleton Design of Rotating Machines: Calculation of D and L for DC, induction and synchronous machines, length of air gap, design of field coils for dc and synchronous machines, selection of rotor slots of squirrel cage induction motors, design of bars and ends, design of rotor for wound rotor for induction motors, design of commutator and inter poles for DC machines.
   Computer Aided Design of Electrical Machines: Analysis and synthesis approaches, design algorithms, Introduction to optimization techniques, Implementing computer program for design of three phase induction motor.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Design DC machines.
   - Design transformers with reduced losses.
   - Calculate the losses and efficiency in the machines.
   - Learn about the Analysis and Synthesis approaches as well as optimal design of electrical machines.

6. **Brief list of topics to be covered**
    - Magnetic Circuits
    - Design of Transformers
    - Concepts and Constraints in Design of Rotating Machines
    - Skeleton Design of Rotating Machines

Course Syllabi: UEE522 Energy Auditing and Management (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE522; Energy Auditing and Management

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Abbi, Y.P. and Jain, S., Handbook on Energy Audit and Environment Management, Teri Bookstore (2006).*
   - *Diwan, P., Energy Conservation, Pentagon Press (2008).*
   - *Younger, W., Handbook of Energy Audits, CRC Press (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy sonservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features.
   Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.
   Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.
   Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs.
   Electrical system: Electricity tariff, Load management and maximum demand control, Power factor improvement, Distribution and transformer losses. Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, energy efficient motors, Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues.
   Compressed air system: Types of air compressors, Compressor efficiency, Efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test Factors affecting the performance and efficiency.
   HVAC and Refrigeration System: Vapor compression refrigeration cycle, Refrigerants, Coefficient of performance, Capacity, Factors affecting refrigeration and air conditioning system performance and savings opportunities, Vapor absorption refrigeration system: Working principle, Types and comparison with vapor compression system, Saving potential, Fans, Blowers and pumps- Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Analyze about energy scenario nationwide and worldwide.
   - Decide about energy management in more effective way.
   - Analyze about various energy related aspect of electrical system.
   - Carry out financial management.
   - Conduct studies related to operational aspects of compressed air system and refrigeration system.

6. **Brief list of topics to be covered**

   - Energy Management and Audit
   - Material and Energy balance
   - Financial management
   - Electrical system
   - Compressed air system
   - HVAC and Refrigeration System

Course Syllabi: UEE523 High Voltage Transmission System (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE523; High Voltage Transmission System

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Arrillaga, J., HVDC Transmission, IEE Press (2007).*
   - *Edwart, K., Direct Current Transmission (Vol. 1), John Wiley and Sons (2008).*
   - *Padiyar, K.R., HVDC Power Transmission System, New Age International (P) Limited, Publishers (2008).*
   - *Arrillaga, J. and Smith, B.C., AC to DC Power System Analysis, IEE Press (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   DC power transmission technology: Introduction, Comparison of AC and DC transmission, Application of DC transmission, Application of DC transmission, Description of DC transmission system, Configurations, Planning for HVDC transmission, Modern trends in DC transmission. Introduction to Device: Thyristor valve, Valve tests, recent trends.
   Analysis of HVDC converters: Pulse number, Choice of converter configuration, Simplified analysis of graetz circuit, Converter bridge characteristics, Characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.
   Converter and HVDC system control: General, Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Current and extinction angle control, Starting and stopping of DC link, Power control, higher level controllers, telecommunication requirements.
   Converter faults and protection: Introduction, Converter faults, Protection against over-currents, Over-voltages in a converter station, Surge arresters, Protection against over-voltages.
   Smoothing reactor and DC line: Introduction, Smoothing reactors, DC line, Transient over voltages in DC line, Protection of DC line, DC breakers, Monopolar operation, Effects of proximity of AC and DC transmission lines.
   Reactive power control: Introduction, Reactive power requirements in steady state, Sources of reactive power, Static var systems, Reactive power control during transients, Harmonics and filters, Introduction, Generation of harmonics, Design of AC filters, DC filters, Carrier frequency and RI noise.
   Component models for the analysis of ac/dc systems: General, Converter model, Converter control, Modelling of DC network, Modelling of AC networks.
   Power flow analysis in AC/DC systems: General, Modelling of DC links, Solution of DC load flow, Discussion, per unit system for DC quantities, Solution techniques of AC-DC power flow equations.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Choose intelligently AC and DC transmission systems for the dedicated application(s).
   - Identify the suitable two-level/multilevel configuration for high power converters.

- Select the suitable protection method for various converter faults.
- Identify suitable reactive power compensation method.
- Decide the configuration for harmonic mitigation on both AC and DC sides.
- Simulate and/or carry out the AC-DC power flow analysis.

6. **Brief list of topics to be covered**
    - DC power transmission technology
    - HVDC converters
    - Converter faults and protection
    - Smoothing reactor and DC line
    - Reactive power control
    - Power flow analysis in AC/DC systems

Course Syllabi: UEE524 Power Quality Monitoring and Conditioning (L:T:P::3:1:0)

1. **Course number and name:** UEE524; Power Quality Monitoring and Conditioning

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Beaty, H. and Santoso, S., Electrical Power System Quality, McGraw–Hill (2002).*
   - *Kennedy, B., Power Quality Primer, McGraw–Hill (2000).*
   - *Bollen, M.H.J., Power Quality Problems: Voltage Sag and Interruptions, IEEE Press (2007).*
   - *Mohan, N., Power Electronics, New Age International (P) Limited, Publishers (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Overview and definition of power quality (PQ): Sources of pollution and regulations, Power quality problems, Rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages.
   Definitions Voltage sag analysis and mitigation: Sag caused by motor starting, Sag caused by utility fault clearing, Sag mitigation, Sag magnitude and duration calculations, RMS voltage, Peak examples of sag magnitude, Calculation in 1-phase systems, Equipment performance in presence of sag, Computers, AC and DC drives.
   Harmonics: Effects-within the power system, Interference with communication harmonic measurements, Harmonic elimination.
   Harmonic distortion: Power system harmonics, Harmonic analysis, Harmonic sources-the static converters, Transformer magnetization and non-linearities, Rotating machines, Arc furnaces, Fluorescent lighting. Introduction to power converters, Fourier analysis, Total harmonic distortion, Rms and average value calculations, Arcing and saturable devices, Effects of harmonic distortion, System response characteristics.
   Principles for controlling harmonics: Locating sources of harmonics, Passive and active filters, Harmonic filter design.
   Monitoring power quality: Monitoring essentials, Power quality measuring equipment, Current industry trends.
   Power Conditioning: Electric power conditioning, Active and passive filters,IEEE, IEC, ANSI standards, Power acceptability curves, various standards.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Reliably identify the sources of various power quality problems.
   - Estimate the impact of various power quality problems on appliances.
   - Educate the harmful effects of poor power quality and harmonics.
   - Decide the compensators and filters to keep the power quality indices within the standards.

6. **Brief list of topics to be covered**

- Power quality
- Voltage sag analysis and mitigation
- Harmonics
- Power Conditioning

Course Syllabi: UMA064 Advanced Engineering Mathematics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA064; Advanced Engineering Mathematics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Simmons, G. F., Differential equations with applications and Historical Notes, Tata Mc Grow Hill (2009), second edition.*
   - *Kasana, H. S., Complex Variables, Theory and Applications, PHI (2004), second edition.*
   - *Kreyzig Erwin, Advanced Engineering Mathematics, John Wiley and Sons (2006), eigth edition.*
   - *Ram, Babu, Engineering Mathematics, Pearson Education (2009)*
   - *Ross Shepley L., Differential Equations, Johan and Wiley and Sons (2007), third edition.*
   - *Krishnamurthy V. K., Mainra, V. P., and Arora, J. L., An Introduction to Linear Algebra, Associated East West Press (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Special Functions: Power series solution of differential equations, Frobeniuous method, Legendre's equation, Legendre's polynomial. Bessel's equation, Bessel functions of the first and second kind. Recurrence relation, equations reducible to Bessel's equation. Error function and its properties, complete solution of Gauss's hyper geometric and Chebyshev's differential equation, the generating functions and recurrence relations.
   Matrix Algebra: Review of complex numbers, Eigen values, eigenvectors and diagonalization for complex matrices. Orthogonal, unitary matrices and their properties. Linear transformation, rank and nullity, composition of linear maps, Matrix associated with linear maps.
   Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and higher order derivatives. Morera's theorem, Cauchy's inequality and Liouville's theorem, Taylor's and Laurent's expansions, singular points and poles, residues, Cauchy's residue theorem, complex integration using the method of residues, evaluation of real integrals by contour integration.
   Conformal mapping: Definition and examples of conformal mapping, bilinear transformations, their properties and classifications, Schwarz's Christoffel transformations.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Use power series solution method to solve the ordinary differential equations having various types of singularities. Students can understand how these solutions which later known as special functions in different forms and their properties may be useful for finding solutions of various electric circuit problems (LCR/LC), mechanical (vibration) and electrostatic potential problems.
   - Evaluate complex integration by using various theorems and their properties. They will understand the importance of bilinear, conformal and Schwartz – Christoffel

transformations. These techniques would be useful for solving the problems of electric circuit, electromagnetic field theory, equipotential surface etc.

- Apply the concepts of linear algebra and properties of matrices to real word phenomenon such as electrical networks, population movement, communication networks. Students will be able to apply these concepts in higher level courses like numerical and optimization techniques.

6. **Brief list of topics to be covered**
    - Special Functions
    - Matrix Algebra
    - Complex integration
    - Conformal mapping

Course Syllabi: UCS048 Data Structure and IT (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UCS048; Data Structure and IT

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Kruse, R.L., Leung, B.P. and Tondo, C.L., Data Structures and Program Design in C, Dorling Kindersley (2008).*
   - *Langsam, Y. and Augenstein, M.J., Data Structures Using C and C++, Dorling Kindersley (2008) 2nd ed.*
   - *Trembley, J.P., Sorenson, P.G., An introduction to data structures with applications, Tata McGraw Hill (2008) 2nd ed.*
   - *Sahni, Sartaj, Data Structures, Algorithms and Applications in C++, Universities Press (2005) 2nd ed.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Data types, structures, review of data structures in C/C++, static and dynamic memory allocation, recursion, Tower of Hanoi problem.
   Stacks & Queues: Concept, operations and representation in C/C++, application to evaluation of post fix expressions, conversion from in fix topost fix representation. Queues-Sequential representation, operations, priority queues, and array implementation.
   Linked Lists & Binary Trees: Concept, operations, stacks and queues as lists, array and dynamic representation circular lists, doubly linked lists, Josephus problem. Binary trees-definition, array and dynamic representations, operations, lists as trees. Almost complete binary trees, threaded binary trees, Games Trees.
   Sorting: Efficiency considerations, Onotation, Bubblesort, Quicksort, Selection sort, binary trees or tHeap, heapsort, heapasapriority queue, Insertion sort, Shellsort, Mergesort, Radixsort.
   Searching: Sequential searching, indexed Sequential searching, binary search, interpolation search, binary tree searching, insertion and deletion, Optimum search trees, height balanced trees, single and double rotations, Multiway, search trees, B-trees, B+- trees, Hashing methods of resolving clashes, methods of choosing hash functions.
   Files: Properties of physical storage media, fleorganization techniques.
   Introduction to Information Concepts: Data Communication equipment, SQL. Software: System Software, Application Software.
   Operating System Concepts: As resource manager & Coordinator of processor, devices and memory; commands of DOS.
   Introduction to Networks: Basics of Data Communication, Introduction to OSI layer model, TCP/IP, networking concepts.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - To implement and learn the basic data structures and learn the appropriate algorithmic approach to a problem and implement various search and sorting techniques.

- To learn various algorithmic strategies.
- To learn the appropriate algorithmic approach to a problem and implement various search and sorting techniques. Solve problems using fundamental algorithms.
- Demonstrate the ability to evaluate algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.
- To learn deterministic and non-deterministic polynomial time algorithm approximation and algorithm for some NP complete problems.

6. **Brief list of topics to be covered**
    - Stacks & Queues
    - Linked lists and binary trees
    - Sorting
    - Searching
    - Operating System Concepts

Course Syllabi: UCE611 Finite Element Methods in Engineering Analysis (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UCE611; Finite Element Methods in Engineering Analysis

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Bhavikati S. S., "Finite Element Analysis" New Age International Publishers, New Delhi (2005).*
   - *Desai C. S. and Abel J. F.; Introduction to The Finite Element Method: a Numerical Method for Engineering Analysis, CBS Publisher (2005).*
   - *Gallagher, R. H., Finite Element Analysis: Fundamentals, Prentice Hall, Englewood Cliffs (1987).*
   - *O.C. Zienkiewicz&R.L.Taylor, "The Finite element method", Butterworth Heinemann (Vol I and Vol II), (2000).*
   - *J. N. Reddy, An introduction to the finite element method, McGraw Hill Inc. (1993).*
   - *C.S. Krishnamoorthy, "Finite Element Analysis, Theory and programming", Tata McGraw Hill, (1994).*
   - *K.J. Bathe, "Finite Element Procedures in Engg. Analysis", Prentice Hall of India, (1996)*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction to Finite Elements: Introduction, Direct formulation of finite element characteristics, Energy approach, Convergence criteria, Displacement functions with discontinuity between elements, Solution bounds, Extension of variational approach.

   Plane Stress and Plane Strain: Introduction, Element characteristics, Assessment of accuracy, Some practical applications.

   Axis-Symmetric Stress Analysis: Introduction, Element characteristics, Practical applications, Non-symmetrical loading.

   Some Improved Elements in 2–D Problems: Introduction, Quadrilateral element, Characteristics derived from triangular elements, Conforming shape functions for a rectangle, Conforming shape functions for an arbitrary quadrilateral, Triangular element with size nodes.

   Isoparametric Formulation: Coordinate Transformation Isoparametric, Superparametric and Subparametric elements, Assembling Stiffness Matrix, Numerical Integration.

   Applications of Finite Element Analysis: Heat and fluid transfer; Analysis of Beams and Rigid frames.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Describe the fundamental ideas of FEM and know the behavior and usage of different elements.
   - Prepare a FEM model for structures.
   - Analyze structure using a software.
   - Interpret and evaluate the results.

6. **Brief list of topics to be covered**
    - Introduction to Finite Elements
    - Plane Stress and Plane Strain
    - Axis-Symmetric Stress Analysis
    - Isoparametric Formulation

Course Syllabi: UMA062 Graph Theory and Applications (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA062; Graph Theory and Applications

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Donald H Sanders, Computers Today, Tata Mcgraw Hill.*
   - *A Siloerschatz and Peter B Galvin, Operating System Concepts, Addison-Wesley*
   - *S Tanenbaum, Computer Networks, PHI.*
   - *Elrnasri &. Navathe, Fundamentals of Database Systems, Pearson Education Asia.*
   - *William Stallings, Network Security Essentials Applications and Standards, Pearson Education Asia.*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Role of operating system in efficiently managing systems resources: Process management Memory Management, File & Device management, Multiprogramming &. Multiprocessing Time sharing Systems

   System Software: Introduction to compiler, assembler, debugger, linker, Working on Linux/Unix/Solaris Utilities like gzip, tar, C Language, make Environment Xterrn, Vi editor

   Programming Paradigm: Object oriented VS Structured programming approach, Concepts of class, object, method, inheritance, polymorphism, abstraction, and encapsulation.

   Networking and Internetworking concepts: Protocols TCPIIP suite, IP addressing scheme; DNS, UDP; TELN'ET, ITP, HTTP.

   Devices: Repeaters, bridges, routers, gateways, switches, Networking Security

   Web Page: Web browsers; development tools, web server, Email server

   Web Technologies: Introduction to ASP, .Net, ActiveX, Java script, VBScript

   Threats: Virus Threats, Hacking Prevention Mechanism: Anti-Viruses, Secured Network, Firewals, Proxy servers

   Concepts of Software Engineering: Life Cycle, Importance of analysis and design in software development process, SDLC models: Prototyping, Spiral Model, Combined Paradigm

   Concepts of RDBMS: Exposure of Backend and Front end Products, Introduction to E-R diagrams, SQL (Simple), SQL (Nested), Normalization.

   Algorithms: Algorithm complexity, efficiency, BIG(O) notation, Searching and Sorting algorithms.

5. **Specific goals for the course**

After the completion of the course, the students will be able to:

- Explain the concept of operating system management.
- Explain the concept of system software.
- Differentiate between various programming Paradigm.
- Apply concepts of web page, software engineering and RDBMS in real applications.

6. **Brief list of topics to be covered**
    - Operating system
    - System Software
    - Networking
    - Programming Paradigm
    - Web page

Course Syllabi: UPH062 Nano Science and Nano Materials (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UPH062; Nano Science and Nano Materials

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**
   - *Booker, R., Boysen, E., Nanotechnology, Wiley India Pvt. Ltd. (2008).*
   - *Rogers, B., Pennathur, S., Adams, J., Nanotechnology, CRS Press (2007).*
   - *Bandyopadhyay, A.K., Nano Materials, New Age Int., (2007).*
   - *Niemeyer, C. N., and Mirkin, C.A., Nanobiotechnology Concepts, Applications and Perspectives, Wiley VCH, Weinhein, Germany (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Fundamental of Nanoscience: Features of Nanosystem, Free electron theory and its features, Idea of band structures, Density of states in bands, Variation of density of state and band gap with size of crystal.
   Quantum Size Effect: Concepts of quantum effects, Schrodinger time independent and time dependent equation, Electron confinement in one-dimensional well and three-dimensional infinite square well, Idea of quantum well structure, Quantum dots and quantum wires.
   Nano Materials: Classification of Nano Materials their properties, Basic concept relevant to application, Fullerenes, Nanotubes and nano-wires, Thin films chemical sensors, Gas sensors, Vapour sensors and Bio sensors.
   Synthesis and processing: Sol-gel process, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and ball milling, Cluster assembly and mechanical attrition, Sputtering method, Thermal evaporation, Laser method.
   Characterization: Determination of particle size, XRD technique, Photo luminescence, Electron microscopy, Raman spectroscopy, STEM, AFM.
   Applications: Photonic crystals, Smart materials, Fuel and solar cells, Opto-electronic devices.

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Explain quantum size effect on the properties of materials at nanoscale.
   - Design and characterize materials at nano-scale.

6. **Brief list of topics to be covered**
   - Fundamental of Nanoscience
   - Quantum Size Effect
   - Synthesis and processing
   - Nano materials

Course Syllabi: UEE841 Industrial Electronics (L : T : P :: 2 : 1 : 2)

1. **Course number and name:** UEE841; Industrial Electronics

2. **Credits and contact hours:** Credits: 3.5; Hours: 5

3. **Text book, title, author, and year**

   - *Dubey, G.K., Power Semiconductor Controlled Drives, Prentice Hall inc. (1989).*
   - *Paul, B., Industrial Electronic and Control, Prentice–Hall of India Private Limited (2004).*
   - *Dubey, G.K., Fundamentals of Electric Drives, Narosa Publications (2001).*
   - *Sen, P.C., Thyristor DC Drives, John Wiley and Sons (1981).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Conventional DC and AC Traction: Electric traction services, Nature of traction load, Coefficient of adhesion, Load sharing between traction motors, Main line and suburban train configurations, Calculation of traction drive rating and energy consumption. Important features of traction drives, Conventional DC and AC traction drives, Diesel electric traction.
   Static converters for Traction: Semiconductor converter controlled drive for AC traction, Semiconductor chopper controlled DC traction.
   Illumination: Nature of light, Basic laws of illumination, Light sources and their characteristics, Light production by excitation and ionization, Incandescence and fluorescence, Different types of lamps, their construction, Operation and characteristics, Applications, Latest light sources, Design of illumination systems electric heating, Advantages of electric heating, Resistance heating, Temperature control of furnaces, Induction and dielectric heating.
   Power Supplies: Performance parameters of power supplies, Comparison of rectifier circuits, Filters, Regulated power supplies, Switching regulators, Switch mode converter, Power factor control, Static reactive power compensation, Shunt reactive power compensator, Application of static SCR controlled shunt compensators for load compensation, Power factor improvement and harmonic control of converter fed systems, Methods employing natural and forced commutation schemes, Methods of implementation of forced commutation.
   Motor Control: Voltage control at constant frequency, PWM control, Synchronous tap changer, Phase control of DC motor, Servomechanism, PLL control of a DC motor.
   Laboratory Work: Performance parameter of various power converters, Sequence control of AC-AC power converter, Comparison of AC-DC converters with and without filters, Four quadrant AC and DC drive, Project on illumination, Simulation of power converters using Matlab.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Simulate and analyse the semiconductor controlled AC and DC drive system.
   - Design and develop an illumination system for domestic, industry and commercial sites.
   - Design an electric heating system for industrial purposes.
   - Equip the skill to design and develop a regulated power supply.

- Simulate and analyse the series and shunt compensators for power factor improvement in drive system.

6. **Brief list of topics to be covered**
    - Conventional dc and ac Traction
    - Static converters for Traction
    - Power supplies
    - Motor control

Course Syllabi: UEE845 Microcontrollers and Applications (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE845; Microcontrollers and Applications

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Ayala, K.J., The 8051 Microcontroller Architecture, Programming and applications, Penram International Publishing (India) Pvt. Ltd. (2007).*
   - *Mazidi, M.A., The 8051 Microcontroller and Embedded System, Pearson Education (2008).*
   - *Predko, M., Customizing The 8051 Microcontroller, Tata McGraw-Hill (2002).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Microcontroller an overview: Introduction to 8 bit microcontrollers; Basic differences and similarities between Microprocessor and Microcontroller, Types of various architectures; Harvard and Von-Neumann, RSIC and CSIC, Concept of pipelining.
   Introduction to 8051 Microcontroller : Intel 8051 history, Pin diagram of 8051, 8051-architecture, Registers, Timers Counters, Flags, Special Function Registers, DPTR, PC, PSW, SP etc. Additional features in 8052.
   8051 Assembly Programming - I: Addressing Modes, Data types and Directives, Jump, Loop and Call instructions, Arithmetic instructions and their simple programming applications.
   8051 Assembly Programming – II: Logic Instructions Single –bit instructions, Timer and Counter programming, Interrupts programming, Serial communication, Memory accessing and their simple programming applications.
   Hardware interfacing: I/O Port programming, Bit manipulation, Interfacing to a LED, LCD, Keyboard, ADC, DAC, Stepper Motors and sensors.
   Introduction to Advanced microcontrollers: Overview of Microchip PIC 16Fxxx, Motorola 680XX, ARM etc. and their comparison with 8051.
   Laboratory Work
   Programming and Application development around 8051, Interfacing to LED, LCD, Keyboard, ADC , DAC , Stepper Motors and sensors etc.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Describe the concept of microcontroller architectures.
   - Explain the addressing modes, data types and instruction set.
   - Program microcontroller for different applications including hardware interfacing
   - Explain the concept of advanced microcontrollers and latest trends.

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6. **Brief list of topics to be covered**
   - Introduction to 8051 Microcontroller
   - 8051 Programming
   - Hardware interfacing

- Introduction to Advanced microcontrollers

Course Syllabi: UEE842 Power System Instrumentation (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE842; Power System Instrumentation

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Cegrell,T., Power System Control Technology, Prentice–Hall of India Private Limited (2001).*
   - *Lindsley, D.M. , Power Plant Control and Instrumentation, IEE Press (2000).*
   - *Jarvis, E.W., "Modern Power Station Practice: Control and Instrumentation (Vol. F)", British Electricity International (1980).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Measurement of electrical quantities, Active and reactive power in power plants, Energy meters, Instrument transformers and their transient response.
   Instrumentation Techniques: Telemetry, Remote control, Remotesignaling and SCADA, Signal formation, Conversion and transmission.
   Signal Transmission Techniques: Analog pulse and digital modulation, Amplitude and frequency modulation, AM and FM transmitter and receiver, Phase modulation, Pulse modulation, Digital transmission techniques, Error detection and correction.
   Telemetry: Telemetry errors, DC, Pulse and digital telemetry methods and systems.
   Supervisory Control and Data Acquisition: Function of SCADA system RTU details, Control center details, Communication between control centers, Control center and remote terminal unit.
   Power Plant Instrumentation: Hydroelectric power plant instrumentation, Thermal power plant instrumentation, Nuclear power plant instrumentation. Applications of SCADA system to indian power systems.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Use electrical and electronics instrument in power systems applications.
   - Able to use signal transmission techniques for specific power system purposes.
   - Analyze the functions of SCADA system.
   - Demonstrate of power system instrumentation.

6. **Brief list of topics to be covered**
   - Instrumentation Techniques
   - Signal transmission Techniques
   - Telemetry
   - SCADA

Course Syllabi: UEE843 Power System Planning (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE843; Power System Planning

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Dasari, S., Electric Power System Planning, IBT Publishers (1999).*
   - *Pabla, A.S., Electric Power Distribution, Tata McGraw–Hill (2008).*
   - *Sullivan, R., Power System Planning, McGraw–Hill (1977).*
   - *Knight, U.G., Power System Engineering and Mathematics, Pergamon Press (1972).*
   - *McDonald, J.R., Modern Power System Planning, McGraw–Hill (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Introduction: Power system planning, Objective, Stages in planning and design, Transition from planning to operation.
   Generating System capability Planning: Probabilistic models of generating units, Growth rate, Rate of generation capacity, Outage performance and system evaluation of loss of load and loss of energy indices, Power supply availability assessment.
   Interconnected Systems: Multi area reliability analysis, Power pool operation and power exchange energy contracts, Quantification of economic and reliability benefits of pool operation.
   Demand/ Energy forecasting: Electricity consumption pattern, Peak demand and energy forecasting by trend and economic projection methods.
   Power System expansion planning: Formulation of least cost optimization problem involving capital, Operation and maintenance costs of candidate units of different types.
   Design of Distribution Systems: Introduction, Optimal conductor selection, Capacitor placement, Reconfiguration, Substation planning.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Assess the generation adequacy yin power system using probabilistic approach
   - Analyse the configuration of substations and power pools
   - Evaluate the peak demand and energy requirements of system using forecasting techniques.
   - Develop the solution methodology for optimising the cost of power system under operation.

6. **Brief list of topics to be covered**
   - Generating System capability Planning
   - Interconnected Systems
   - Demand/ Energy forecasting
   - Power System expansion planning
   - Design of Distribution Systems

Course Syllabi: UEI512 Robotics and Related Instrumentation (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEI512; Robotics and Related Instrumentation

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Nikku, S.B., Introduction to Robotics, Prentice–Hall of India Private Limited (2002).*
   - *Schilling. R. J., Fundamentals of Robotics: Analysis and Control, Prentice–Hall of India Private Limited (2006).*
   - *Criag, J., Fundamentals of Robotics: Analysis and Control, Prentice–Hall of India Private Limited (2006).*
   - *Gonzalex, R. C. and Fu, K. S., Robotics Control Sensing, Vision and Intelligence, McGraw–Hill (2004).*
   - *Koren,Y., Robotics for Engineers, McGraw–Hill (1985).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Basic Concepts in Robotics: Automation and robotics, Robot anatomy, Basic structure of robots, Resolution, Accuracy and repeatability
   Classification and Structure of Robotic System: Point to point and continuous path systems. Control loops of robotic systems, The manipulators, The wrist motion and grippers.
   Drives and Control Systems: Hydraulic systems, Dc servo motors, Basic control systems concepts and models, Control system analysis, Robot activation and feedback components, Positional and velocity sensors, actuators. Power transmission systems, Robot joint control design.
   Robot arm Kinematics and Dynamics: The direct kinematics problem, The inverse kinematics solution, Lagrange-Euler formation, Generalized D'Alembert equations of motion, DenavitHartenberg convention and its applications.
   Sensors and Instrumentation in robotics: Tactile sensors, proximity and range sensors, Force and torque sensors, Uses of sensors in robotics.
   Vision Systems: Vision equipment, Image processing, Concept of low level and high level vision.
   Robot Programming : Method of robots programming, Lead through programming methods, a robot programs as a path in space , Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching capabilities and limitation of lead through methods.
   Robot Language: The textual robot languages, Generations of robot programming languages, Robot language structure, Constants, Variables and other data objects, Motion commands, End effectors and sensor commands computations, Programmecontrol and subroutines, communication and data processing, Monitor mode commands, Introduction to Artificial Intelligence.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Demonstrate the basic concepts of robotics, their classification and structure.

- Explain the type of the drive and control systems used in robotics.
- Describe the type of sensors and other instruments used in robotics.
- Perform the robot language programming.

6. **Brief list of topics to be covered**
    - Basic Concepts in Robotics
    - Classification and Structure of Robotic System
    - Driveand control systems
    - Sensors and Instrumentation in robotics
    - Robotlanguage programming

Course Syllabi: UEE844 Transients in Power Systems (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE844; Transients in Power Systems

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Gupta, B.R., Power System Analysis and Design, S.Chand and Company Limited (2003).*
   - *Harold,P., Transients in Power System, John Wiley and Sons (1999).*
   - *Reinhold Ruder Berg, R.R., Transient Performance of Electric Power systems, MIT Press (1991).*
   - *Melipoulus,S., Power System Grounding and Transisents, M.Dekker Inc.(1981).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**
   a. Brief description of the content of the course (catalog description)

   Transients in Power systems: Simple switching transients, Circuit closing and recovery transients, Arcing grounds, Double frequency transients, Damping, resistance switching.
   Abnormal Switching Transients: Current chopping, Capacitance switching, Ferro-resonance, Transformer magnetizing inrush currents, Re-striking phenomenon and its effects on recovery voltage.
   Transients in three phase circuits: Switching of three phase transformers, Effect of types of neutral connection, Three phase capacitance switching, Symmetrical component method of analysis of three phase switching transients, Effect of open conductors.
   Traveling Waves: Traveling waves in transmission lines, Reflection and refraction of waves, Typical cases and effects of line terminators, Equivalent circuit for traveling wave studies, Forked line , Reactive termination, Bewley lattice diagram, Multi conductor systems.
   Lightning: Lightning phenomenon, Line design based on direct strokes, Over voltage due to lightning.
   Protection against transients: Protection of power systems against transient over-voltage due to switching and lightning, Lightning arrestors, Surge diverters, Surge capacitors and reactors, Overhead ground wires, Insulation coordination, Computer aids to calculate transient (EMTP).

5. **Specific goals for the course**
   After the completion of the course, the students will be able to:
   - Reliably distinguish between various switching transients and lightning surges.
   - Analyse power system behaviour during switching transients and lightning surges.
   - Demonstrate the competence to design the protection scheme of power system equipment using ground wires, surge absorbers and arrestors.
   - Decide the insulation level of power system components to withstand the surge voltage.

6. **Brief list of topics to be covered**
   - Transients in Power systems
   - Abnormal Switching Transients
   - Transients in three phase circuits
   - Traveling Waves

- Lightning
- Protection against transients

Course Syllabi: UEE803 Load Dispatch and Communication (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UEE803; Load Dispatch and Communication

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Carlson, A.B., Crilly; P.B., Rutledge, J.C., Communication Systems, McGraw–Hill ISE (2002).*
   - *Chakraborti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai and Co. (P) Ltd. (2008).*
   - *Nagrath, I.J. and Kothari, D.P., Modern Power System Analysis, Tata McGraw–Hill (2006).*
   - *Pabla, A.S., Electric Power Distribution, Tata McGraw–Hill (2008).*
   - *Wang, X., Modern Power System Planning, McGraw–Hill ISE (1994).*
   - *Gupta, B.R., Power System Analysis and Design, S.Chand and Company Limited (2009).*
   - *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Estimation of power system: Introduction, State estimation: Topology, Bad data handling, Observability analysis, Least square estimation, Steady state estimation of power systems, Tracking state estimation of power systems, Some computational considerations, External system equivalencing, Treatment of bad data, Network observability, Pseudo measurements.
   States of power system: Introduction, Components of modern energy control center.
   Load prediction: Estimation of average and trend terms, Periodic and stochastic components, Difference model forecasting.
   Load dispatch centres: Introduction, functions, SLDC/RLDC, NLDC, Pre-dispatch, During-dispatch, Post dispatch functions. Supervisory control and data acquisition (SCADA) system RTU, Front end computers, Main computers, Visual display units, Mimic boards, Energy management System-functions.
   System management: Introduction, Load management, Load shedding, Voltage/Frequency control, Reactive power management, Grid management, Operational co-operation, Import/Export of energy, Role of tariff in system operation, Maintenance, On-line maintenance, Grid disturbance/Case studies, Software tools.
   Communication system: Introduction, Types-PLCC, Microwave, Leased lines, Fibre optics, Satellite, V-SAT, Communication comparison, Characteristics, Modules, Planning criteria, Selection criteria, RTUs, Modems, Baudrate, Communication protocols, Data exchange, System noise and interference, Integrated communication system.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:
   - Carry out state estimation and computational methods related to power system.
   - Analyze various components of modern energy control centre.

- Carry out the prediction and forecasting related to load.
- Conduct studies related to various component of load dispatch centre.
- Decide the impact of system management.
- Decide the different modules for communication system.

6. **Brief list of topics to be covered**
    - Estimation of power system
    - States of power system
    - Load prediction
    - Load dispatch centres
    - System management
    - Communication system